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Editorial: expectations and acknowledgments

Editorial: expectativas y agradecimientos

 José Luis Crespo Fajardo

Editor of *Maskana* – University of Cuenca

This new issue of *Maskana* is published with some fantastic news: the journal has been accepted for inclusion in the prestigious *Scopus Elsevier* database.

We are now diving into the world of impact metrics, which can be indecipherable at times but are generally based on the number of citations received within a given time frame. The editorial committee greatly values the prospects that this opens up. Without a doubt, the visibility of the University of Cuenca's good research management will now be the focus of interest for a diverse group of international scientists. Expectations must be viewed with caution: the delicate exercise of predicting the future is obviously abstruse, almost esoteric. However, becoming an impact journal and ranking among the mere nine Ecuadorian serial publications currently listed in *SCImago Journal Rank* is an honor that was previously unthinkable for this small window into the world of knowledge. It is time to rejoice in the fact that journals in our region are taking off and reaching remarkable heights in spaces where, in the past, it took a great deal of effort for a Latin American publication to break through the thick storm clouds and discover itself, as strange as a black swan, in a sky filled with North American and Northern European journals, essentially in the English language.

If there is one thing we can demonstrate now, it is not arrogance or a hunger for greater aspirations. Our team is driven by no other ambition than to do

a good job in line with a set of values. The editorial process is, in this sense, certainly demanding: every paragraph passes through many reviewers, and every contingency is scrutinized, and that is no secret. The level of self-discipline we have imposed on ourselves is the absolute expression of the ethical principles we want to demonstrate. In this way, we work tirelessly, putting our heart and soul into our work, trying never to slow down the editorial process, and stepping up the pace as the publication date approaches. The result is a handful of articles that, knowing that they have demonstrated unique qualities after overcoming the rampant hurdles that lead to publication, mean the world to us.

Consistent with the responsibility of being a magazine that seeks to establish a name and personal brand, we must not forget the role of our valued readers: scholars and amateurs, enthusiasts, and experts. You are the image on the screen reflecting these advances. We are immensely grateful for your loyalty. Likewise, knowing that commitment requires sacrifice and that, in this regard, we always act with a sense of moral obligation aligned with the idea of who we want to become, it is necessary to dedicate a few words of heartfelt thanks to the members of the editorial committee, talented individuals who shine brightly behind the scenes.

Together, we keep the engine purring: thank you very much!

Dating Violence and the Use of Coping Strategies in Adolescents from Rural Institutions in Cuenca (2022–2024)

Violencia en el noviazgo adolescente y el empleo de estrategias de afrontamiento en instituciones rurales de Cuenca (Ecuador) 2022- 2024

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Dating Violence and the Use of Coping Strategies in Adolescents from Rural Institutions in Cuenca (2022–2024)

Violencia en el noviazgo adolescente y el empleo de estrategias de afrontamiento en instituciones rurales de Cuenca (Ecuador) 2022- 2024

Abstract

Adolescent romantic relationships often involve power struggles where coping strategies play a significant role. This study aimed to determine the presence of dating violence and coping strategies among adolescents from rural institutions in the Cuenca canton. The instruments used were the Coping Strategies Inventory (CSI) and the Violence in Dating Relationships Questionnaire (CUVINO). A total of 133 students aged 12 to 18 participated, 50 of whom were in a romantic relationship. The findings revealed that 92.3% of participants had experienced violence, with 50% reporting psychological violence. Additionally, self-criticism and problem-solving will slightly positively correlated with coercion. Age was also associated with wishful thinking and problem avoidance. The study concluded that psychological violence, in its various dimensions is related to certain copying strategies.

Keywords: dating, violence, adolescents, coping strategies, rural area.

Resumen

El noviazgo en la adolescencia en ocasiones muestra un dominio de la pareja debido a una lucha de poder, situación que da lugar al uso de estrategias de afrontamiento. Este trabajo buscó determinar la presencia de violencia en el noviazgo y las estrategias de afrontamiento a las que recurren adolescentes de instituciones rurales del cantón Cuenca. Instrumentos: Inventario de Estrategias de Afrontamiento (CSI) y Cuestionario de Violencia de Novios (CUVINO). Participaron 133 estudiantes, en edades comprendidas entre los 12 y 18 años; 52 se encontraban en una relación de pareja. De acuerdo con los resultados, el 92.3 % manifestó haber vivenciado violencia; de estos, el 50 % sufrió violencia psicológica. Además, se identificó que la autocrítica y la resolución de problemas se relacionaban positivamente de manera leve con la coerción; asimismo, la edad mostró relación con el pensamiento desiderativo y la evitación de problemas. Se concluye que la violencia psicológica, en sus distintas dimensiones, se relaciona con algunas estrategias de afrontamiento.

Palabras clave: violencia, noviazgo, adolescentes, estrategias de afrontamiento, área rural

1. Introduction

Violence is defined as any intentional act intended to cause psychological, physical, or sexual harm, which may even lead to death (Póo & Vizcarra, 2008). According to the World Health Organization [WHO, 2002], violence can be perpetrated against oneself or another person, group, or community. It is a public health issue due to the individual, family, and social consequences it generates, and for people between 15 and 44 years of age, it is the leading cause of death in the world. Another alarming figure given by this organization is that worldwide, 1.4 million people die, and many more suffer serious injuries that can affect them for the rest of their lives.

Regarding intimate partner violence, WHO (2016) defines it as violent, abusive, or coercive behaviors exercised towards the partner that cause psychological, physical, or sexual harm. For Rey-Anacona (2013), dating violence can be physical and includes any type of blows such as kicks, punches, throwing objects, pushing, and attacks with weapons; psychological violence, which includes all types of humiliation, intimidation, threats or denigration, whose consequences can be more serious and lasting than physical violence; and sexual violence that includes forced sexual intercourse, sexual use, whose purpose is manipulation and criticism for performance to sexual appearance. In order to understand dating violence, there are three major theoretical frameworks: attachment theory, social learning theory, and feminist theory (Rubio-Garay et al., 2015).

According to social learning theory, when violence is naturalized in a social and cultural context, it becomes difficult to identify it (Durrant, 2021). According to Valenzuela-Varela and Vega-López (2015), “violent relationships are socially and culturally constructed and learned from the home, and institutions such as the school, the Church and the media” (p. 164), so the family context plays a leading role in the acquisition of behavioral parameters and the way to interact violently. On many occasions, these behaviors are

seen as normal and are even legitimized, which is why it is not easy to recognize them (Fernández-Antelo et al., 2020; Viejo et al., 2024).

A study carried out by the Queen Sofia Center in 2005 on homicides committed by partners or ex-partners showed that the highest rate was found in young people between 15 and 24 years of age (5 women per million) (Sarasua et al., 2007). Similarly, according to Bonomi et al. (2012), dating violence in its different manifestations begins in adolescents between 13 and 19 years of age. On the other hand, according to Sánchez-Zafra et al. (2024), those who have received violence early tend to develop a lower sense of well-being and greater victimization; therefore, there is a risk of continuing with violence in marriage. Finally, Pacheco et al. (2016), in Colombia, found that emotional violence is the most frequent in this population.

In Ecuador, according to the National Plan for the New Ecuador [PND] (2024-2025), the most important reason for the presence of adolescent pregnancy is sexual violence. One explanation that could determine why violence occurs at this stage of life is that adolescents come from violent homes. In dating relationships, the patterns of interaction they learn can be repeated and continued or transformed (Valenzuela-Varela & Vega-López, 2015). This type of violence is not the only risk factor; in fact, it is known that “interpersonal factors of a biological, behavioral, psychological and relational type and situational factors such as the physical, family, economic, historical, social and community environment” (Rubio-Garay et al., 2015. p. 49) are also involved.

Regarding the economic and community factors, it is known that there is a greater likelihood of violence in rural areas (Marquart et al., 2007; Spencer & Bryant, 2000) and in urban-marginal neighborhoods (Karriker-Jaffe et al., 2021). Furthermore, according to Marquart et al. (2007), community violence has a potentially devastating effect on dating violence for both the perpetrator

and the victim. Another determinant factor in adolescent dating is the influence of their peers with aggressive behaviors against their partners. In the words of Gómez et al. (2014), pushing or hitting may be acceptable interaction styles understood as games or jokes in their contexts.

In this sense, when talking about dating violence in adolescents, we must start from the fact that this stage of development, characterized by the transition from childhood to adulthood, involves a set of bodily changes that unfold and the development of sexual drives and desires (Lillo Espinosa, 2004).

According to Pick (2001), dating violence in adolescents refers to any act by which a partner seeks to dominate or control his or her partner and exerts power over him or her through various acts of sexual, physical, and emotional abuse and even social isolation. Although psychological violence is indeed more frequent in a bidirectional manner, when this scale tends to be unidirectional, it is more prevalent in women (Paíno-Quesada et al., 2020).

Faced with this reality, coping strategies become relevant. One of the most important factors for personal functioning that allows an adequate adaptation to the stressors that may arise in life, such as relationship difficulties, is coping strategies (Lazarus, 1966). Several theoretical models explain coping strategies, which are nourished by a cognitive-behavioral approach (Chanmugam, 2015) and form a core part of stress theory (Tobin et al., 1989). Based on these criteria, coping strategies are understood as the specific actions that a person carries out before an important moment (Pelechano, 2000); that is, they are any constantly changing cognitive and behavioral effort that is developed to manage internal or external demands that overwhelm the individual's resources.

There are two types of higher-order strategies: problem-focused and emotion-focused strategies; however, several studies also speak of seven coping strategies: problem-solving, social withdrawal,

social support, cognitive restructuring, self-criticism, emotional expression, and desiderative thinking (Tobin et al., 1989). Cano et al. (2007) add a secondary division, which proposes adequate problem-directed coping (problem-solving and cognitive restructuring), emotion-directed coping (social support and emotional expression), inadequate coping (problem avoidance and desiderative thinking), and emotion-directed coping (social withdrawal and self-criticism).

However, coping strategies tend to vary throughout life, much more so in adolescence, because the transition between childhood and adulthood leads them to use different cognitive, emotional, and behavioral strategies that even depend on the circumstances that each person is going through (Kahn et al., 2020). In this sense, previous studies warn that situations of violence in intimate partner relationships are maintained when there is social isolation and loneliness (Addy et al., 2021; Lausi et al., 2021; Momeñe et al., 2022), which are also related to poor relationships within the family environment, to the extent that they trigger a lack of confidence to communicate the events experienced (Pastor-Bravo et al., 2023). In addition, the stage of the relationship influences the use of coping strategies; thus, in the early stages, there is a tendency to use maladaptive strategies that do not allow leaving the violent circle, while in later stages, problem-solving strategies are used more frequently, (Puente Martínez et al., 2022). On the other hand, a study by Bauman et al. (2008) found that women's emotion-focused strategies did not allow them to cope with feelings of violence.

Based on this background and considering that dating violence precedes marital and intrafamily violence (Cáceres & Cáceres, 2006), this research was proposed, whose general objective was to determine the relationship between manifestations of teen dating violence and coping strategies; to this end, we sought to describe the expressions of violence in adolescents in a dating relationship and to relate the expressions of violence and socio-demographic characteristics, such as sex and age in adolescents in a dating relationship.

2. Materials and methods

This study used a quantitative approach with a comparative relational design and a cross-sectional cut (Espinoza-Pajuelo & Ochoa-Pachas, 2020). We initially worked with the entire population of students between eighth and tenth grade of elementary school in two rural educational institutions in the southern area of Cuenca: 133 students, 70 females (52.6%) and 63 males (47.), who were between the ages of 12 and 18 years, with a mean age of 14.3 years

(SD = 2.1); most belonged to the age group of adolescents between 12 and 15 years. Of these, 52 (39.1%) were identified as being in a couple relationship, and 67.3% were in a relationship of more than 6 months. The details are shown in Table 1. The sample size responds to the previous calculation using G*Power software with a mean effect size of $p=.3$, an error of 5%, and statistical power of 95%.

Table 1: Characteristics of participants. **Fuente:** Source: Own elaboration.

Features		Yes		No		Total	
		n	%	n	%	n	%
Gender	Female	27	51.9	43	53.1	70	52.6
	Male	25	48.1	38	46	63	47.4
Age	12 to 15	32	61.5	75	92.6	107	80.5
	16 to 18	20	38	6	7.4	26	19.5
Time on a relation with a partner	More than 6 months	35	67.3	0	0	35	67.3
	1-2 years	15	28.8	0	0	15	28.8
	Over 2 years	2	3.8	0	0	2	3.8

The inclusion criteria were as follows: (1) the adolescents were between 12 and 18 years of age; (2) they were enrolled in either of the two rural institutions in the southern area of the canton of Cuenca; (3) they were in a relationship. The exclusion criteria were having ended their relationship or not being in a relationship at all.

2.1. Instruments

Socio-demographic data: This self-developed instrument sought to determine basic characteristics such as sex, age, couple relationship, and time in the relationship.

Dating Violence Questionnaire (CUVINO): This instrument has been validated in Spain,

Mexico, and Argentina. Its objective is to evaluate interpersonal relationships in couples and to identify the manifestation of violence within these relationships, which can be applied to young people and adults. It comprises 42 items, divided into eight dimensions: detachment, humiliation, sexual, coercion, physical, gender, emotional, and instrumental punishment. The items must be answered in a five-choice frequency Likert-type format (0= never and 4 = very frequently). The factor loadings of the items range from .37 to .77 (Rodríguez-Franco et al., 2010). For this study, the alpha value was .939.

Coping Strategies Inventory (CSI) is adapted by Cano et al. It is an instrument used to determine the frequency with which an individual uses a

specific coping strategy when facing a stressful situation. The strategies it includes are these: problem-solving (items 1, 9, 17, 25, 33), self-criticism (items 2, 10, 18, 26, 34), emotional expression (items 3, 11, 19, 27, 35), desiderative thinking (items 4, 12, 20, 28, 36), social support (items 5, 13, 21, 29, 37), cognitive restructuring (items 6, 14, 22, 30, 38), problem avoidance (items 7, 15, 23, 31, 39) and social withdrawal (items 8, 16, 24, 32, 40). It is presented on a Likert scale of 0-4, where 0= not at all, 1= a little, 2= quite a lot, 3= a lot, and 4= completely. For the interpretation, it is understood that the higher the score, the greater the presence of the strategy. The alpha of this adaptation, .959, showed good internal consistency, ranging from .72 to .94 for each strategy.

2.2. Procedure

Two rural educational institutions in the canton of Cuenca were contacted to participate in the research; each of them received information on the study's objectives; it was also indicated that, for their participation, the students would receive preventive workshops to address these issues in the classroom. After their acceptance, approval was requested from the participants' parents, who signed an informed consent form. The adolescents, after receiving parental consent, signed the informed consent form. The research followed the ethical guidelines of the American Psychological Association [APA], 1992, and the Declaration of Helsinki (WMA General Assembly, 2008), that

is, respect for confidentiality, voluntariness, and anonymity of each participant. Subsequently, the questionnaires were administered. The duration was approximately 20 minutes.

2.3. Data analysis

Descriptive and inferential statistical procedures were used to analyze the research data. Initially, absolute and percentage frequencies were used to identify the presence of violence. Central tendency and dispersion measures were used to identify the intensity of these manifestations and coping strategies. To evaluate the association between the presence of violence, sex, and age group, the Chi-square statistic (X^2) was used and the effect size was visualized using Cramer's V. To relate the intensity of violence with sex and age, the Mann-Whitney U test (U) was performed and the effect size is related using the biserial correlation by ranks because the behavior of the data was non-normal according to the Kolmogorov Smirnov test ($p < 0.05$). Finally, the relationships between the coping strategies used by the students and the manifestations of violence received were explored using Spearman's correlation coefficient (r_s). Data processing was performed in the SPSS V 29 statistical package, and the significance considered was 5 % ($p < 0.05$). For the interpretation of the effect size, the Cohen (1998) recommendation for psychological studies >0.17 small, >0.43 medium, and $>.84$ high was used (Brydges, 2019).

3. Results

In order to demonstrate the fulfillment of the objectives, first, the expressions of violence in adolescents will be described. In this case, it was identified that 92.3% of the students with a dating relationship manifested some expression of violence, 50% exclusively psychological

violence, 11.5% psychological violence and physical violence simultaneously, and 1.9% psychological violence, physical violence, instrumental and sexual violence simultaneously. Table 2 describes the map of a combination of violence in students.

Table 2: Map of violence.
Source: Own elaboration.

<i>Expressions of violence</i>				<i>n</i>	<i>%</i>
Without expressions of violence				4	7.7
Sexual Violence				1	1.9
Psychological Violence	Exclusive			26	50.0
	Sexual Violence			4	7.7
	Instrumental			3	5.8
	Physical			6	11.5
	-	Instrumental Violence	Sexual Violence	1	1.9
	Physical Violence	-	Sexual Violence	2	3.8
		Instrumental	-	4	7.7
		Sexual Violence	1	1.9	

The rates of each type of violence can be seen in Table 3. It can be seen that 90.4% referred to psychological violence and 25% to physical violence.

3.1. Presence of violence According to sex and age

When relating violence to sex and age group, relationships were identified in physical violence in both sex and age: 40% of men with a partner

relationship reported suffering physical violence compared to 11.1% of women with a mild effect size ($X(2)=4.34$; $p=.037$; $V=.333$). 1 % of women with a slight effect size ($X^2=4.34$; $p=.037$; $V=.333$), as well as 37.5 % of students between 12 and 15 years of age versus 5 % of students between 16 and 18 years of age ($X^2=5.31$; $p=.009$; $V=.365$). The intensity with which each type of violence was manifested was not different in sex and age (Table 3).

Table 3: Violence according to sex and age.
Source: Own elaboration.

Type of violence		Gender		Age	
		Mujer	Hombre	De 12 a 15 años	De 16 a 18 años
General n=48; 92,3% M=14,56 Me=8.0 Rango= 1 -104	n (%)	25 (92.6)	23 (92.0)	30 (93.8)	18 (90.0)
	X2 (p)	0.000	(1.000)	0.00	(1.000)
	V de Cramer	.011		.068	
	Mediana	6.0	9.00	9.5	5.5
	Rango	(1 - 51)	(1 - 104)	(1 - 104)	(1 - 22)
	U (p)	214.0	(.128)	341.0	(.132)
	r	-.256		.263	

Psicológica n=47; 90,4% M=12,87 Me=6.0 Rango= 1 -102	n (%)	25	(92.6)	22	(88.0)	29	(90.6)	18	(90.0)
	X2 (p)	0.008		(0.928)		0.00		(1.000)	
	V de Cramer		.078				.010		
	Mediana	5.0		8.0		7.0		5.5	
	Rango	(1 - 45)		(1 - 102)		(1 - 102)		(1 - 22)	
	U (p)	177.0		(.036)		297.5		(.430)	
	r		-.356				.140		
Física n=13; 25.0% M=2,15 Me=1.0 Rango= 1 -8	n (%)	3	(11.1)	10	(40.9)	12	(37.5)	1	(5.0)
	X2 (p)	4.34		(0.037)		5.31		(0.009)	
	V de Cramer		.333				.153		
	Mediana	1.0		2.0		1.5		1.0	
	Rango	(1 - 1)		(1 - 8)		(1 - 8)		(1 - 1)	
	U (p)	-		-		-		-	
	r								
Sexual n=9; 17,3% M=3,78 Me=4.0 Rango= 1 -11	n (%)	5	(18.5)	4	(16.0)	7	(21.9)	2	(10.0)
	X2 (p)	0.000		(1.000)		0.53		(0.454)	
	V de Cramer		.033				.153		
	Mediana	4.0		2.5		4.0		1.5	
	Rango	(2 - 1)		(1 - 11)		(1 - 11)		(1 - 2)	
	U (p)	12.0		(.706)		12.0		(.176)	
	r		.200				.714		
Instrumental n=9; 17,3% M=3,56 Me=1.0 Rango= 1 -11	n (%)	4	(14.8)	5	(20.0)	8	(25.0)	1	(5.0)
	X2 (p)	0.016		(0.899)		2.18		(.129)	
	V de Cramer		.068				.257		
	Mediana	3.0		1.0		1.5		1.0	
	Rango	(1 - 10)		(1 - 11)		(1 - 11)		(1 - 1)	
	U (p)	14.0		(.348)		-		-	
	r		.400						

Note: X2= Chi-square test, U= Mann Whitney U test, p= statistical significance, Cramer's V=evaluates the strength of association between two categorical variables; r = effect size for Mann Whitney U (biserial rank correlation). Tests without a log of relationship are due to insufficient variability in each group.

3.2. Relationship between manifestations of violence and coping strategies

The frequency of use of coping strategies and the intensity with which the different types of violence were manifested showed no general relationship; however, age was slightly positively related to desiderative thinking ($r=.288$; $p=.038$) and problem avoidance ($r=.287^*$, $p=.039$).

Considering that there are different dimensions of psychological violence, the decision was

made to disaggregate them in order to relate them to coping strategies. Thus, it was identified that the manifestations of coercion perceived by the students were positively related in a slight intensity with problem-solving ($rs=.279$; $p=.045$) and self-criticism ($rs=.276$; $p=.048$). Likewise, emotional punishment was slightly positively related to problem-solving ($rs=.307$; $p=.027$), emotional expression ($rs=.281$; $p=.043$), and cognitive restructuring ($rs=.349$; $p=.011$). (Table 4).

Table 4: Relationship between manifestations of violence and coping strategies
Source: Own elaboration.

		Coercion	Gender	Detachment	Humiliation	Emotional Punishment
Problem resolution	rs	.279*	.092	.092	.066	.307*
	p	.045	.515	.516	.643	.027
Self-Criticism	rs	.276*	.147	.160	.163	.259
	p	.048	.299	.257	.249	.064
Emotional Expression	rs	.201	.184	.092	.175	.281*
	p	.153	.192	.514	.216	.043
Wishful thinking	rs	.192	.033	-.025	.015	.216
	p	.173	.815	.862	.914	.124
Social Support	rs	.047	.145	.190	.184	.237
	p	.738	.305	.176	.190	.091
Cognitive restructuring	rs	.151	.113	.077	.134	.349*
	p	.284	.424	.587	.343	.011
Problem Avoidance	rs	-.012	.113	-.026	.087	.217
	p	.934	.425	.856	.538	.122
Social withdrawal	rs	.205	.102	.126	.140	.199
	p	.145	.472	.374	.321	.158

Note: rs = Spearman's rho correlation coefficient, p = statistical significance.

4. Discussion

Teen dating violence is becoming increasingly frequent (Cuccí et al., 2020); in addition, the isolation that adolescents tend to generate due to the use of social networks and the difficulty in developing social skills is marked by today's society, making it a risk factor for this situation to continue (Addy et al., 2021; Lausi et al., 2021; Momeñe et al., 2022). In this sense, the objective of the research was to determine the relationship between the manifestations of violence in adolescent dating and coping strategies. For this purpose, the expressions of violence in adolescents in a dating relationship were described. The expressions of violence and socio-demographic characteristics such as sex and age in adolescents in a dating relationship were related.

It was found that the majority of adolescents manifested some expression of violence and that half of them reported having experienced psychological violence exclusively, a result explained by the social learning theory that suggests that violent relationships are constructed and learned in the different contexts in which the individual develops. This agrees with the finding of Gómez et al. (2014), that the most frequent violence in adolescents is emotional and verbal, regardless of being male or female, and contradicts the research of Pérez-Castejón et al. (2021), who found that the prevalent violence is physical. Furthermore, 40.4 % presented a combination of psychological violence with other types of violence, which resembles the data reported by

Théorêt et al. (2021), according to which, based on a sample of 3100 adolescents, 19 % perceived both physical and psychological violence.

Concerning the demographic characteristics of age and sex, it was found that the most frequent age at which physical violence is perceived was 12-15 years, which is consistent with Gómez et al. (2014), who concluded that physical violence is more prevalent in early adolescence, while the older the age, the greater the manifestation of sexual violence. Regarding gender, males perceive greater physical violence compared to females, data that resembles that found by Allen and Bradley (2018) but contradicts the results of Cyr et al. (2006), who point out that there is no marked difference and that violence is bidirectional, that is, both partners violate each other. It is also discordant with the study by Sanmartín-Andújar et al. (2023), who found that women are the ones who perceive greater violence by men. This can be understood from the cognitive-behavioral approach, which holds that behaviors are observed and reinforced by their relationship with the environment, social interactions, and individual cognitive development typical of adolescence.

Also, the intensity with which each type of violence is manifested was not different in sex and age, which may be because violence has now become normalized in relationships among adolescents who justify and tolerate it (Fernández-Antelo et al., 2020). However, the results also indicate that psychological violence has an exception since there are greater manifestations perceived by men, which contradicts the findings of Théorêt et al. (2021), who found that the manifestations of psychological violence were present to the same degree among men and women; in addition,

it does not agree with the findings of Cuadrado-Gordillo et al. (2023), that men perceive the severity of violence in a lesser way, compared to women.

Finally, the results indicate that the manifestations of coercion perceived by the students are positively related in a slight intensity to problem-solving; that is, the adolescents seek to use cognitive and behavioral strategies to avoid the situation experienced (Cano et al., 2007) although there is also a relationship with self-criticism, so it is common for them to blame themselves for finding themselves in a pressured or threatening situation (Cano et al., 2007). Likewise, emotional punishment is related to problem-solving, emotional expression, and cognitive restructuring, so those who live emotionally manipulated tend to seek to escape from these attitudes, seek to express what they feel, and try to give it another meaning to alleviate the pain (Cano et al., 2007).

These data may indicate that adolescents remain in a violent circle without finding a way out, despite their desire to do so (Puente-Martínez et al., 2022). This may be due to the fact that relationships in adolescence tend to be romanticized (Cucci et al., 2020) by the consumption of digital media (Jaureguizar et al., 2024). Therefore, negative coping strategies such as self-criticism may intensify the risk of victimization. These strategies prevent dealing with conflict effectively and may exacerbate adolescents' vulnerability by maintaining a negative view of themselves and avoiding constructive coping. Negative strategies can intensify the effects of violence by avoiding confronting and resolving conflicts, which can lead to increased exposure to violence and lower self-esteem (Hagen et al., 2020).

5. Conclusions

In conclusion, teen dating violence is a worrying phenomenon that manifests itself in different ways; adolescents report at least one form of violence, with psychological violence being the

most prevalent. These findings reinforce the social learning theory and highlight the high frequency of physical and verbal violence in this group.

Regarding gender, males report higher rates of physical violence; in addition, younger adolescents show a higher prevalence of this form of violence, which could be linked to a growing normalization of aggressive behaviors in adolescence.

On the other hand, the coping strategies employed are often ineffective, such as problem-solving, self-criticism, and cognitive restructuring, and are related to the types of violence experienced, suggesting an attempt to manage emotional pain

and pressures in a variety of ways; however, it keeps them trapped in a cycle of violence from which they find it difficult to escape and intensifies their vulnerability.

These results highlight the importance of addressing these manifestations from a multifactorial perspective where contextual influences are considered, and positive coping strategies are encouraged so as to provide tools to resolve conflicts without resorting to violence or remaining in abusive relationships.

6. Recommendations

It is also possible to compare the data found with those found in other institutions, especially private ones, in order to determine other factors that may be considered risk factors for violent situations. Likewise, according to the data obtained, it

is imperative to promote psychoeducation on more constructive coping strategies that allow adolescents to manage the dynamics of their relationships in a healthier way to avoid normalizing violence.

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Knowledge and practices regarding the use of medicinal plants during pregnancy in Costa Rica

Conocimientos y las prácticas sobre el uso de plantas medicinales durante el embarazo en Costa Rica

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Knowledge and practices regarding the use of medicinal plants during pregnancy in Costa Rica

Conocimientos y las prácticas sobre el uso de plantas medicinales durante el embarazo en Costa Rica

Abstract

This study aims to identify the knowledge and practices regarding the use of medicinal plants and analyze how gender and educational level influence such knowledge and practices during pregnancy in Costa Rica, addressing research gaps. A total of 144 individuals aged 20 to 49 were surveyed. 59% of respondents were aware of the risks associated with the use of medicinal plants during pregnancy, with women showing greater knowledge than men. A higher educational level was associated with greater concern about risks such as abortion and fetal malformations. The most commonly used plants were *Matricaria chamomilla*, *Ruta graveolens*, *Satureja viminea*, and *Zingiber officinale*, with leaves being the most frequently used part and infusions the most common preparation method. These plants were primarily used to treat nausea and gastrointestinal issues. The study concluded that further research is needed to guide healthcare professionals and the public on the safe use of medicinal plants during pregnancy in Costa Rica.

Keywords: medicinal plants, pregnancy, perception of use of medicinal plants, risk of using medicinal plants, ethnobotany.

Resumen

Este estudio tiene como objetivo identificar el conocimiento y las prácticas relacionadas con el uso de plantas medicinales y analizar cómo el género y el nivel educativo influyen en dichos conocimientos y prácticas, durante el embarazo en Costa Rica, abordando brechas de investigación. Se encuestaron 144 personas de 20 a 49 años. El 59% de los encuestados conocía los riesgos del uso de plantas medicinales en el embarazo, y las mujeres mostraron mayor conocimiento que los hombres. Un mayor nivel educativo se asoció con mayor preocupación por riesgos como el aborto y las malformaciones fetales. Las plantas más usadas fueron *Matricaria chamomilla*, *Ruta graveolens*, *Satureja viminea* y *Zingiber officinale*, siendo las hojas la parte más empleada y las infusiones el método de preparación más común. Se utilizaron principalmente para tratar náuseas y problemas gastrointestinales. El estudio concluyó que es necesario más investigación para guiar a los profesionales de la salud y al público en el uso seguro de plantas medicinales durante el embarazo en Costa Rica.

Palabras clave: plantas medicinales, embarazo, percepción del uso de plantas medicinales, riesgo del uso de plantas medicinales, etnobotánica.

1. Introduction

The use of medicinal plants as a therapeutic resource dates back to a time even before the existence of human beings, being a practice observed among various species of mammals and birds (Pattanayak, 2024). For humans, medicinal plants have historically been the primary source of remedies for treating a wide variety of ailments and diseases. This practice remained the primary therapeutic approach until the mid-20th century. Even today, medicinal plants continue to play a significant role in healthcare, with an estimated 80% of the global population relying on them, either as complementary treatments or, in many cases, as the sole form of medicine (Kéry, 2023).

During pregnancy, a large percentage of women (50-90%) experience nausea, vomiting, and exacerbated health issues. Medicinal plants, including those that aid in childbirth, serve as a source of relief (Dekkers et al., 2020). The prevalence of medicinal plant use during pregnancy varies widely, from 1% to 71.8% across different regions, influenced by cultural practices and traditional knowledge (Balarastaghi et al., 2022; Jackson et al., 2024; Jahan et al., 2022; Quzmar et al., 2021).

Globally, the use of medicinal plants in maternal health is well-documented in traditional medicine systems, particularly in countries with strong cultural ties to herbal remedies. Research highlights that medicinal plants are frequently used in Asia, Africa, and Latin America for managing symptoms such as nausea and gastrointestinal issues, as well as for labor facilitation. However, while certain plants like *Matricaria chamomilla* (chamomile) and *Zingiber officinale* (ginger) are commonly used, they can carry risks if not standardized or properly dosed (Im et al., 2023; Balarastaghi et al., 2022). This underscores the importance of regulated use to prevent adverse effects, a concern that holds especially true in Costa Rica, where limited research has explored the impact and safety of these plants during pregnancy across diverse populations.

In Costa Rica, research on medicinal plant use during pregnancy remains scarce, with only a few studies primarily focused on indigenous populations in Central America (Locklear et al., 2013) and the Coto Brus region (Solano-Acuña and Rodríguez-Brenes, 2015). This narrow focus leaves a substantial gap in our understanding of how these plants are used across different Costa Rican communities. Extensive research is necessary to document the use of medicinal plants during pregnancy nationwide, as this knowledge could contribute to the preservation of traditional medicinal practices and inform public health policies that address the specific needs of Costa Rican society.

Despite the potential benefits, the use of certain medicinal plants during pregnancy presents risks. The World Health Organization (WHO) has raised concerns about the unregulated use of herbal medicine due to possible teratogenic effects or premature contractions induced by some plants. For instance, studies have identified *Ruta graveolens* (rue) and *Cinnamomum verum* (cinnamon) as plants with uterotonic effects, which could lead to premature contractions if used improperly (Bernstein et al., 2021; Kothari & DeGolier, 2022). Moreover, high doses of chamomile and ginger have been linked to increased uterine contractility and bleeding risks, highlighting the importance of professional guidance when using these herbs (de Abreu Tacon et al., 2020).

The socio-cultural and educational background of individuals also influences their perception and use of medicinal plants during pregnancy. Research suggests that women with higher educational levels are more aware of the potential risks associated with herbal medicine, while those with less formal education are more likely to rely on traditional knowledge (Mustofa & Rahmawati, 2020). In Latin America, particularly among indigenous communities, medicinal plants remain a primary option for maternal care. Studies have

shown that traditional plant use is often the first line of treatment, especially in rural areas with limited access to modern healthcare facilities (Locklear et al., 2013). Therefore, understanding these practices within the Costa Rican context requires examining the socio-cultural dynamics that drive plant use in maternal care.

From a public health perspective, the integration of medicinal plant use in maternal healthcare is essential to developing inclusive health policies. The World Health Organization has established guidelines for the safe use of traditional medicine, emphasizing the importance of awareness campaigns and regulatory policies (World Health Organization, 2013). Countries such as Brazil have adopted health policies that address the safe use of traditional medicine in maternal care, aiming to minimize risks while preserving cultural heritage (Leite et al., 2021). Adopting similar frameworks in Costa Rica could guide both healthcare professionals and the public towards the safe use of medicinal plants during pregnancy.

Presented below are the hypotheses, specific objectives, and research questions that guided the course of this study.

Hypotheses:

1. Women in Costa Rica possess greater knowledge and awareness of the risks associated with the use of medicinal plants during pregnancy compared to men.

2. Higher educational levels correlate with increased concern about risks such as miscarriage and fetal malformations resulting from the use of medicinal plants during pregnancy.

Specific Objectives:

1. To assess the level of knowledge about the use of medicinal plants during pregnancy in the Costa Rican population
2. To identify the most common practices related to medicinal plants during pregnancy, including the species used, the parts employed, and the preparation methods.
3. To explore gender differences in knowledge and practices related to the use of medicinal plants during pregnancy.
4. To analyze the relationship between educational levels and the use of medicinal plants during pregnancy.

Research Questions:

1. What is the level of knowledge among the Costa Rican population regarding the use of medicinal plants during pregnancy?
2. What are the most commonly used medicinal plant species during pregnancy in Costa Rica?
3. To what extent do gender and educational level influence knowledge about medicinal plants?

2. Materials and Methods

A descriptive cross-sectional quantitative study was conducted. Data were collected through a semi-structured interview. The study was conducted between July and September 2023 and targeted Costa Rican residents aged 20 to 49 years across all seven provinces (San José, Alajuela, Cartago, Heredia, Guanacaste, Puntarenas, and Limón). A non-probabilistic convenience

sampling method was used, resulting in a final sample of 144 participants. Interviews were conducted at various bus terminals in San José, strategically selected as central transit points for residents from all provinces, allowing for a geographically diverse representation of the Costa Rican population.

Data Collection Tools and Procedures:

1. The main tool was a semi-structured interview guide, developed and validated through a pilot test with 10 participants (pilot data were not included in the final analysis). The interview guide covered:

- Demographic information (age, gender, province of residence, education level)
- Knowledge of medicinal plants used during pregnancy
- Awareness of risks associated with plant use during pregnancy
- Cultural practices and beliefs regarding plant use

2. Interview Process

- Potential participants were approached at bus terminals.
- The study objectives were explained. Interviews were conducted in Spanish.
- Each interview lasted approximately 5-20 minutes.

3. Technical Procedures and Measurements

- Plant Identification
- Common plant names were recorded as provided by participants.
- Scientific names were later verified using:
 - The Manual de Plantas de Costa Rica (Manual of Costa Rican Plants)
 - The National Herbarium database
 - Consultation with botanical experts when necessary

• Plant Information Categorization

- Parts used (e.g., leaves, roots, flowers)
- Preparation methods (e.g., infusion, decoction)
- Reported uses during pregnancy
- Perceived risks and contraindications

4. Statistical Analysis

• Quantitative Analysis

- Descriptive statistics were calculated using SPSS version 25.0.
- Frequencies and percentages were determined for categorical variables.
- Means and standard deviations were calculated for continuous variables.
- Student's t-tests were employed to compare means between groups.
- ANOVA was used for comparing multiple groups.
- Statistical significance was set at $p < 0.05$.

5. Data Quality Control

- Interview forms were reviewed daily for completeness.
- Double data entry was performed to minimize errors.
- Inconsistencies were resolved by cross-referencing with original forms.

3. Results

Survey Demographics: This study included 144 individuals aged 20 to 50 (52 men and 92 women) from various Costa Rican provinces: 26 from San José, 23 from Alajuela, 24 from Cartago, 21 from Heredia, 14 from Guanacaste, 15 from Puntarenas, and 20 from Limón. Education levels

varied: 5 had incomplete elementary school, 18 had elementary school, 15 had incomplete high school, 29 had completed high school, 33 had started university studies, 12 held a bachelor's degree, 29 held another degree, and 3 with a postgraduate degree.

Plant Usage Insights: Out of 144 participants, 95 provided information on medicinal plant use. Identified 59 species; 26 considered prohibited,

17 recommended throughout pregnancy, and 17 had conflicting reports on usage during this stage.

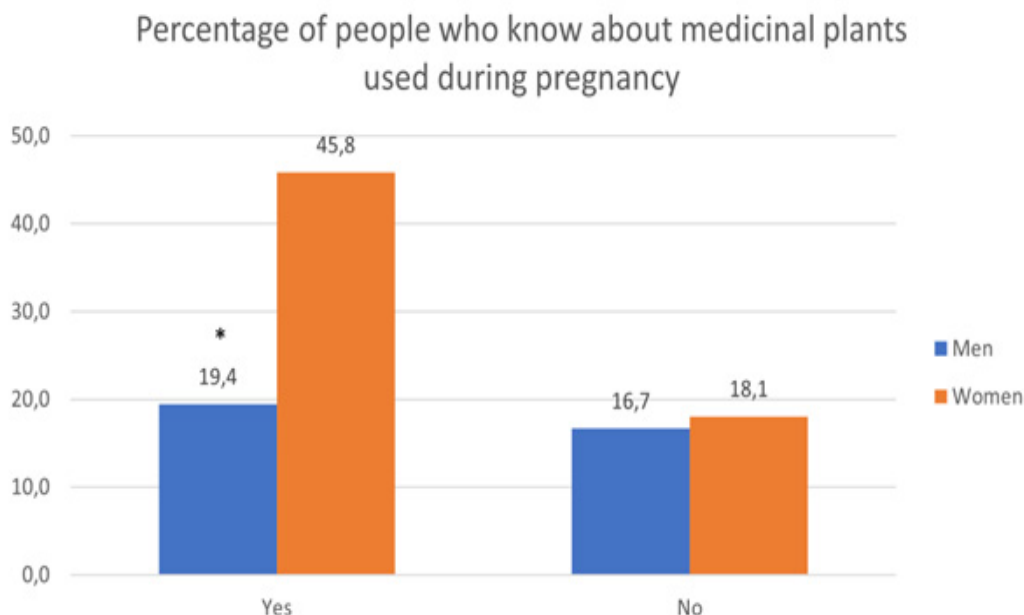


Figure 1: Percentage of people who know about medicinal plants used by pregnant women to treat various health problems, according to gender. * There is a statistically significant difference between genders (t Student = 0.025). Source: Own elaboration.

Women demonstrate greater awareness of medicinal plants used during pregnancy than men ($t = 0.025$), as shown in figure 1. However, there are no significant differences between genders in the average number of known plant species ($t = 0.097$), awareness of medicinal plants posing risks during pregnancy ($t = 0.543$), understanding of pregnancy-related risks ($t = 0.618$), or knowledge of plant categorization based on pregnancy risk ($t = 0.078$).

The region of residence, whether rural or not, does not yield a statistically significant difference in knowledge about medicinal plants used during pregnancy ($t = 0.087$), the average number of known plant species ($t = 0.487$), or awareness of medicinal plants unsuitable for this condition ($t = 0.084$).

When comparing provinces, there is no significant difference in the respondents' knowledge of medicinal plants used during pregnancy. Additionally, there is no statistical difference

in age groups concerning awareness of the use of medicinal plants in pregnancy (ANOVA = 0.623), the number of known medicinal plants (ANOVA = 0.185), awareness of medicinal plants unsuitable for pregnancy (ANOVA = 0.546), or the perceived risks associated with these plants (ANOVA = 0.958).

Regarding educational levels, there is no significant difference in knowledge about medicinal plants used during pregnancy (ANOVA = 0.259) or the average number of known plants (ANOVA = 0.237). However, there is a statistically significant difference in awareness of medicinal plants unsuitable for this period (ANOVA = 0.042), indicating that individuals with university education possess greater knowledge compared to those with primary or secondary education. Similarly, there is a significant difference in awareness of potential adverse effects from the use of certain medicinal plants (ANOVA = 0.013).

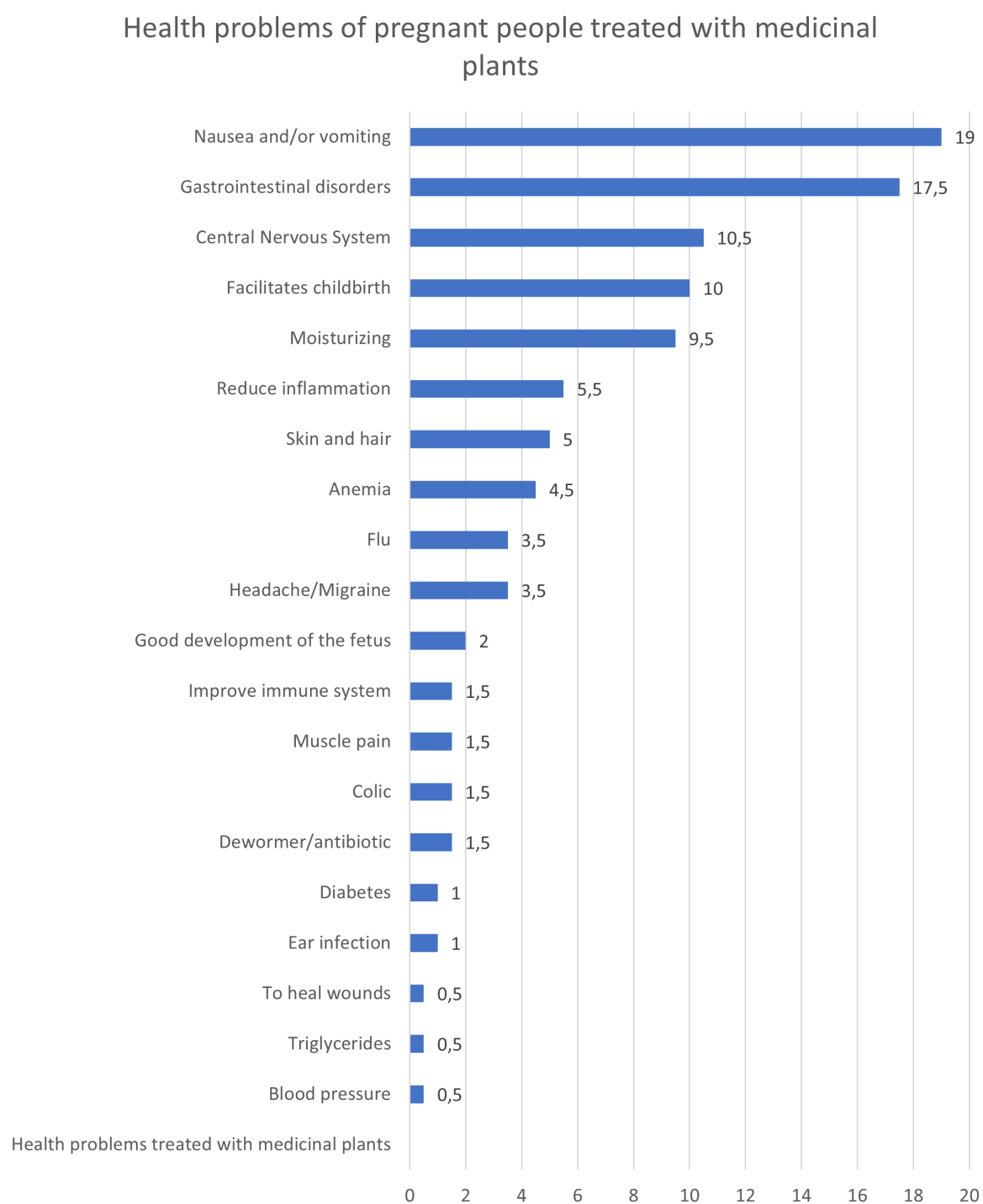


Figure 2: Health problems for which pregnant women use medicinal plants. Note: Gastrointestinal problems include improve digestion, remove acidity, treat stomach pain and treat colitis. Central nervous system includes treating anxiety, nerves, relaxation, sleep aid
Source: Own elaboration.

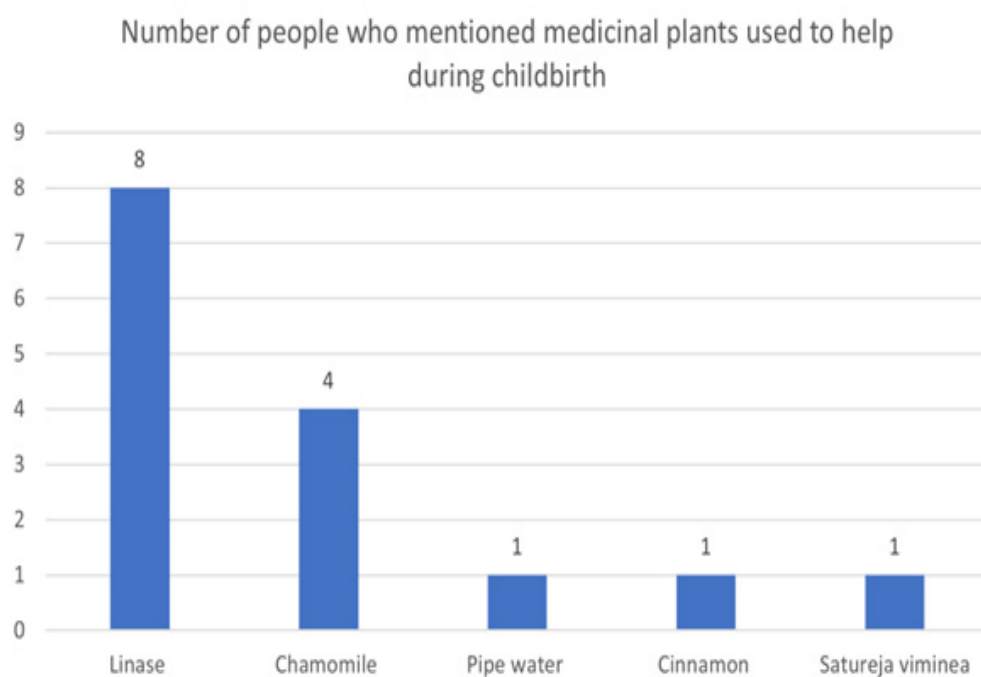


Figure 3: Of the 95 people who provided information on medicinal plants, 13 indicated medicinal plants that help during childbirth.
Source: Own elaboration.

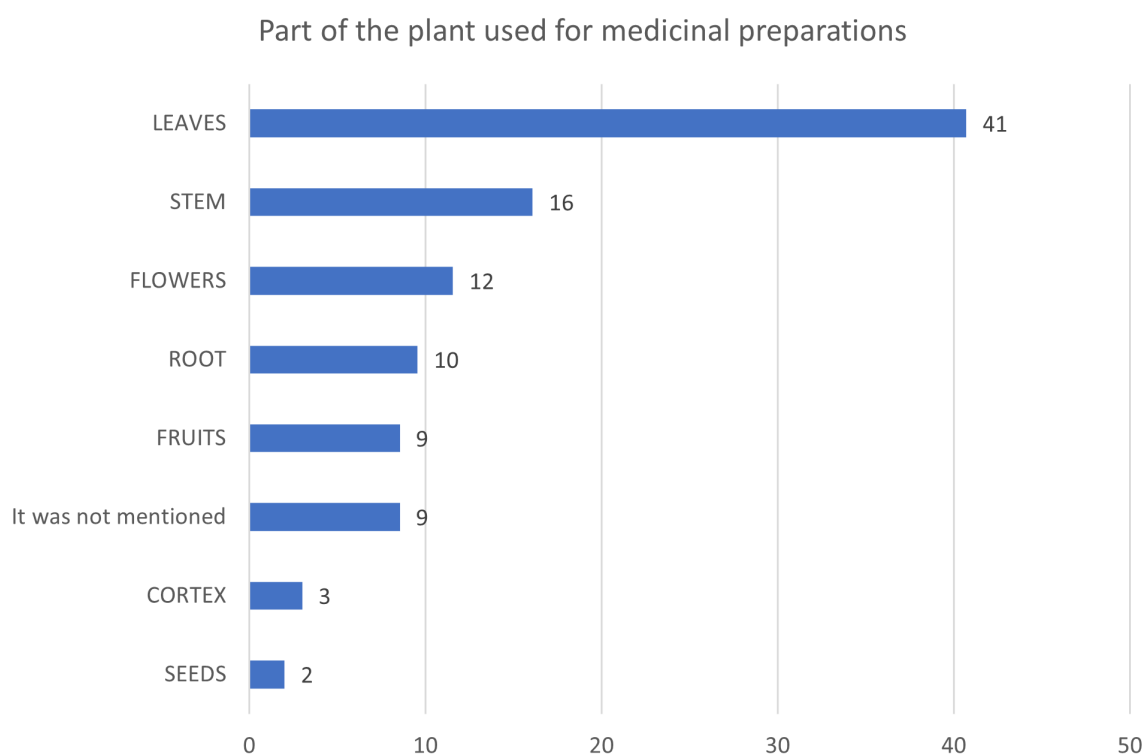


Figure 4: Part of the plant used for the preparation of the treatments
Source: Own elaboration.

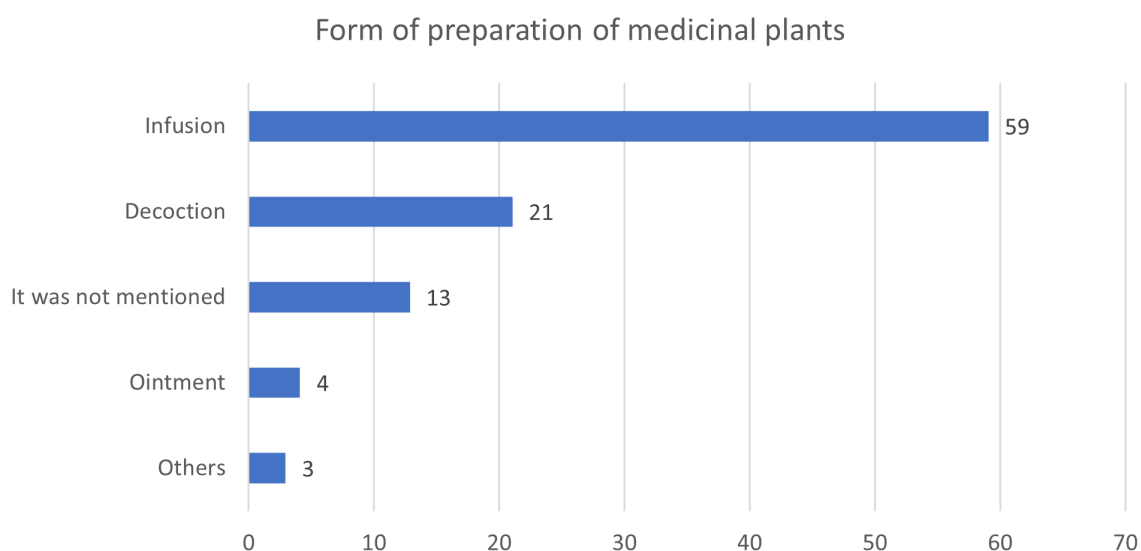


Figure 5: Form of preparation of medicinal plants.
Source: Own elaboration.

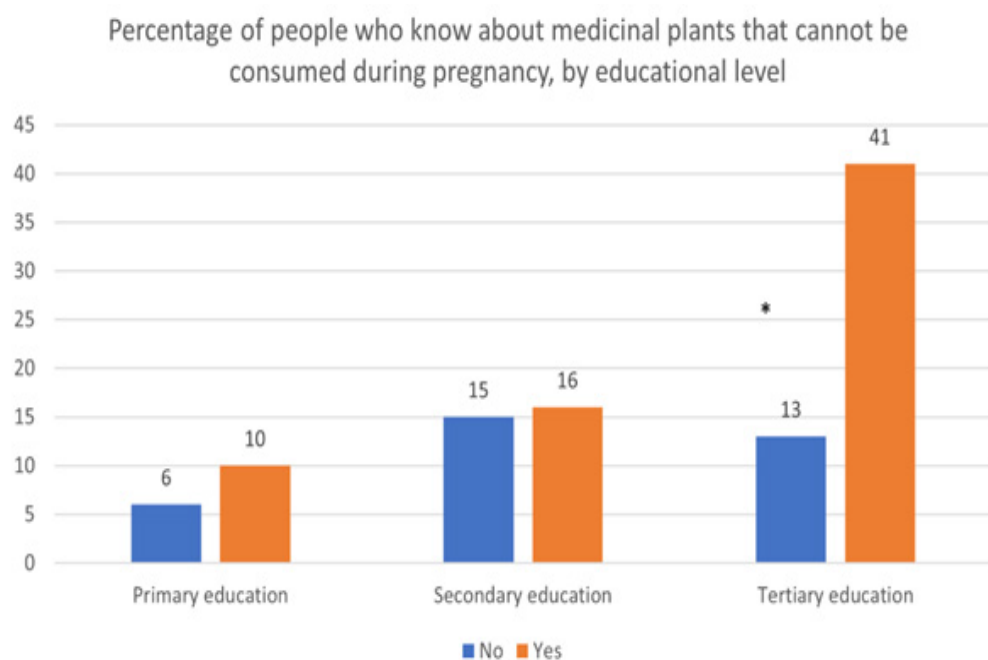


Figure 6: Percentage of people who know about medicinal plants that increase the probability of abortion or fetal malformations, according to level of schooling (people with one or more years of primary school; one or more years of secondary school; one year of university up to postgraduate studies). The difference between groups is statistically significant, $p < 0.05$.

Source: Own elaboration.

Knowledge about the possible risk produced by the use of medicinal plants in pregnancy.

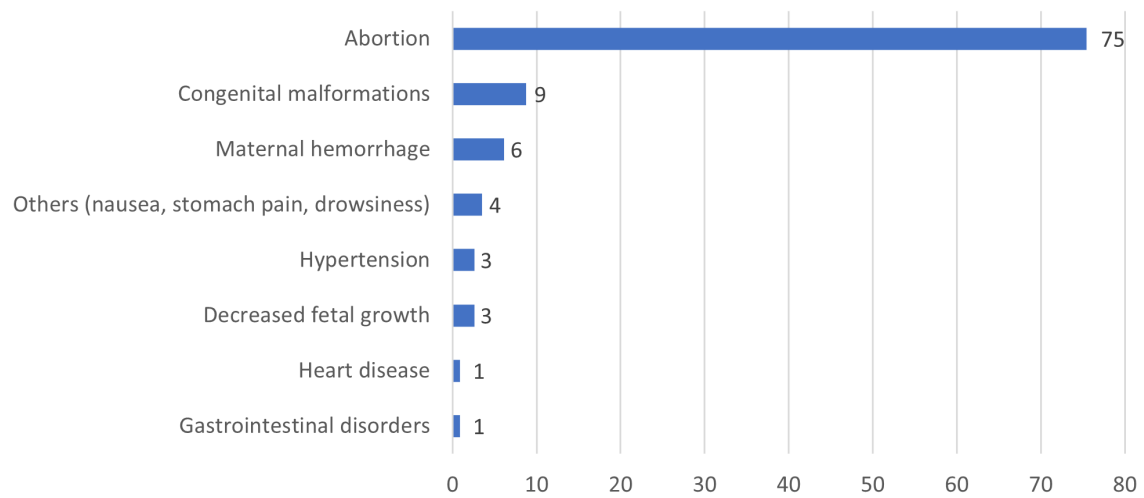


Figure 7: Awareness of potential risk produced by the use of medicinal plants in pregnancy. Note: Of the 144 people interviewed, 85 people mentioned one or more risks of medicinal plant consumption during pregnancy.

Source: Own elaboration.

Table 1: . Plant species mentioned according to their use or restriction during the pregnancy period.

Note: Table modified from Hernández-Salón and León-Chavarría, 2023. *Species not mentioned in the previous study. In quotes the names that only appear in Spanish and are typical of Costa Rica.

Source: Own elaboration.

Common name	Used	Not to be used	Family	Species
Chamomile	49,5	34,7	Asteraceae	<i>Matricaria chamomilla</i>
Rue	0,0	34,7	Rutaceae	<i>Ruta graveolens</i>
“Menta”	16,8	7,4	Lamiaceae	<i>Satureja viminea</i>
Ginger	15,8	3,2	Zingiberaceae	<i>Zingiber officinale</i>
Cinnamon	4,2	12,6	Lauraceae	<i>Cinnamomum verum</i>
Flaxseed	0,0	12,6	Linaceae	<i>Linum usitatissimum</i>
Aloe	6,3	3,2	Liliaceae	<i>Aloe vera</i>
Rosemary	3,2	5,3	Lamiaceae	<i>Salvia rosmarinus</i>
Corn mint	4,2	4,2	Lamiaceae	<i>Mentha arvensis</i>
Linden	6,3	2,1	Acanthaceae	<i>Justicia pectoralis</i>
Thyme	7,4	1,1	Lamiaceae	<i>Thymus vulgaris</i>

Common name	Used	Not to be used	Family	Species
Canabis	0,0	7,4	Cannabaceae	<i>Cannabis sativa</i>
Eucalyptus	0,0	5,3	Myrtaceae	<i>Eucalyptus sp.</i>
“Cuculmeca”	5,3	0,0	Smilacaceae	<i>Smilax dominguensis</i>
Sage	0,0	5,3	Lamiaceae	<i>Salvia officinalis</i>
Anise	0,0	5,3	Apiaceae	<i>Pimpinella anisum</i>
“Hombre grande”	0,0	4,2	Simaroubaceae	<i>Quassia amara</i>
Turmeric	2,1	2,1	Zingiberaceae	<i>Curcuma longa</i>
*Pot marigold	1,1	3,2	Asteraceae	<i>Calendula officinali</i>
Caraño shell	4,2	0,0	Burseraceae	<i>Trattinnickia aspera</i>
Bushy matgrass	2,1	1,1	Verbenaceae	<i>Lippia alba</i>
Garlic	2,1	1,1	Liliaceae	<i>Allium sativum L</i>
*Passiflora	2,1	1,1	Passifloraceae	<i>Passiflora sp</i>
Mexican oregano	1,1	1,1	Lamiaceae	<i>Lippia graveolens</i>
Lemon grass	2,1	0,0	Poaceae	<i>Cymbopogon citratus</i>
Guava	0,0	2,1	Myrtaceae	<i>Psidium guajaba</i>
Lemon	2,1	0,0	Rutaceae	<i>Citrus aurantifolia</i>
“Indio desnudo”	1,1	1,1	Burseraceae	<i>Bursera simaruba</i>
“Gavilana”	1,1	1,1	Asteraceae	<i>Neurolaena lobata</i>
Orange	2,1	0,0	Rutaceae	<i>Citrus × sinensis</i>
Mallow	1,1	1,1	Malvaceae	<i>Malva parviflora</i>
Plantain	0,0	2,1	Plantaginaceae	<i>Plantago sp</i>
Pineapple	0,0	2,1	Bromeliaceae	<i>Ananas comosus</i>
Trumpet tree	0,0	2,1	Cecropiaceae	<i>Cecropia peltata</i>
Coconut	0,0	2,1	Arecaceae	<i>Cocos nucifera</i>
Lavender	2,1	0,0	Lamiaceae	<i>Lavandula angustifolia</i>

Common name	Used	Not to be used	Family	Species
*Parsley	0,0	2,1	Apiaceae	<i>Petroselinum crispum</i>
*Pineapple	0,0	2,1	Bromeliaceae	<i>Ananas comosus</i>
Bitter gourd	0,0	1,1	Cucurbitaceae	<i>Momordica charantia</i>
Dandelion	0,0	1,1	Asteraceae	<i>Taraxacum officinale</i>
Cobblers pegs	0,0	1,1	Asteraceae	<i>Bidens pilosa</i>
Horsetail	0,0	1,1	Equisetaceae	<i>Equisetum giganteum</i>
Spiny coriander	1,1	0,0	Apiaceae	<i>Eryngium foetidum</i>
Nutmeg	0,0	1,1	Myristicaceae	<i>Myristica fragrans</i>
Sensitive Plant	0,0	1,1	Fabaceae	<i>Mimosa pudica</i>
Basil	1,1	0,0	Lamiaceae	<i>Ocimum basilicum</i>
Mountain tobacco	0,0	1,1	Asteraceae	<i>Arnica sp</i>
Lemon balm	1,1	0,0	Lamiaceae	<i>Melissa officinalis</i>
Cat's claw	1,1	0,0	Rubiaceae	<i>Uncaria tomentosa</i>
Valerian	1,1	0,0	Caprifoliaceae	<i>Valeriana officinalis</i>
*Wormwood	0,0	1,1	Asteraceae	<i>Artemisia absinthium</i>
*Borrajé	1,1	0,0	Boraginaceae	<i>Borago officinalis</i>
Orange blossom flower	1,1	0,0	Rutaceae	<i>Citrus aurantifolia</i>
*Chicory	1,1	0,0	Asteraceae	<i>Chicorium intybus</i>
*Chang	1,1	0,0	Lamiaceae	<i>Hyptis suaveolens</i>
*Ginkgo biloba	1,1	0,0	Ginkgoaceae	<i>Ginkgo biloba</i>
*Ginseng	1,1	0,0	Araliaceae	<i>Panax ginseng</i>
*Jasmine	1,1	0,0	Oleaceae	<i>Jasminum officinale</i>
*Licorice	0,0	1,1	Fabaceae	<i>Glycyrrhiza glabra</i>

Note: Of 144 people, 95 gave the name of medicinal plant species that could or could not be used during pregnancy. In quotes the names that only appear in Spanish and are typical of Costa Rica. *Source:* Own elaboration

4. Discussion

The study highlights significant gender differences in knowledge of medicinal plants used during pregnancy, with 71% of women and 52% of men demonstrating awareness (Figure 1). This disparity mirrors global findings in which women generally hold more knowledge of traditional medicinal practices, often due to cultural roles that position them as primary caregivers in family health, particularly during pregnancy (Abdullah & Andrabi, 2021; Mustofa & Rahmawati, 2020). This finding suggests that in Costa Rica, as in other Latin American settings, gender-specific health education could further empower both men and women to make informed decisions on the safe use of medicinal plants during pregnancy.

Health issues such as nausea, gastrointestinal problems, and anxiety were the most commonly treated conditions with medicinal plants, as indicated by respondents (Figure 2). This aligns with the global use of plants like *Matricaria chamomilla* (chamomile) and *Zingiber officinale* (ginger) for their anti-nausea and digestive properties (Dekkers et al., 2020; Balarastaghi et al., 2022). While these plants are traditionally seen as safe, it is essential to emphasize dosage and preparation guidelines. For instance, chamomile, though commonly used, has been associated with increased uterine contractility at high doses, which poses a risk for pregnant women (Kothari & DeGolier, 2022). This underlines the need for health professionals to provide clear information on safe use, especially in rural areas with limited access to formal healthcare.

When analyzing plant use for labor facilitation, respondents identified flaxseed, chamomile, and cinnamon as popular choices (Figure 3). Flaxseed, in particular, was frequently mentioned for its perceived benefits in labor preparation, supported by findings from an Ethiopian hospital where flaxseed consumption correlated with a 72% reduction in labor complications (Nigussie et al., 2023). However, the effects of other plants, like cinnamon, are more complex. While

cinnamon is traditionally used for labor induction in parts of Latin America, some studies in animal models suggest that it may actually inhibit uterine contractions, contrary to its traditional use (Arbati et al., 2021). These contradictions highlight the necessity for further research into the physiological effects of these plants on labor and delivery outcomes in humans.

The study also found considerable variation in the plant parts used and preparation methods among the respondents. Leaves were the most commonly used plant part (40.7%), followed by stems (16.1%) and flowers (11.6%), while infusions (59.1%) and decoctions (21.1%) were the predominant preparation methods (Figures 4 and 5). This trend aligns with findings from studies in Morocco and South America, where infusions and decoctions are the preferred preparation methods for medicinal plants (Kachmar et al., 2021; Horackova et al., 2023). The preference for these methods likely aligns with cultural practices that prioritize gentle extraction techniques perceived as safer. However, preparation methods significantly affect a plant's efficacy and safety profile, suggesting a need for standardization to minimize potential adverse effects.

The awareness of risks associated with medicinal plant use during pregnancy is relatively high, with 59% of respondents indicating knowledge of potential dangers (Figure 6). This awareness was more pronounced among individuals with higher educational attainment, similar to patterns observed in Ethiopia, where education level correlates with safer medicinal plant use practices (Wondemagegn & Seyoum, 2023). This suggests that individuals with access to more formal education might have greater exposure to health information, underscoring the importance of public health campaigns targeted at all educational levels to ensure widespread awareness of safe medicinal plant use during pregnancy.

Among the identified risks, the most concerning were miscarriage and fetal malformations,

reported by 75.4% of participants (Figure 7). These concerns align with established literature on certain medicinal plants that can induce spontaneous abortion or increase uterine contractility (Bernstein et al., 2021). For example, rue (*Ruta graveolens*) and marijuana (*Cannabis sativa*) were frequently mentioned as dangerous, with 34.7% and 7.4% of respondents, respectively, aware of their risks (Table 1). Rue, a commonly used plant in traditional medicine, has been associated with uterine hyperdynamia and related complications, highlighting the need for clear public health messaging. (Campos et al., 2023). Marijuana use during pregnancy is similarly concerning, as prenatal cannabis exposure has been associated with neurodevelopmental issues

and behavioral impairments in children (Evanski et al., 2024).

Finally, the study highlights some misconceptions, particularly the perception that coconut water is abortive (it was found that 4 out of 144 interviewees believed that coconut water is abortive), despite existing evidence suggesting its safety and potential benefits in moderation (Akinsulie et al., 2023). This misconception underscores the need for culturally tailored educational interventions that address local beliefs and provide accurate information on the safe use of commonly used plants. Addressing these knowledge gaps through community health education could mitigate risks and promote safer traditional practices.

5. Conclusions

In Costa Rica, the widespread use of medicinal plants persists as a common alternative for addressing minor health concerns among pregnant women throughout diverse regions. Most participants demonstrated a moderate level of knowledge regarding the risks and benefits of medicinal plants during pregnancy. Primary health issues, such as gastrointestinal ailments and nervous system disorders, are predominantly managed through the application of medicinal plants.

Chamomile (*Matricaria chamomilla*), “menta” (*Satureja viminea*), and ginger (*Zingiber officinale*) are the most commonly employed species for addressing the health problems of pregnant women. Leaves were the preferred plant part, and infusions were the preferred preparation method for medicinal plants used during pregnancy. Despite the widespread use of medicinal plants, certain myths persist in the

Costa Rican population regarding the effects of specific medicinal plants on pregnancy, illustrated by misconceptions surrounding tap water and flaxseed.

Women demonstrated significantly greater knowledge about medicinal plants and their associated risks compared to men, highlighting the traditional role of women as primary caregivers and users of natural medicine in the Costa Rican context.

Individuals with higher educational levels showed greater concern about associated risks, such as abortion and fetal malformations. This finding underscores the importance of formal education in promoting safe practices related to the use of medicinal plants during pregnancy. Additionally, a significant portion of the population is aware of potential risks associated with the use of certain medicinal plants during pregnancy.

6. Recommendations

Implement robust public awareness campaigns to disseminate accurate information on the safe use of medicinal plants during pregnancy.

Provide training for healthcare professionals, including doctors, midwives, and nurses, to ensure they stay informed on the safe use of medicinal plants during pregnancy.

Advocate for expanded research efforts on the impact of medicinal plants during pregnancy, with a particular emphasis on scrutinizing species like *Satureja viminea* on embryonic development.

7. Acknowledgments

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Pedagogical practices of music education with deaf students in southern of Chile

Prácticas pedagógicas en la educación musical con estudiantes sordos en el sur de Chile

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Pedagogical practices of music education with deaf students in southern of Chile

Prácticas pedagógicas en la educación musical con estudiantes sordos en el sur de Chile

Abstract

Music encompasses various dimensions of human life, significantly impacts all students, and is part of the national curriculum. The objective is to reveal the pedagogical practices used by music teachers to teach deaf students in educational institutions in four cities in southern Chile. The instrument applied was a semi-structured interview with six music education teachers. The results show a central category called pedagogical practices in music education, with three subcategories: methods for teaching music education, music teaching strategies, and material resources. The conclusions highlight that the teaching experience to give an educational response is based on the acquired experiences and their interest. Likewise, using various resources and multisensory strategies is valued, highlighting the willingness to innovate and generate new teaching strategies.

Keywords: inclusion, music, deaf students, pedagogical practices, education

Resumen

La música abarca diversas dimensiones de la vida humana y tiene un impacto significativo en todos los estudiantes y forma parte del currículum nacional. El objetivo es develar las prácticas pedagógicas que utilizan los profesores de música para enseñar a estudiantes sordos en instituciones educativas de cuatro ciudades del sur de Chile. El instrumento aplicado fue una entrevista semiestructurada a 6 profesores de educación musical. Los resultados muestran una categoría central denominada prácticas pedagógicas en educación musical, con tres subcategorías: métodos para la enseñanza de la educación musical, estrategias de enseñanza de la música y recursos materiales. Las conclusiones destacan que la experiencia docente para dar una respuesta educativa se basa en las vivencias adquiridas y en su interés personal, así mismo, se valora el uso de una variedad de recursos y estrategias multisensoriales, relevando la disposición para innovar y generar nuevas estrategias de enseñanza.

Palabras clave: inclusión, música, estudiantes sordos, prácticas pedagógicas, educación.

1. Introduction

Music possesses the unique ability to unite individuals across linguistic and cultural boundaries. It evokes memories, tells stories, and, arguably, enriches the human spirit. Del Barrio et al. (2024) affirm that “among the policies that define a nation’s educational system, access to music education should be included as a key factor promoting cultural development” (p.1). In this context, inclusion, music education, and the presence of deaf students in the classroom demand a high degree of pedagogical and organizational responsibility from music teachers committed to inclusive education.

The musical arts are widely recognized as a means to foster motor, cognitive, and social skills. They are known to enhance processes such as memory, attention, concentration, imagination, emotional expression, balance, muscular development, and creativity (Martínez Romero & Vivas Tamayo, 2021; Silva et al., 2020). The Spanish experience, for instance, highlights the need for teacher training programs in music education to include didactic preparation that ensures all students—regardless of their abilities—can access the same content and develop equivalent skills (del Barrio et al., 2024, p.6).

In Chile, the national Music Education Program positions this discipline as a subject with the potential to significantly impact students’ lives and act as a powerful motivational tool for learning. Its implementation is considered essential due to the wide array of benefits it offers. However, the role and impact of music in the education of deaf students often depend on the teacher’s conceptualization of deafness.

If a teacher approaches deafness from a medical or rehabilitative perspective, the focus tends to be on the “ear” and auditory capacity (Buitrago Ocampo, 2021), which minimizes music’s role as a dynamic and expressive art form. Conversely, from a socio-anthropological viewpoint that values the cultural and linguistic identity of deaf individuals, music is seen through a broader lens—one that acknowledges diverse musical

expressions and alternative forms of access (Silva et al., 2020; Barra & Muñoz, 2020).

It is important to note that when a person is diagnosed with deafness, both possibilities and limitations are commonly defined early on—often by their own family, which may include assumptions about whether or not they can engage with music. In educational contexts, many curricula for deaf students have traditionally emphasized rhythm as a tool for speech development and phonological rehabilitation, thus prioritizing auditory training over visual strategies—despite the latter being more aligned with how deaf individuals typically perceive the world (Brétéché, 2021; Cerda et al., 2021).

Otero (2015) explains that for deaf individuals, rhythm is perceived primarily through vibration—a central component of their musical experience rather than a supplementary one. Music is experienced through the entire body. In this sense, signed music emerges as a powerful art form that combines lyrical and non-lyrical performance in sign language, deeply rooted in Deaf culture and developed by Deaf musicians themselves (Cripps, Witcher, & Youssouf, 2022).

As Otero (2015) suggests, “the power of music lies in its ability to awaken the desire to share feelings, practices, worldviews, and meanings that people build and challenge through interaction” (p.135). These insights invite us to reconsider the importance of offering music experiences to deaf students—not necessarily through hearing, but through pedagogical actions that promote alternative, inclusive access to music.

Pedagogical practices, therefore, are deliberate strategies designed to facilitate learning and promote interaction throughout the teaching-learning process. They encompass the construction of knowledge, values, procedures, and habits (Bravo, 2008; Gamboa et al., 2013; Gamboa, 2017). In today’s diverse classrooms, music teachers often find themselves working with deaf students who use Chilean Sign Language

(Government of Chile, 2021), a situation that requires rethinking both the concept of deafness and the teaching strategies applied to ensure inclusive learning environments.

Despite this growing need, many music teachers report being insufficiently prepared to teach deaf students or adapt their instructional strategies accordingly. Latorre (2013) notes that most teacher education programs fail to provide adequate preparation to address students' individual needs. Yet, the current curriculum increasingly demands that arts teachers adopt inclusive approaches and respond to student diversity as a pedagogical imperative.

In Latin America, music education programs rarely offer coursework or seminars addressing student diversity. Instead, they tend to focus on developing competencies in instrumental and vocal performance, as well as in the symbolic language of music notation and structure (Gardner, 2011; Martínez Romero & Vivas Tamayo, 2020). Curriculum plans are generally aligned with grade-level educational objectives rather than inclusive pedagogical frameworks.

However, studies on individual learning differences underscore the need to design flexible curricula that reflect the variety of skills and learning styles found in any classroom. Music, known for its cognitive and emotional benefits, should be equally accessible to all students—including those with disabilities—as part of a broader strategy for inclusive education.

While classroom instruction is typically designed for all students, the learning process is inevitably unique to each individual. Students internalize and interpret knowledge based on their prior experiences and contexts. Research involving deaf students often focuses on comparing their abilities to those of hearing students, inadvertently framing them as disadvantaged. Instead, we should ask: must deaf students experience music the same way as their hearing peers? Or can they develop their own unique relationship with music?

Indeed, deaf students do not perceive sound through hearing in the same way as their hearing peers. However, they can engage with music

through alternative sensory pathways such as sight and touch. Tools that translate song lyrics into visual elements, for instance, allow deaf students to follow rhythm and tempo. Rhythm is not solely an auditory phenomenon—it is also embedded in the body's natural functions, such as heartbeat, breathing, and blinking (Cerdeña et al., 2021).

The concept of “deaf listening” challenges traditional, audiocentric models of musical experience. Deaf individuals experience sound through its visual, tactile, and vibratory dimensions. Their musical engagement extends beyond hearing, making music a truly embodied and visual reality (Brétéché, 2021). Music, therefore, is not limited to sound—it involves the eyes, the body, and alternative sensory experiences.

Lafuente (2019) highlights the cognitive and emotional benefits of music for diverse learners, including those with dyslexia, language delays, or hearing loss. Despite this, there is still limited research in Chile on how music impacts deaf individuals or on effective teaching strategies tailored to their needs.

Morales and Verdugo (2022) call for visually oriented didactic methods that are grounded in Deaf culture. They advocate for a pedagogical shift away from sound-centered instruction. Similarly, Sabbatella (2008) introduces the concept of the “inclusive music educator”—a teacher who understands each student's unique characteristics and adapts their teaching methods to ensure equitable access for all.

The literature reviewed supports the idea that musical experiences can be enriching and accessible for deaf students, provided they are adapted to their cultural and linguistic context (Ministry of Education, 2022). Díaz Santamaría and Moliner García (2020) affirm that music facilitates participation and learning, particularly among students from marginalized or traditionally excluded groups.

Vivas and Martínez (2019) propose a pedagogical model for enhancing musical awareness among deaf students, which includes physical rhythm

exercises like clapping or tapping, the use of tactile objects (e.g., balloons to feel sound vibrations), and instruments that produce high-frequency tones. These strategies underscore the increasing need for inclusive pedagogical practices that recognize and respond to the diversity within classrooms.

In Colombia, Osorio Medina et al. (2024) describe how educational curricula have been adapted using the Kodály methodology to foster practical and participatory music learning among deaf students. The most significant takeaway from such studies is that deaf students must no longer be excluded from musical experiences. Their auditory differences should not be viewed

as barriers, but as opportunities to rediscover and reconstruct music with them (Cerdeja Caicedo, 2022).

These reflections lead us to reconsider which subjects—beyond the core areas of language, math, or science—are essential to holistic human development. The arts, and particularly music, play a crucial role in the formation of both hearing and deaf individuals. In this context, music teachers' pedagogical practices, strategies, and adaptations are vital to ensuring inclusive and meaningful learning. Therefore, this research seeks to uncover the pedagogical practices used by music teachers to instruct deaf students in educational institutions across four cities in southern Chile.

2. Methodological framework

Approach and Design

This study adopts a qualitative approach, as it involves collecting and analyzing data, and identifying new questions during the interpretation phase (Hernández et al., 2014; Hernández & Mendoza, 2018). Furthermore, a multiple case study design is utilized. As López (2013) explains, this design enables the simultaneous analysis of several individual cases in order to explore, describe, explain, evaluate, or intervene in a given educational reality. In this study, the focus is on the pedagogical practices that form part of the daily teaching experiences of music educators working with deaf students.

Participant

The participant group consisted of six music education teachers who currently teach deaf students. These educators work in a range of

educational settings, including regular schools at the kindergarten, elementary, and middle school levels, as well as special education institutions and institutions of higher education. To preserve anonymity, participants are referred to using the codes PM1 through PM6.

Instrument

For this study, a semi-structured interview protocol was designed, covering three dimensions: methods, strategies, and resources. Each dimension included three guiding questions. The instrument was validated by expert reviewers in educational research, and their suggestions were incorporated into the final version. Before conducting the interviews, participants signed an informed consent form to ensure compliance with ethical research standards.

3. Results

The collected data were transcribed and analyzed using content analysis. This process led to the identification of a central category—Pedagogical Practices in Music Education—and three subcategories: Methods for Teaching Music Education, Teaching Strategies, and Material Resources.

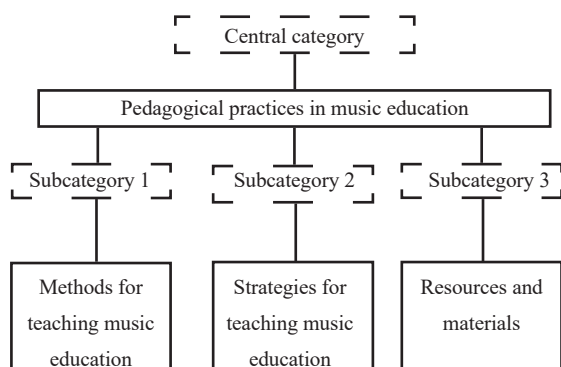


Figure 1: Central category and Subcategories
Source: Own elaboration

3.1. The central category, pedagogical practices in music education, reflects the everyday teaching experiences of music educators across various educational settings. These practices are guided by curriculum requirements and aim to develop students' musical knowledge and skills (Díaz, 2006).

Subcategory 1. *Methods for teaching music education* refer to the diverse instructional approaches that, when applied in combination, aim to help deaf students experience and enjoy the process of learning music.

In relation to this subcategory, participants use various teaching methods, such as the Kodály method, which benefits deaf students by representing musical notes through signs, facilitating their participation in class,

I began using the Kodály method, which employs a universal musical language represented through hand signs for each note. I adopted this component, and it worked well—the student quickly understood it” (PM2)

They also use the Colores method, which is characterized by providing support by assigning colors to each musical note. This methodology offers the deaf student the possibility of playing instruments through visual support,

Now we are playing instruments, with the support of colors... with him we are doing the following... in the score we paint the notes, for example, we paint the C in blue, the F in orange and so on, then without listening, he is supported by the colors (PM2).

Subcategory 2. Teaching strategies for music education refers to the ways used to implement the methods mentioned above.

One strategy involved teaching musical notes using Chilean Sign Language—not just for the deaf student, but for the entire class since he believes that this could be useful for everyone and not only for one student in particular,

For example, I use my hands to do the DO, RE, MI, DO, DO, RE, MI, DO, MI, MI, FA, SOL, MI, FA, SOL. Then all the children participated and learned the notes in Sign Language... All this as group work then, I understood that in reality it is useful for everyone, not only for him (PM2).

On the other hand, the use of these strategies facilitates musical learning through playful activities, as pointed out by another participant,

There is another strategy that works very well or works at least for me, it had to do with dancing, through this strategy the deaf student manages to dance cueca [Chile's national dance] and other dances. How did we do it? without shoes (PM6).

Subcategory 3. Material Resources consider those resources that can manifest in physical or virtual formats and have the fundamental objective of motivating the students' interest. It is essential

that they adjust to the physical characteristics of the student body, at the same time facilitating the teaching task by serving as orientation, and have the remarkable virtue of adapting to a wide variety of contents

For example, one participant mentions that he used metallophones, applying this instrument in conjunction with the Colores method,

For example, with a class we played metallophones, I brought some metallophones from school and taught them music in colors and that is visual, and although they did not hear what they were playing they did associate it to the colors and so I taught them some little songs (PM3).

On the other hand, another participant prefers melodica since the use of this instrument in his classes allows the deaf student to play it while observing the blackboard. In addition, the incorporation of this instrument benefits the way the student learns,

Particularly I teach melodica, I do not like the metallophone because the child needs to see the blackboard and also the instrument, but the melodica, which is similar to the piano, the child can see and play, even if the instrument

does not sound for the child, he knows he is doing it well because he knows where the notes are located (PM1).

Most of the participants also emphasize the use of speakers, as they generate high vibrations. This statement is supported by the experiences of another participant, who incorporated a subwoofer, a device that reproduced bass sounds. All this, in relation to his previously mentioned strategy of taking off his shoes, allowing the deaf student to feel the musical rhythm,

What I did was to place the speakers on the table and a subwoofer on the floor and what this does is to generate a strong and powerful vibration that can be felt in the feet, so she did not listen, but she felt the rhythm in her feet and I emphasize again the rhythm, not the melody (PM6).

In addition to the above, another participant also mentions that he used a speaker and a water balloon, through which the deaf student could perceive the vibrations of the music,

Sometimes I would put a balloon over him to make him feel the music, through how the water moved (PM5).

4. Discussion

Teachers, as facilitators of learning and key actors in the educational process, are responsible for employing appropriate pedagogical methods tailored to the diverse ways in which students process and internalize knowledge (Chica et al., 2021). In the field of music education, teachers implement multisensory teaching approaches that move beyond auditory-based methods. This aligns with Morales and Verdugo (2022), who advocate for a redefinition of sound as the dominant element in music instruction.

In this context, music educators who participated in the study reported a lack of formal training to address the educational needs of diverse student populations. This limited preparation restricts their ability to adapt instruction to the realities of inclusive classrooms—an issue also identified by Latorre (2013), who argues that teacher education programs often fail to equip future teachers with the tools needed to address diversity. In response, Del Barrio et al. (2024) recommend incorporating didactic training that ensures all students are able to achieve learning goals equitably.

Although the participants lack formal training in inclusive education or deaf pedagogy, they exhibit a strong willingness to independently seek out information and resources. This self-initiative enables them to adapt instructional activities and assessment methods, developing strategies that foster the integration of all students. These efforts align with the national music curriculum and with Lafuente's (2019) findings, which highlight music's role in supporting cognitive and emotional development through its motivational and facilitative properties.

This reflects a clear connection with the theoretical framework, particularly the concept of the Inclusive Music Educator. Teachers in this study align with this profile by combining their limited formal knowledge with independent inquiry and the adaptation of resources, enabling them to address the diverse needs of deaf students. In doing so, they contribute to the development of deaf listening, challenging the pervasive myth that deaf individuals cannot access or appreciate music—a belief often rooted in viewing deafness solely as a disability (Buitrago, 2021).

Participants described using the Music in Colors method, which associates each musical note with a specific color, thereby reinforcing rhythmic and melodic learning through visual cues. This strategy taps into the visual culture of deaf students and fosters natural engagement with music. These methodologies aim not to cultivate professional musicianship but to develop an early appreciation for music and introduce a distinct, culturally relevant way for deaf individuals to interpret and experience it (Navarro Solís, 2017; Buitrago Ocampo, 2021).

The material resources described by teachers align with the findings of Morales and Verdugo (2022), who stress that deaf students experience music through multiple senses. In this context, educators employ multisensory strategies such as using speakers, incorporating physical games,

utilizing water balloons, playing percussion instruments, and even removing shoes to enhance tactile perception. These practices create varied entry points for deaf students to engage with music.

Given that deaf individuals naturally develop strong visual processing skills, it becomes essential to offer materials that leverage these strengths (Guerrero-Arenas et al., 2023; Muñoz et al., 2024). Analysis of the data revealed additional teacher-developed strategies, including the creation of concrete, tactile materials. These included learning guides that paired musical notes with their respective signs in Chilean Sign Language, thereby fostering symbolic learning through visually rich and accessible resources.

Giraldo Menjura (2024, p.99) states that “musical experience is essentially a form of learning, which invites pedagogy to critically examine how to support such practices.” This reinforces the importance of music as a social integrator—a universal language that transcends linguistic and cultural barriers, fostering relationships, collaboration, and community (Shirokij et al., 2008). The reflections of the participants in this study echo this view, as they intentionally include all students in music instruction and recognize the specific benefits it offers to deaf learners.

Looking to the future, Giraldo Menjura (2024, p.100) expresses that “the experience in the classroom would allow elucidating deaf artists as guides in signed music for deaf schoolchildren,” giving the opportunity to new generations of hearing peers know other ways of understanding, approaching and performing music, so that by including them in this subject, they have perceived that they have a positive attitude during the activities and a feeling of belonging is generated, providing the opportunity to express themselves and channel emotions, feeling on equal terms as their hearing peers.

5. Conclusions

The conclusions are organized around four key points. First, this study contributes to the limited body of research on pedagogical practices in music education for deaf students. It also underscores the need for further research to explore the effects and benefits that music instruction can offer this linguistic and cultural minority.

Second, it is essential that future music teacher training programs include coursework on inclusive education and strategies for addressing student diversity. Such content would prevent the continued marginalization of deaf students in music classrooms, challenging medical-rehabilitative models that view the “ear” as the only access point to music. Instead, a more comprehensive and effective pedagogical approach should be adopted—one that addresses the actual needs of deaf learners and fosters a more inclusive and equitable educational environment.

Third, music teachers do have access to instructional resources for working with deaf students, and they predominantly employ multisensory strategies. These strategies often emphasize visual, tactile, and motor skills and include tools such as speakers, aerophones, and percussion instruments, along with instructional

guides that incorporate Chilean Sign Language. Overall, teachers demonstrate a continual effort to adapt their methods to the learning styles of deaf students.

Fourth and finally, establishing professional networks among music teachers who work with deaf students is essential. These networks would facilitate the exchange of experiences, methods, strategies, and practical resources, all while promoting awareness of deaf diversity. In addition to strengthening individual teaching practices, such collaboration would highlight, validate, and recognize the significant efforts made by educators to foster inclusion—affirming that deaf students are equally capable of valuing and experiencing music alongside their hearing peers.

Finally, it can be affirmed that teachers demonstrate a genuine commitment to their deaf students, visualizing them as any student with the right to a quality education, showing a genuine interest in their learning and inclusion, recognizing the importance of their subject, and advocating for greater recognition among their colleagues and the educational community that continues to believe that deaf students do not benefit from the musical arts.

6. Recommendations

This study highlights the importance of continuing research in the field of music education for deaf students, particularly to identify which pedagogical practices most effectively support their cognitive development. Additionally, future studies should include the perspectives of deaf

students themselves, exploring their experiences, preferences, and challenges with music education. Expanding the participant pool to include a larger and more diverse group of music educators would also strengthen future research outcomes.

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The art workshop of discussion method to investigate the experience of Artist-Teachers in the post qualitative era

El método Taller Artístico de Discusión para investigar la experiencia de artistas-docentes en la era postcualitativa

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The Art Workshop of Discussion Method to Investigate the Experience of Artist-Teachers in the Post Qualitative Era

El método Taller Artístico de Discusión para investigar la experiencia de artistas-docentes en la era postcualitativa

Abstract

This article introduces the Art Workshop of Discussion (AWD) as a post-qualitative method to explore the subjectivities and identities of artist-teachers in the Los Lagos Region, Chile. The method integrates arts-based research strategies, specifically social cartography, and was implemented in two sessions. The first session employed discussion groups to establish networks and gather discursive inputs, and the second focused on social cartography, enabling participants to reflect and creatively express their artistic-teaching trajectories. Results emphasize how AWD fosters collective dialogue and artistic introspection, offering new ways to understand teaching and artistic practices in specific social and cultural contexts. The conclusions highlight AWD's transformative potential to promote critical reflection, peer connection, and collective knowledge generation through artistic action.

Keywords: art workshop of discussion, post-qualitative methodologies, artist-teacher, social cartography, subjectivity.

Resumen

Este artículo presenta el Taller Artístico de Discusión (TAD) como un método postcualitativo para explorar las subjetividades e identidades de artistas-docentes en la Región de Los Lagos, Chile. El método integra estrategias de investigación basadas en las artes, específicamente la cartografía social, y se desarrolló en dos encuentros. El primer encuentro empleó grupos de discusión para establecer redes y obtener insumos discursivos. El segundo, centrado en la cartografía social, permitió a los participantes reflexionar y expresar sus trayectorias artísticas-docentes de forma creativa. Los resultados destacan cómo el TAD fomenta el diálogo colectivo y la introspección artística, facilitando nuevas formas de comprender las prácticas docentes y artísticas en contextos sociales y culturales específicos. Las conclusiones subrayan el potencial transformador del TAD para promover la reflexión crítica, la conexión entre pares y la generación de saberes colectivos desde la acción artística.

Palabras clave: taller artístico de discusión, metodologías postcualitativas, artista-docente, cartografía social, subjetividad.

1. Introduction

The problem of this study focuses on the fields of arts education and teacher professional development to understand how people who teach arts in Chile are building their teaching subjectivity in educational contexts where the institutional framework marginalizes the arts within the curriculum (Del Valle & Rojas, 2020). This difficulty shows that art teachers build their knowledge and experiences from experiences of tension, conflicts, and resilience as part of their teaching experiences and educational strategies (García-Huidobro, 2018; García-Huidobro & Viveros-Reyes, 2023)

The field of teachers' continuous professional development has been widely studied in Chile (Ávalos et al., 2010; Carrasco-Aguilar et al., 2023), and a multiplicity of studies have sought to understand and accompany teachers' subjectivities. In the field of arts education, fewer Chilean studies have focused on knowing the professional identities of this teaching group (Quintana-Figueroa & Pizarro Vocar, 2020; Montenegro & García-Huidobro, 2021) because it is an invisible area of the school curriculum, which has been built based on scarce resources, lack of adequate infrastructure and with several hours that does not allow developing permanent creative processes with the students. These difficulties, typical of arts education, have led to various discomforts on the part of the teaching staff in Chile (Llona, 2011).

At the time of initiating this research, in 2018, the Los Lagos Region only had one diagnostic study on the state of arts education in that locality (Errázuriz et al., 2014), which shows the lack of theoretical and practical corpus that investigates the subjectivities of artist-teachers in this region. Therefore, this study was presented as an opportunity to learn first-hand about the experiences, progress, and difficulties of those who teach the arts, considering this body of experiences part of their teaching subjectivity. At the same time, and understanding the lack of studies and systematization of experiences in this

area, the study was presented as an opportunity to accompany artist-teacher experiences and generate connections between teachers. That is why the study reported here gave great relevance to the methodological aspects since it considered the process of collecting information also as a space for accompaniment and a strategy to strengthen the dialogue and the relationship between art teachers (Onsés & Hernández, 2017).

Given the relevance of the Artistic Reflection Workshop (TAD) technique in this study, this article focuses on sharing and highlighting the methodological aspects of the research entitled Professional Identities of artists-teachers in the Los Lagos Region: Transformations of the Social in Cultural Commitment, developed in southern Chile, under the Regular Internal competition of the Universidad de Los Lagos.

The main objective of this study was to understand how the identities and subjectivities of visual arts teachers influence social and cultural development in the Los Lagos region of Chile. From this central question, four specific objectives were proposed: (1) to identify key elements in the formation and trajectory of the teachers, (2) to analyze the conflicts and needs they face, (3) to explore the link between their artistic-educational projects and local needs, and (4) to describe the characteristics of their pedagogical and artistic practices.

The study combined a mixed methodological approach. The first stage was quantitative and then qualitative, for which conversation sessions were designed through artistic creation to generate dialogue and exchange of experiences among teachers. The latter seems fundamental to us and is what is problematized in the article since, in this study, we have understood the subjectivity of artist-teachers as such:

A complex knot with multiple historical, political, economic, symbolic, psychic, and sexual inscriptions, which are re-inscribed in their diverse contexts of artistic and

pedagogical action in the region. It is about thinking a subjectivity that occurs in the situated and rooted action of being, reviewing who we are and where we want to go because it is precisely in these actions and situations where the modes of subjectivity proper to the artist-teachers unfold (García-Huidobro & Ferrada, 2020, p.15).

Based on these reflections, the Artistic Discussion Workshop (TAD) method was devised as the most suitable way to inquire about the subjectivities of teachers in the arts since the technique allows us to demonstrate a crossover between methodological forms with the epistemology and ontology of teaching artists (García-Huidobro et al., 2020). This collection method allows us to cross artistic experiences with characteristics of focus groups, such as sharing and reflection (García-Huidobro, 2016). The TADs were created as a method that investigates experiences based on the space of creation and encounter of knowledge, and they are based on three fundamental premises. The first refers to incorporating collective artistic exercises to collect information. This is given that artistic practice for those who teach arts is relevant in and for the construction of their teaching subjectivity (García-Huidobro & Ferrada, 2020). Secondly, given that creating spaces for dialogue and conversation among art teachers is a strategy that strengthens the professional development and isolation of those who teach this discipline (Hernández-Hernández, 2014). Thirdly, given that methodology cannot be reduced to the use of techniques or methods for those who do research, it must refer to the production of knowledge that arises from embodied experiences and from a given context, two variables that are fundamental to inquire into professional subjectivity.

We consider that this proposed method draws on post-qualitative and post-materialist methodologies (St. Pierre, 2014; Lather & St. Pierre, 2013; Correa Gorospe, Aberasturi Apraiz, and Gutiérrez-Cabello, 2020) since they are ways of collecting information and promoting

knowledge that give greater relevance to action, to the participatory and subjective, by placing the lived artistic experience above knowledge.

TADs are a strategy that promotes the researcher's experimentation (St. Pierre, 2018), where there is no place for data control. However, it is a way that places the artistic action process of the participants as a way to generate valid knowledge for the study. In addition, it allows us to know reality and a phenomenon that transcends words and writing and reveals aspects that, from other collection methods, it is impossible to account for (Hernández-Hernández, 2008).

The ideas of this method that we propose are nourished by what Patti Lather and Elizabeth A. St. Pierre (2013, p. 365) have called "methodologies that go being" since, in TAD, it is not possible to control the creative process or the artistic results that emerge. Therefore, those who investigate through this method must be flexible and open to novelty as a possibility of new knowledge. From this proposal, we intend to show the need for new methods in the social sciences, which move away from traditional modes to problematize aspects that transcend the reflexive turn and are linked to action, artistic experimentation, and affect as knowledge. In this regard, Marcus (2009) proposed the idea of metamethod as a way of reconceptualizing conventional research practices that point towards experimentation. These post-qualitative methodologies, guided by the Deleuzian idea, are built from a relational basis and give life to the data from other places, senses, and sensibilities.

From these ideas, we situate TAD as a post-qualitative method that seeks to be a group interview space from elements of Arts-Based Research (Barone & Eisner, 2006; Hernández-Hernández, 2008; Marín-Viadel, 2011); to account for how artistic practice can be used as a strategy that allows us to organize, give coherence and new social meanings to the subjectivity of artist-teachers.

2. Materials and methods

The research has an emergent design and has used a mixed empirical methodology, which in its first phase was quantitative and in the second qualitative, to respond to the various specific objectives of this study. We will explain the first quantitative phase and then focus on the qualitative phase since it is the heart of this article.

2.1. Quantitative phase

In the first quantitative stage, we responded to the first specific objective of the study, which sought to identify key elements in the formation and trajectory of art teachers. To this end, five dimensions were used to construct variables and value scales in relation to their artistic and teaching experiences. The dimensions covered in the first part of the study were considered as those aspects that influence the identity formation of the artist-teachers and allowed to give order and sense to the collection instrument. The dimensions selected can be seen in Figure 1, which were: (i) training and professional career, (ii) characteristics of the artistic practice, (iii) conflicts of the artistic-teaching practice, (iv) needs of the artistic-teaching practice and finally, (v) contributions to the cultural development of the region.

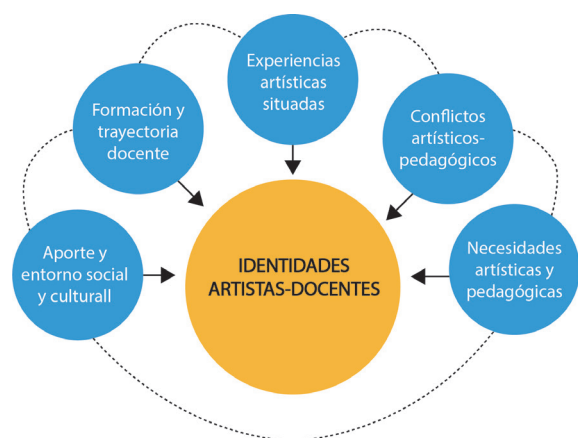


Figure 1: Dimensions affecting the shaping of artist-teacher identities (2018).

Source: Own elaboration.

Based on these dimensions, a virtual survey was created in Google Forms, and it was decided not to send it to a probabilistic sample but by convenience. It was sent, through various databases and media, to all visual arts teachers in the Los Lagos region of Chile. The instrument remained open during the first two weeks of December 2018 and was answered by 97 art teachers (50% Llanquihue province, 36.6% Chiloé province, 11.2% Osorno province, and 2.2% Palena province), constituting a non-probabilistic sample, given the operational difficulties that meant that a certain percentage for each province would respond to the survey, especially considering the high percentage of rurality of the region and difficulties for technological access. The collection instrument consisted of 21 questions with open, multiple, and selective answers, which were organized according to the five dimensions of the teaching subjectivity of art teachers. Once the instrument was constructed, it was validated by two experts in national art education. Subsequently, the information obtained was analyzed using the SPSS statistical analysis program, which allowed us to generate a matrix of data, crosstabs, and variables between dimensions. After making the matrix, we developed an exploratory interpretation based on the descriptive analysis of each variable and statistic. This gave us a better understanding of the phenomenon studied (García-Huidobro & Ferrada, 2020) and, among its results, helped us to generate new questions to guide the second stage.

2.2. Qualitative phase

The second phase of the collection was qualitative and sought to understand the following specific objectives: to analyze the conflicts and needs faced by artist-teachers, explore the link between their artistic-educational projects, and describe the characteristics of their pedagogical and artistic practices.

This phase was conceived as a space for the research group to collect the necessary information to meet its objectives and as a meeting place for artistic

subjectivities and teachers, where participants could meet, dialogue, and learn to rethink their practices. To this end, we conducted two days of discussion groups, each with a different objective, but both took post-qualitative elements, such as agency, experimentation, and creation, as elements of meaning to build knowledge (St. Pierre, 2018; Correa Gorospe, Aberasturi Apraiz and Gutiérrez-Cabello, 2020).

The first day was attended by a representative sample of 28 arts teachers from the region who had participated in the survey. This group of teachers was divided into four groups to dialogue and discuss some questions that arose from the survey results and that the group of researchers considered relevant to deepen to respond to the study's objectives. Some of these were: In what way and how are my classes or teaching experiences part of my artistic production? Why do I consider it relevant (or not) to link my artistic work with my experiences as a teacher? What does it contribute to me to make these crossings? To what extent and how does my artistic-pedagogical practice contribute to the culture and the Lakes Region?

After the discussion groups, a workshop was held for all attendees. In it, they were given ideas and tools to develop artistic and educational projects, with the aim of solving some of the problems expressed in the survey responses.

Weeks after this first qualitative meeting, a second day was held, which we called the Artistic Discussion Workshop (ADD). The TADs take elements from the Arts-Based Research design since it is a methodology that uses artistic means (visual, literary, performative) to unveil and take data that are not possible to capture in any other way (Barone & Eisner, 2006; Hernández-Hernández, 2008; Marín-Viadel, 2011). It seemed relevant to us to seek a more dialogic, immersive, and creative methodology, where artistic tools were fused with qualitative strategies (Marín-Viadel & Roldán, 2019), which would allow participants to reflect on their perception of the contribution of the arts and pedagogy, emphasizing their roles and contributions.

The TADs were attended by 22 artist-teachers from the region (mostly the same ones who attended the first one). In this instance, the exercise of pedagogical social mapping was developed as an artistic strategy to trace and explore each artist-teacher's experience. At the same time, this strategy was intended to help trigger a reflective dialogue among the participants (García-Huidobro, 2016) to talk about their experiences as artist-teachers and deepen some aspects discussed on the first day.

The first and second-day dialogues were recorded, transcribed, and analyzed. For this last process, a thematic and narrative analysis was carried out, from which their oral narratives were codified based on the themes that were worked on in the TAD. These codifications were reorganized and provided broader categories that were later theorized and that account for the subjectivities of the artist-teachers of the Los Lagos Region (García-Huidobro & Viveros, 2023).

In the following sections, we will delve into the Artistic Discussion Workshop (ADW) method and the cartographic strategy since we value how this innovative, post-qualitative, alternative way of collecting information provides new ways of understanding social reality and experience through the arts. In addition, it is situated in a creative, pedagogical, innovative, and reflexive way that allows us to rethink the experience of artist-teachers to promote subjectivity.

2.3. TAD Phases

The Artistic Discussion Workshops (TAD) methodology was developed in phases that articulated the artistic, dialogic, and reflective through visual tools. The four phases are described below:

Phase 1. Planning and conceptual preparation

The workshop's objectives, the key concepts to be worked on, and the necessary materials were defined. A sample of participants was selected, and activities were designed to include pedagogical social mapping to promote introspection and collective dialogue. About the key concepts,

eight fundamental concepts were introduced (Desires, Obstacles, Culture, Teaching, Lakes Region, Artistic Creation, Objects/Materiality, and Subjects) that were previously identified as significant for the construction of subjectivities in the artist-teachers. This conceptual framework provided a starting point for the creative and analytical activities.

Phase 2. Creation of social cartographies during the TAD

During the workshop, the research team explained the mapping's objective and the eight concepts and invited the participants to start working together. Participants made personal cartographies in a collaborative environment using visual and symbolic materials. This phase included moments of individual and group reflection, where the construction of visual narratives representing their experiences as artist-teachers was promoted.

Phase 3. Collective reflection

At the end of the creative process, each participant presented and discussed his or her map in a collaborative environment. A space for critical dialogue was facilitated in which participants shared their trajectories and connected their

experiences with their peers. This phase allowed for a collective understanding of the subjectivities and challenges faced.

Phase 4. Qualitative analysis

The research team coded and analyzed, using Atlas.ti, the visuality, and conceptualization of each participant's mapping, personal narratives, and peer dialogue. This allowed the identification of emerging categories such as resilience, difficulty, desire, and culture, which were subsequently theorized (García-Huidobro and Viveros, 2023).

The coding was thematic, as the concepts emerging from the cartographies were grouped into categories that reflected the concerns and meanings shared by the participants. The frequency and position of the concepts in the visual and oral narratives of each artist-teacher were evaluated. Subsequently, a stage of conceptual interrelation was followed, where it was investigated how the concepts dialogued with each other, allowing us to understand the subjective displacements and the rhizomatic articulation between difficulties, desires, and culture as part of the most relevant findings.

3. Results and discussion

This section will describe two processes: an account of how TADs were developed and a theoretical discussion that analyzes the development of this technique, with its contributions and challenges.

3.1. Description and development of the TAD method

We will relate the experience of the Artistic Discussion Workshop as an innovative method that allows mapping, from the individual and the collective, the experience of artist-teacher subjectivity. In the study's first phase, a survey was applied to 97 art teachers. From its analysis,

the research team identified eight key concepts they wanted to work on in the TAD through mapping. This artistic strategy was used so that the participants could relate their experience in a different way and, at the same time, help the research group to think about how the meaning of these concepts is shaping the subjectivity of the participants (García-Huidobro & Hoecker, 2022).

A group of 22 artist-teachers representing the various communes that make up the Los Lagos Region gathered in Puerto Montt.

Inspired by the steps proposed by Barragán and Amador (2014) and Risler and Ares (2013, 2014), participants were invited to carry out a cartographic work. Although three types of maps can be identified, for this TAD, we proposed to work on the temporal-social type of map in order to focus on how teachers recognized certain elements as events in their artistic and pedagogical experiences. In this sense, the objective of the artistic workshop was that each participant could put together a visual and discursive journey of his or her experience as an artist-teacher based on certain concepts provided

Given the number of participants in the TAD, two working rooms were set up. In each of them, tables were joined together and covered with white flip chart paper, simulating a large canvas. Pencils, colored cards, wool, scissors, glue, and other materials were placed on this paper. Of all this, the colored cards were key, since on each of these were written the concepts/elements that would help give meaning to the cartographies and act as triggers for their experiences.

Upon arrival of the group of participants, the research's objective was explained to them, and each person was invited to make an individual mapping based on the eight key concepts (Figure 2). The research group had previously studied

these concepts as elements that influence and affect the construction of subjectivity of artist-teachers. Therefore, the objective was for each participant to give temporal-social and subjective meaning to these concepts in their own experience, given that their visual and oral account would help to understand how each one moves and transits in their spaces as artist-teachers. The key concepts provided were Desires, Objects/materiality, Obstacles, Teaching, Subjects, Artistic Creation, Lakes Region, and Culture.

The group was randomly divided into two rooms, and the researchers ensured that men and women worked in both groups. A researcher coordinated each of the work tables, and an assistant noted relevant aspects and made the audiovisual record.

Upon arriving at the rooms where the material was located, each participant sat around the table. A brief personal introduction was generated at that moment, an essential element for building trust. The methodology to be developed was explained and, as proposed by Risler and Ares for the development of the cartographies, they were encouraged "to create their forms of representation, either through images, icons, drawings, texts, vignettes and any other resource that would allow them to communicate and disseminate meanings and senses" (Risler & Ares, 2013, p. 14).



Figure 2: Photographs presentation of the TAD experience, artist-teachers get to know the working materials (2018).
Source: Own elaboration.

For this purpose, each participant had a set of eight cards, each with the basic concepts written on one side. Each one had to express on the back side what his or her reflection was and his or her personal experience regarding how that concept was present in his or her teaching subjectivity. Then, they had to place their cards on the canvas (standard table) in a meaningful order. With the available wool, each had to link their cards to trace their trajectory, which they would relate to the rest of the group at the end of the experience.

In both groups, there was an atmosphere of work at the beginning, typical of a teacher who is pushed to reflect on his or her professional and, therefore, personal practices and experiences. In both groups the participants spent a long time, approximately 50 minutes writing in notebooks, making sketches, many sighs, hands resting on the head in reflection (hands on the forehead, chin, covering the mouth, holding the head), and then writing (Figure 3).



Figure 3: Development of the TAD. Participants reflected on the concepts delivered to perform the mapping (2018).
Source: Own elaboration.

The length of the writing on the cards was dissimilar; some wrote only concepts extracted from their notes, and others extended the length and breadth of the card.

The use of the canvas was developed gradually; some of them watched how the first ones did it, which gave them the confidence to arrange their work. Once the cards were laid out, each one

marked his or her line on the same plane, which meant that, in some situations, some paths and concepts crossed or interrupted those of others. In some cases, the traces were linear, circular, and zigzagging. In one of the groups, the trajectory even required rising from the two-dimensional canvas, as seen in Figure 4. However, all the cartographies alluded to what Guattari (1996) has called epistemological territory or existential territories since they all showed a displacement between multiple life experiences.



Figure 4: : Development of the TAD. Participants performing the paths of their mappings (2018).
Source: Own elaboration.

The group was invited to share their creation experiences at the end of the personal cartographic work. At that point, we moved on to the second part of the TAD, where the space for listening, critical reflection, and dialogue, typical of discussion groups, was promoted. On this experience, we rely on Risler and Ares (2013, 2014), who express that the construction of a map allows, through graphic and visual support, the approach of subjective elements present in a collective. It is a collective strategy of Resistance that helps to elaborate narratives around the reflection of themes, in which a democratic space for participation and representation of diverse personal, socio-cultural, and political positions is ensured. The product can be built individually or in groups, but the final result is always collective; we do not look at the parts but the whole, from the explicit content to the aesthetics of the union of the elements. This allows us to generate dialogue, reflection, and visibility of what is often challenging to bring to light or is unknown about oneself.

In this sense, we highlight the ideas proposed by Risler and Ares (2013, 2014) since the visual result, that is, the set of cartographies that shared the same plane reaffirmed the crossing of oral narratives of the participants. Even though the narratives reflected individual trajectories, they became collective as they intertwined. By telling aloud how each artist-teacher linked these concepts in his/her artistic-teaching experience

(Figure 5), the research group could learn in-depth what each concept meant in the trajectory for the participants and the common points among them. This generated a link between artists and teachers, who could identify aspects of their trajectory in each other's process. Likewise, sharing their cartographies allowed them to give voice and word to their subjectivities, but from the collective, which speaks of a construction of meanings and knowledge arising from a shared personal and social space (Tardiff, 2004).

3.2. Discussion on TAD: Collective mapping as a strategy for understanding teacher subjectivity

Next, we will explain the use of social mapping as an artistic experience that, from Arts-Based Research, proposes new ways of generating and giving meaning to knowledge, especially for the research process in the areas of teacher training and professional development (Correa Gorospe, Jiménez de Aberasturi & Gutiérrez-Cabello, 2020). For Barragán (2016), society requires generating new forms of social research that allow inquiring into people's subjectivity; this author defines mapping in social and pedagogical research as:

A research and accompaniment in which collective action participants are led to



Figure 5: : Development of the TAD. Participants recount the meaning of their cartographies and links to their artist-teacher experience (2018).Source: Own elaboration.

reflect on their practices and understandings of a common problem, creating a map (cartography) in which the problems that occur in that territory become evident (Barragán, 2016, p. 256).

From here, we understand that it is fundamental to consider mapping as a post-qualitative and materialistic strategy. This strategy allows us to approach the reality of social sciences and education from the place of reflection, transformation, affect, and other sensibilities.

On this idea, Rey and Granese (2019) point out that the studies of Deleuze and Guattari (2002) regarding the identification of the rhizome concept are key to giving epistemological support to this technique (and also to the post-qualitative theories), becoming the rhizome in the trace that

manages to base the map or the mapping process. We can point out that the cartographies made by the participants allude to the rhizome since they give a collective meaning to the elements that compose it and define a collective symbolic territory, which, as we will see below, is far from being limited only by geographical boundaries.

The poet Néstor Perlongher (1996) uses cartography and defines it as “an intensification of the flows of life and not as a simple investigation external to events” (Rey & Granese, 2019, p. 287). This accounts for how collaborative and rhizomatic cartographies allow us to account for joint subjectivities

Developing cartographies as a data collection strategy in the TAD of this research led us to the notion of epistemological territory or existential

territories, where Guattari (1996) manages to identify them as a non-geographical space in which the map to be made is located. These maps allow the abstraction and resignification of the experiences of those who participate in the dialogue. The map, on the other hand, is the graphic representation of the tensions, the abstractions, in which the personal account intersects with the account of others, enriching the theme, visualizing individual and collective actions to confront the theme that led the reflection and/or the dialogue.

León and Vargas (2015) propose something similar, considering that Deleuze and Guattari's contribution (2002) redefines cartography as a creative practice of Resistance nourished by the experience of individuals who collectively constitute it.

This collective construction, in a way, deconstructs the relationship between the product -the research- and the academy since the research topics are simply a framework on which the life experience of the participating subjects is situated, being this experience the reality that must be analyzed. Regarding this, Díez and Chanampa (2016) point out that "what the cartographic method seeks is to speak in conjunction with the experience of reality and not about reality" (Díez & Chanampa, 2016, p.87).

On the other hand, Barragán and Amador (2014) introduce pedagogical social cartography, referring to the use of the cartographic technique for research and interventions that address the educational environment, its actors, and interactions. They describe that this method requires propitious times and spaces to generate reflection and the appropriate materials for the group to work with. To the above-mentioned by the authors mentioned here they add the following:

A social-pedagogical mapping should prioritize collective reflections, go through the territories where events take place, recognize needs and absences, and make visible the knowledge and opportunities for transformation offered by its social actors. (Barragán and Amador, 2014, p.136).

It is necessary to highlight what Díez and Chanampa (2016) value: the fact that, through this method, a relationship is established between the researcher and the study participants. An experience is shared where the participants cease to be objects of observation since they become actors of knowledge. In addition, sharing the mapping experience generates familiar places for dialogue and reflection between researchers and participants.

The cartographies produced in the framework of the Artistic Discussion Workshop (TAD) allow us to explore the subjectivities of artist-teachers in depth since they operate as visual and symbolic representations of their personal and professional trajectories. Through the strokes, colors, icons, and spatial arrangements, participants narrate and reconfigure their experiences, tensions, and aspirations. This creative process is aligned with Deleuze and Guattari's (2004) rhizomatic perspective, where knowledge is constructed in a web of multiple relationships without a fixed center, allowing constant displacements between the personal and the collective.

3.3. TAD contributions to artist-teacher subjectivity

The visibility of cartographies becomes a key tool for constructing subjectivities since it allows art teachers to dynamically represent the crossings between fundamental concepts such as culture, desire, obstacles, and teaching. According to Risler and Ares (2013), social maps organize information and act as resistance devices by making visible experiences and meanings that, in traditional educational contexts, are usually made invisible. In the case of TAD, teachers capture their trajectories through linear, circular, or rhizomatic visual trajectories, which reflect how they perceive their professional trajectories, achievements, difficulties, and resilience processes.

This graphic representation allows the emergence of complex subjectivities, understood as narratives in constant movement, configured by multiple historical, social, and cultural inscriptions (García-Huidobro, 2016). The arrangement of key concepts in the cartographies' visual space

Table 1: Elements or steps to be considered for mapping development (2018).
Source: Own elaboration.

Social Cartography (Risler and Ares, 2013, pp.16-18)	Social Pedagogical Cartography (Barragán and Amador, 2014, pp.137-139)
• Workshop preparation	• Selecting the type of problem • Selecting the map type
• Presentation of the work to be developed	• Motivation of the participants
• Group work	• Working groups • Convention agreement • Making the map
• Sharing	• Map explanation • Transformation agreements
• The researcher seeks consensus on the final product through various methodologies.	• Analysis of maps and cartography report (researcher's work)

allows self-exploration and a process of collective dialogue in which individual experiences are re-signified in the group context. Díez and Chanampa (2016) state that cartographic methods promote participatory knowledge, where the actors generate shared knowledge from their lived experiences.

In addition, using visual elements in the artistic process allows the expression of what Hernández-Hernández (2008) calls affective knowledge, which cannot be fully captured through verbal language. Cartographies, by combining graphic and narrative elements, give rise to new forms of signification, where visibility acts as epistemological mediation. This approach strengthens the professional agency of those who teach the arts by allowing them to articulate their identities in terms of their own experiences and their pedagogical and artistic aspirations.

Visual traces, artist-teachers can express and re-signify their experiences, challenging the normative structures that traditionally make artistic knowledge invisible in the educational environment. This methodology promotes critical

reflection and strengthens the connection between peers, generating a relational and transformative learning space. Thus, TAD contributes to the construction of situated teaching subjectivities, capable of facing the challenges of the educational system from a position of agency, creativity, and resilience (Guattari, 1996; St. Pierre, 2018).

One of the most relevant results of the TAD identifies that art teachers face the challenges of educational practice from a resilient perspective (García-Huidobro & Viveros, 2023). Four main categories were identified through the analysis of experiences collected in the TADs: culture, difficulties, desires, and teaching the arts as a resilient act. These categories illustrate how the subjectivities of the participants are constructed in a constant dialogue between the personal and the collective, addressing the tensions of their teaching and artistic work to transform them into tools for cultural and social impact. This approach reinforces the importance of TAD as a space that fosters critical reflection, collective learning, and the capacity for collective agency in the face of adverse contexts that place arts education in a complex scenario (Del Valle & Rojas, 2020).

4. Conclusions

This article has exposed the Artistic Discussion Workshop (ADW) as an innovative post-qualitative methodology to explore the subjectivities and identities of artist-teachers, addressing complex dimensions of their professional experience. From the results, it is possible to synthesize a series of key findings and significant contributions of the method, both to the field of educational research and to the professional development of teachers in artistic contexts. We will summarize the main contributions of TAD; they are articulated in five fundamental aspects:

The first is how this method contributes to constructing relational and situated subjectivities. The process of artistic creation during the TAD allowed participants to map their personal and professional trajectories through meaningful concepts such as culture, obstacles, desires, and teaching. These mappings function as visual narratives that reveal how artist-teachers construct and reconstruct themselves in a rhizomatic environment, where individual experience takes on new meaning as it is contrasted and re-signified in a collective space. This approach is linked to Deleuze and Guattari's (2004) rhizome theory, which postulates a non-linear understanding of knowledge based on multiple connections and meanings. The collective experience also promoted mutual recognition that strengthened the participants' professional identity by reflecting the interdependence of their experiences.

Secondly, TAD promotes spaces of Resistance, agency, and professional empowerment. TAD, a strategy combining artistic creation with critical reflection, becomes a space for Resistance in the face of institutional conditions that have traditionally marginalized the arts in the school curriculum (Del Valle & Rojas, 2020). During the workshops, teachers expressed the importance of having spaces where their experiences could be shared and validated, allowing a revaluation of their professional role. This collective validation process strengthens what St. Pierre (2018) describes as the capacity for agency, where

participants reflect on their working and cultural conditions and find symbolic and emotional tools to generate transformations in their practices. Thus, the TAD operates not only as a method of information gathering but also as an experience of professional self-affirmation.

Thirdly, the contribution of TAD becomes a methodological innovation and a deepening of educational reflection. Unlike other research methods, such as structured interviews or questionnaires, TAD allows access to affective, symbolic, and sensory dimensions that do not always emerge in conventional methodologies. The social mapping used in the workshop allowed teachers to relate their experiences and represent them visually, generating new meanings in the creative process. This approach is consistent with arts-based research proposals (Barone & Eisner, 2006; Hernández-Hernández, 2014), where the act of creating becomes a way to build knowledge and re-signify experiences. Participants highlighted how this exercise allowed them to remember and reorganize their perceptions about the challenges and achievements in their teaching careers. In addition, the dialogic dynamics of the workshop, which promoted active listening and joint reflection, facilitated relational learning that reinforced the idea that teacher subjectivity is configured in interaction with others (Tardif, 2004).

A new aspect we emphasize about TAD is its contribution to teachers' professional development and continuous critical training. TAD proved to be a useful tool to accompany introspection, allowing teachers to identify and redefine fundamental aspects of their artistic and pedagogical practice. The critical reflection that emerges from these instances is key to professional development, as it allows for recognizing action patterns, recurrent tensions, and possibilities for transformation in daily work. From this perspective, the method contributes to strengthening the role of teachers as "transformative intellectuals" (Giroux, 1990), capable of critically analyzing their working

conditions and generating educational practices that are more conscious and committed to their social and cultural environment.

Finally, TAD contributes to reconfiguring artistic practice as an educational strategy.

A central aspect of this method is the capacity of artistic practice to act as an epistemological mediation, which implies that the creative process transcends its aesthetic function and becomes a knowledge device. Participants could negotiate their subjectivities through creation, opening new spaces of meaning that challenged established norms. According to Gergen (1996), this process

of creation is essential for the development of agency since it allows the subject not only to be a spectator of his or her reality but to transform it from an active and reflective position.

Finally, TAD has not only contributed to developing new methodological frameworks for research in art education but has also shown how collective creation and critical reflection can strengthen the subjectivity and professional agency of artist-teachers. This methodological approach is a relevant contribution for those seeking to promote critical, collaborative, and transformative learning spaces, both in educational contexts and in post-qualitative research.

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The Project Method in Early Childhood Education and its scientific production: a systematic review

El Método de Proyectos en Educación Infantil y su producción científica: una revisión sistemática

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The Project Method in Early Childhood Education and its scientific production: a systematic review

El Método de Proyectos en Educación Infantil y su producción científica: una revisión sistemática

Abstract

The Project Approach (PBL) has emerged as a key pedagogical strategy in Early Childhood Education. This article conducts a systematic review of 31 selected studies to analyze the trajectory and current state of PBL research in Spain, published between 2020 and 2024. Using the PRISMA methodology, relevant research extracted from academic databases indexed in JCR such as ERIC, Google Scholar, Dialnet, Redalyc and Scielo were identified, selected and synthesized. The findings reflect a sustained increase in the application of PBL in Early Childhood Education, highlighting its positive impact on the development of key competencies such as creativity, critical thinking and teamwork. In addition, a diversity in the implementation of PBL is observed, including interdisciplinary and technological approaches, which evidences its potential to improve educational practice in different contexts and scenarios.

Key words: projects, project method, early childhood education, systematic review, PRISMA methodology.

Resumen

El Método de Proyectos (ABP) ha emergido como una estrategia pedagógica clave en la Educación Infantil. Este artículo realiza una revisión sistemática de 31 estudios seleccionados para analizar la trayectoria y el estado actual de la investigación sobre el ABP en España, publicados entre 2020 y 2024. Utilizando la metodología PRISMA, se identificaron, seleccionaron y sintetizaron investigaciones relevantes extraídas de bases de datos académicas indexadas en JCR como ERIC, Google Scholar, Dialnet, Redalyc y Scielo. Los hallazgos reflejan un aumento sostenido en la aplicación del ABP en Educación Infantil, subrayando su impacto positivo en el desarrollo de competencias clave como la creatividad, el pensamiento crítico y el trabajo en equipo. Además, se observa una diversidad en la implementación del ABP, incluyendo enfoques interdisciplinarios y tecnológicos, lo que evidencia su potencial para mejorar la práctica educativa en distintos contextos y escenarios.

Palabras clave: proyectos, método de proyectos, educación infantil, revisión sistemática, metodología PRISMA.

1. Introduction

The Project Method, better known as Project Learning (PBL hereafter), has gained special relevance in Early Childhood Education as an effective pedagogical methodology to foster active, collaborative, and contextualized learning (Martínez Hernando, 2021; Botella & Ramos, 2019; Bell, 2010). This pedagogical approach is characterized by placing students at the center of the educational process, allowing them to assume an active role that facilitates the acquisition of key competencies, such as creativity, critical thinking, and problem-solving (Osorio Pérez, 2024; Lucenko et al., 2023). The purpose of PBL in this context is to connect learning with students' interests and experiences, achieving more profound and meaningful learning (Muzás & Blanchard, 2020; Blumenfeld et al., 1991). Likewise, the Project Approach not only develops academic competencies but also has the potential to positively influence emotional competencies, in line with what is pointed out by García Andrade (2019), who highlights the importance of linking emotional neuroscience with individual development in educational contexts.

The origin of the Project Method can be found in the pedagogical theories of John Dewey (1938), who emphasized the importance of experiential learning based on interaction with the environment. Over the years, this methodology has been adapted to current educational needs, finding a particularly suitable space for its implementation in Early Childhood Education. At this educational level, PBL fosters academic competencies and social and emotional skills that are fundamental for comprehensive development from an early age, preparing students to face future challenges (Cascales et al., 2020; Clark, 2006). Incorporating educational technologies in PBL is another outstanding aspect, as it opens new possibilities for interactive and collaborative learning, promoting the development of digital competencies from the early years (Wulandani et al., 2022; Cascales et al., 2017). On the other hand, the investigated approach has been consolidated as a flexible and applicable pedagogical method at

various educational levels, from Early Childhood Education to university, as demonstrated by Díaz Tenza (2020) in his practical and applied analysis, where he highlights the potential of PBL to connect learning with real and meaningful contexts (Aljabreen, 2020; Díaz, 2020).

Despite the apparent benefits, PBL in Early Childhood Education has been less researched than in higher educational stages (Kokotsaki et al., 2016). The existing literature on PBL has mainly focused on primary and secondary education, leaving a significant lack of empirical studies on its impact on early childhood education. Despite the rise of PBL at higher educational levels, research on its impact on Early Childhood Education remains limited (Fernández-Cruz & Fernández-Díaz, 2016; Sánchez Garrido, 2021). This gap limits the ability of teachers and educational leaders to make informed decisions about the integration of this methodology in the early years of schooling, a critical period for the development of cognitive and socioemotional competencies (Arantes-Do Amaral, 2021; Jane, 1998).

The need for a systematic review of the Project Approach in Early Childhood Education is urgent, as this methodology can foster deep learning during a crucial stage of child development (Holm, 2011; Sarceda et al., 2016; Condliffe, 2017). The lack of specific scientific evidence raises questions about how this absence may hinder pedagogical innovation and limit educational equity, especially in rural or disadvantaged contexts (Torrego & Martínez, 2018; Ruiz & Ortega-Sánchez, 2022).

The main objective of the present study is to fill this research gap through a systematic review of the literature on PBL in Early Childhood Education in Spain, published between 2020 and 2024. Based on the studies collected using the PRISMA methodology for its acronym in English, Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA hereafter), it seeks to analyze the current state of research in this field, identify good practices, areas of

opportunity, and systematize the available scientific evidence (Kołodziejcki & Przybysz-Zaremba, 2017). This review will offer practical guidance for researchers and teachers, providing

a solid foundation for implementing PBL in Early Childhood Education and promoting its effective incorporation in classrooms (Hutton et al., 2015).

2. Materials and methodology

To ensure the replicability of the present study, a systematic review was designed following the PRISMA protocol, a methodology recognized for its rigor in structuring and transparency of the identification, selection, evaluation, and synthesis of the scientific literature (Moher et al., 2009). PRISMA allows reviews to be organized in four well-defined stages: identification, selection, eligibility, and inclusion. This approach facilitates not only the repetition of the study but also the comparison of results and updating the review in future research.

2.1. Methodological design of the investigation

The systematic review was structured according to the four phases established in PRISMA. First, an exhaustive search was conducted in academic databases indexed in JCR, such as ERIC, Google Scholar, Dialnet, Redalyc, and Scielo. These sources were selected for their reputation for indexing high-quality educational research nationally and internationally. To optimize the search, key terms in Spanish and English were used, such as “Project Method,” “Project-Based Learning,” “Project-Based Learning,” and “Project Method.” Combining these terms with Boolean operators (AND, OR, NOT) made it possible to reduce the risk of obtaining irrelevant results, especially from studies focused on educational stages other than Early Childhood Education. To ensure the quality of the selected sources, Journal Citation Reports (JCR) was used exclusively to identify high-impact journals in education. However, the articles analyzed in this

review were extracted from recognized databases such as ERIC, Google Scholar, Dialnet, Redalyc, and Scielo, ensuring a broad and diverse coverage of studies on Project Learning in Early Childhood Education.

The search was then restricted to publications between 2020 and 2024, with filters for language (Spanish and English) and type of study (excluding theoretical reviews and conferences without empirical data). In addition, open access was established as a priority criterion to facilitate the consultation of the studies. To guarantee the exhaustiveness of the process, a search strategy was designed with the equation: (‘Project-Based Learning’ OR ‘Project Method’ OR ‘Project-Based Learning’) AND (‘Early Childhood Education’ OR ‘Early Childhood Education’). This search was performed on titles, abstracts, and keywords in the selected databases, using Boolean operators to maximize the inclusion of relevant studies. Zotero software was used to manage bibliographic references and ensure the rigorous organization of the selected studies, allowing the creation of a structured database and accurate citation management (Hutton et al., 2015).

Therefore, of the 130 studies initially identified, the inclusion and exclusion criteria were applied to filter out those that really met the study’s objective. Only empirical research in Early Childhood Education was considered, excluding studies on higher levels, and studies with proven methodological rigor were prioritized.

Table 1: Inclusion and Exclusion Criteria. .
Source: Author (2025).

Inclusion Criteria	Exclusion Criteria
Scientific studies with qualitative and quantitative designs;	Studies that do not correspond to the field of education;
Scientific articles;	Non-empirical studies such as essays or conferences;
Academic work (TFG, TFM, doctoral thesis);	Articles or studies published before 2020;
Year of publication between 2020 and 2024;	Studies published in languages other than Spanish and English;
Available in English and Spanish;	
Open and complete access;	Studies on educational levels other than Early Childhood Education;
Studies focused on PBL in Early Childhood Education.	

On the other hand, the article selection process is explained below. Table 2 presents a detailed breakdown of the article selection phases, which began with the identification of 130 studies and culminated in the inclusion of 31 final studies. This table highlights the exclusion criteria applied

in each phase, which ensured that the selected studies provided significant empirical evidence on the implementation of PBL in Early Childhood Education. This process confirms the alignment of the selected studies with the research objectives.

Table 2: Article selection process
Source: Author (2025).

Stage of the prcess	Number of studies	Criteria applied
Initial identification	130	- Exhaustive search in databases: ERIC, Google Scholar, Dialnet, Redalyc, Scielo. - Search terms in English and Spanish: Método de Proyectos, ABP, Project-Based Learning, Project Method, etc.
Review of titles and abstracts	60	- Exclusion of studies not focused on Early Childhood Education. - Elimination of non-empirical studies (essays, theoretical reviews, conferences). - Filtering of studies outside the 2020-2024 range. - Language (Spanish or English).
Complete revision of texts	40	- Complete reading to ensure thematic relevance. - Evaluation of the clarity of the objectives. - Verification of methodological quality (data collection and analysis, representativeness of the sample, validity).
Final selection of relevant studies	31	- Prioritization of studies with methodological rigor. - Inclusion of studies with methodological diversity (qualitative, quantitative, mixed). - Focus on studies that provide innovations or solid evidence on PBL in Early Childhood Education.

2.2. Study population and sample

The review focused on studies conducted in the Spanish educational context between 2020 and 2024. The final sample, consisting of 31 empirical investigations, includes qualitative, quantitative, and mixed studies. Although this number could be considered limited, it responds to the need for a detailed and methodologically rigorous analysis of the use of the Project Method in early childhood. This selection allows us to observe methodological trends, types of results, and implementation approaches in the field of PBL in early childhood education, thus providing an adequate and meaningful representation of the state of current research (Ruiz & Ortega-Sánchez, 2022). Although the number of studies included (n=31) may seem limited, it responds to the need for methodologically rigorous analysis, selecting only empirical research with proven and contextualized quality criteria. Similar studies have used comparable sample sizes for systematic

educational reviews (Condliffe, 2017; Kokotsaki et al., 2016).

2.3. Coding of variables and data analysis

The studies were coded according to variables relevant to the comparative analysis:

- 1. Variables extrinsic to the scientific process: The name of the journal, the year of publication, and the academic institution associated with each study were recorded.
- 2. Methodological variables: These included the type of methodological design, data collection strategies (interviews, surveys, observations), and sample size.
- 3. Variables about the participants, Such as educational stage and implementation context.
- 4. Variables related to PBL: Aspects such as key competencies studied, technological integration, and the projects' interdisciplinary approach.

Tabla 3: Variables for coding studies.
Source: Author (2025).

Category	Variable	Description
Variables extrinsic to the scientific process	Magazine publication	Name of the journal or source in which the study was published
	Year of publication	Year in which the study was published
	Scientific or university institution	Affiliated institution of the authors or of the academic center where the research was conducted
Methodological variables	Type of design	Methodological design used in the study (qualitative, quantitative or mixed).
	Data collection strategy	Methods used for data collection (interviews, surveys, observations, etc.)
	Sample size	Number of participants or data analyzed in each study
Variables on participants	Educational stage attended	Educational level of students participating in the studies
Variables related to PBA	Educational stage to be attended	Stage or cycle of Early Childhood Education studied (first cycle or second cycle)
	Aspect studied	Specific components of PBL analyzed (key competencies, social-emotional impact, etc.)

The data analysis was based on a narrative synthesis of the main findings and a comparative analysis of patterns in the implementation of PBL

in different educational contexts. To ensure the validity of the results, each study was evaluated according to the established methodological

quality, following criteria such as clarity in the objectives and rigor in the data analysis (Ruiz & Ortega-Sánchez, 2022).

2.4. Statistical analysis

Although the main focus of this review was qualitative, a descriptive analysis was performed to categorize and graphically represent the trends observed in the selected studies. This integration of qualitative and quantitative analysis provides a comprehensive and detailed overview of the

impact of PBL in Early Childhood Education. It facilitates the interpretation of the results based on the different methodological approaches employed in the sample (Cascales & Carrillo-García, 2018). With this methodology, the study seeks to offer a replicable and transparent analysis of the current state of research on PBL in Early Childhood Education, providing a solid empirical basis that can serve as a guide for future studies and for the implementation of PBL in the classroom.

3. Results

The analysis of the results was structured according to the data extracted from the 31 selected studies, thus complying with the inclusion criteria established in the methodology. The main

findings are presented below, organized into key categories, and accompanied by representative tables summarizing the most relevant data for the study.

Table 4. Previous search in the databases (search words in EN and ES). **Source:** author's own elaboration based on data obtained from the database available in ERIC, Google Scholar, Dialnet, Redalyc and Scielo.
Source: Author (2025).

Keywords	Database					
	<i>ERIC</i>	<i>Google Scholar</i>	<i>Redalyc</i>	<i>Scielo</i>	<i>Dialnet</i>	Total
Project Method in Early Childhood Education	2	2	1	1	2	8
PBL in Early Childhood Education	3	5	2	2	4	16
Project Work in Early Childhood Education	2	2	1	1	1	7
Project-based learning in Early Childhood Education	3	3	1	1	1	9
<i>Project Method in Early Childhood</i>	6	8	3	4	3	24
<i>Project-Based Learning in Early Childhood</i>	7	8	3	4	7	29
<i>Project-Based Learning in Infant Education</i>	3	4	1	2	1	11
<i>Project Work in Kindergarten</i>	2	3	2	2	1	10

Keywords	Database					
	ERIC	Google Scholar	Redalyc	Scielo	Dialnet	Total
<i>Task-Based Learning in Early Childhood</i>	2	2	0	1	2	7
<i>Learning through Projects in Infant Education</i>	1	3	1	1	1	7
Total	24	40	13	17	19	130

Table 4 shows the distribution of the studies identified in each database according to the keywords used in Spanish and English. This process resulted in a total of 130 initial studies, of which only 31 met the inclusion and methodological quality criteria to form part of the final analysis. The databases used included ERIC, Google Scholar, Dialnet, Redalyc and Scielo. This search and filtering phase allowed us to ensure the relevance and specific focus on Early Childhood Education within Project Based Learning.

On the other hand, the article selection process is explained below. Table 4 presents a detailed breakdown of the article selection phases, which began with the identification of 130 studies and culminated in the inclusion of 31 final studies. This table highlights the exclusion criteria applied in each phase, which ensured that the selected studies provided significant empirical evidence on the implementation of PBL in Early Childhood Education. This process confirms the alignment of the selected studies with the research objectives.

Tabla 5: Article selection process.
Source: Author (2025).

Stage of the process	Number of studies	Criteria applied
Initial identification	130	- Exhaustive search in databases: ERIC, Google Scholar, Dialnet, Redalyc, Scielo. - Search terms in English and Spanish: Método de Proyectos, ABP, Project-Based Learning, Project Method, etc.
Review of titles and abstracts	60	- Exclusion of studies not focused on Early Childhood Education. - Elimination of non-empirical studies (essays, theoretical reviews, conferences). - Filtering of studies outside the 2020-2024 range. - Language (Spanish or English).
Complete revision of texts	40	- Complete reading to ensure thematic relevance. - Evaluation of the clarity of the objectives. - Verification of methodological quality (data collection and analysis, representativeness of the sample, validity).
Final selection of relevant studies	31	- Prioritization of studies with methodological rigor. - Inclusion of studies with methodological diversity (qualitative, quantitative, mixed). - Focus on studies that provide innovations or solid evidence on PBL in Early Childhood Education.

According to the data analyzed, 53.12% of the studies were concentrated in five key academic journals, such as Early Childhood Education Journal and Scielo, indicating a growing interest

in specialized journals within the educational field (Table 5). This publication pattern reflects both the relevance of the Project Approach in the current educational context and the potential

challenge of accessibility to these studies for classroom teachers, who could benefit from greater dissemination of these findings in open access media.

Table 6: Relationship between journals and number of articles published. Author (2025)

Magazine	Number of items	Percentage
Early Childhood Education Journal	4	12,5%
Scielo	4	12,5%
Dialnet	4	12,5%
Redalyc	3	9,38%
Academia.edu	2	6,25%
Otras publicaciones	15	46,88%

Table 6 illustrates the increase of PBL studies in Early Childhood Education in the post-pandemic period (2021-2023). This significant increase can be attributed to the need for adaptation methodological adaptation of educational institutions during the COVID-19 pandemic, which favored the implementation of flexible pedagogical approaches such as PBL (Feyen, 2020; Rocha, 2020; Santillán-Aguirre et al., 2023). Recent research suggests that the

health crisis accelerated the adoption of active methodologies, such as PBL, to foster autonomy and project-based learning in hybrid environments (De Santiago, 2020; Engel & Coll, 2022; Suárez et al., 2023; Orozco et al., 2023, Posso, 2023). Most of the selected studies were published in 2023, suggesting a consolidated interest in this methodology as a response to new educational demands (Hira & Anderson, 2021).

Table 7: Relationship between year of publication and number of articles published. A
Source: Author (2025).

Year of publication	Number of items	Percentage
2020	5	16,13%
2021	7	22,58%
2022	6	19,35%
2023	10	32,26%
2024	3	9,68%

The methodological distribution of the studies shows a predominance of qualitative approaches, representing 53.13% of the studies analyzed, while 28.13% correspond to quantitative studies and 18.75% to mixed studies (Table 8). This preference for qualitative methods reflects an interest in exploring teachers’ and students’

experiences and perceptions of PBL in the classroom, although it also points to a need for additional quantitative evidence assessing the impact of PBL on academic achievement and the development of key competencies in Early Childhood Education students (Chen & Yang, 2019).

Table 8: Predominant study methodology.
Source: Author (2025).

Methodology used	Percentage	Number of studies
Qualitative studies	53,13%	17 studies
Quantitative studies	28,13%	9 studies
Mixed studies	18,75%	5 studies

The 31 selected studies reflect a diverse panorama of methodological approaches and applications of Project Based Learning in Early Childhood Education. A trend toward the use of PBL to foster autonomy and active participation of children in their learning process was identified (Apaza Canada et al., 2022). Likewise, the relationship of the Project Method with the improvement in academic performance and the development of socioemotional skills in the first years of schooling has been pointed out (Barrera Arcaya et al., 2022).

The results show that PBL contributes significantly to the development of fundamental competencies such as creativity, critical thinking, and teamwork (Lucenko et al., 2023). In addition, increasing use of technology in Early Childhood Education was observed in PBL, especially in approaches related to the Science, Technology, Engineering, Arts, and Mathematics (STEAM) concept, reflecting an interest in the integration of digital tools as a complement in Early Childhood Education (Wulandani et al., 2022). These findings suggest that the incorporation of technology in PBL facilitates more interactive and contextualized learning (63% of the articles relate PBL and technology), which is particularly relevant in a post-pandemic context, where hybrid

and remote learning has gained prominence (Hira & Anderson, 2021; Cascales et al., 2017).

Regarding the implementation of PBL in specific educational contexts, the reviewed studies highlight its potential to foster inclusion and reduce educational inequalities in rural or disadvantaged contexts, where PBL can improve access to enriching and personalized learning experiences (Beneke & Ostrosky, 2009; Irure & Belletich, 2015; Clavijo et al., 2016; Barrera Arcaya et al., 2022). However, the lack of specific studies in these settings suggests an opportunity for future research exploring the differential impact of PBL in different educational contexts (Cascales & Carrillo-García, 2018).

In summary, the analysis of the 31 selected studies confirms that PBL is an effective methodology for promoting key competencies in early childhood education, with special emphasis on its applicability during the post-pandemic period. The distribution of the studies in terms of methodology and context underlines both the value of PBL in varied settings and the need to continue exploring its quantitative impact on the development of specific competencies and its effectiveness in diverse educational contexts.

4. Discussion

The findings of this systematic review reinforce the value of project-based Learning in Early Childhood Education as an effective methodology

for the development of key competencies such as creativity, critical thinking, problem-solving, and teamwork. These results coincide with previous

research highlighting how PBL fosters active and contextualized learning, allowing students to connect their learning with the environment and their interests, generating meaningful and lasting learning (Martínez Hernando, 2021; Osorio Pérez, 2024). This study contributes to the field by providing a comprehensive synthesis of recent research in Spain, thus filling a gap in knowledge about the specific impact of PBL in the early years of schooling (Apaza et al., 2022).

Interdisciplinary approach to PBA

PBL is characterized by its ability to integrate different areas of knowledge in an interdisciplinary manner, facilitating a deep understanding of concepts and promoting the transfer of skills between disciplines such as science, mathematics, and languages. This interdisciplinary approach allows students to address real problems, reinforcing transversal competencies, such as informed decision-making and problem-solving, essential in child development (Cascales et al., 2020; Lev et al., 2020). The review identifies a growing trend in studies towards the use of STEAM (Science, Technology, Engineering, Arts, Mathematics) approaches, highlighting how the combination of PBL with educational technologies enhances collaboration and adaptive learning, especially in the post-pandemic context (Wulandani et al., 2022; Hira & Anderson, 2021).

Need for more research in early childhood education

The review has highlighted a lack of studies focused on the Early Childhood Education stage, compared to other educational stages such as Primary and Secondary. This imbalance reflects a gap in knowledge, which is especially worrisome given that early childhood education is a critical stage in cognitive and socioemotional development (Li & Schoenfeld, 2019). The study confirms the observations of Arantes-Do Amaral (2021), who stresses that educational experiences in these early years lay the foundation for future learning. Despite the abundance of research on PBL in higher stages, this review demonstrates the urgent need for empirical studies that address the impact of PBL in Early Childhood Education, especially to guide teachers in the effective

implementation of this methodology from early ages (Aksela & Haatainen, 2019; Fernández-Cruz & Fernández-Díaz, 2016; Sánchez Garrido, 2021).

Comparison between qualitative and quantitative approaches

The predominance of qualitative studies (53.13%) reflects the interest in exploring and understanding the experiences of teachers and students in implementing PBL in Early Childhood Education. Qualitative studies provide rich insights into motivation and engagement in the classroom, but the limited presence of quantitative (28.13%) and mixed (18.75%) studies points to a need for more empirical evidence to generalize the effects of PBL and quantify its impact on specific competencies. Well-designed quantitative studies would be essential to validate qualitative findings and provide a more complete understanding of PBL in children's contexts. As Krajcik and Blumenfeld (2006) suggested, combining qualitative and quantitative approaches could provide a more robust and enriching analysis.

The studies analyzed suggest that PBL implementation varies significantly between public and private institutions. While some private schools have more resources and curricular flexibility to apply active methodologies, in the public sector, there may be limitations in terms of teacher training, curriculum load, and access to adequate educational materials (Cascales & Carrillo-García, 2018; Vasconcelos, 2007). These differences should be addressed in future research to ensure equity in the application of ABP and maximize its benefits in different educational contexts (Ruiz Hidalgo & Ortega-Sánchez, 2022).

Limitations in current research and future opportunities

This review highlights several limitations in the current research. The scarcity of longitudinal studies is a relevant finding since, although the studies reviewed show immediate benefits in developing key competencies, it is essential to know whether these effects persist over time (Sarceda et al., 2016). Longitudinal studies would make it possible to analyze the sustainability

of the benefits of PBL and its contribution to the comprehensive development of students throughout their educational trajectory (Ramey & Ramey, 2023). Another limitation observed is the geographic concentration of studies in urban contexts, which suggests a lack of knowledge about the potential of PBL to reduce educational inequalities in rural and disadvantaged contexts (Barrera Arcaya et al., 2022). These contexts represent a significant opportunity for future research that could examine how PBL can contribute to more equitable and accessible education. Also, the selection of studies focused exclusively on research published between 2020 and 2024, which may have excluded relevant prior work. In addition, most of the studies reviewed were qualitative in nature, which limits the generalizability of the findings to broader populations. Future research could address this gap through longitudinal studies and quantitative analyses to more accurately measure the impact of PBL in Early Childhood Education (Chen & Yang, 2019; Ramey & Ramey, 2023).

One of the main challenges identified in the studies reviewed is the lack of specific teacher training for implementing the Project Approach in Early Childhood Education. According to Barrera Arcaya, Venegas-Muggli, and Ibacache Plaza (2022), insufficient training limits the impact of PBL, as teachers may face difficulties in designing effective projects and adequately assessing children's learning. This reinforces the need to develop continuous training programs that integrate innovative pedagogical strategies and interdisciplinary approaches (Engel & Coll, 2022).

Another limitation identified in this review is the lack of specific data on the implementation of Project Based Learning (PBL) in differentiated contexts, such as public and private institutions. Many studies analyzed do not detail the type of educational center in which the Project Approach is implemented, which makes it difficult to identify key differences in terms of resources, teacher training, and pedagogical approaches. The availability of infrastructure, access to teaching materials, and the degree of curricular autonomy can significantly influence the effectiveness of PBL, but these factors are not always considered in

existing studies. Therefore, future research should focus on comparing PBL implementation in different types of schools, exploring how resource differences and teacher training impact learning outcomes (Ruiz Hidalgo & Ortega-Sánchez, 2022; Cascales & Carrillo-García, 2018).

Furthermore, this review has focused on the context of Spain, which is another limitation regarding the generalization of the results. Although the studies analyzed provide a valuable framework for implementing PBL in Early Childhood Education in this country, the literature reviewed does not include enough comparative studies with other educational systems. Given that the adoption of PBL can vary significantly according to each country's curricular frameworks, pedagogical culture, and educational policies, future research should expand the literature search to include international studies. This would allow for a more global view of the impact of PBL and the identification of innovative approaches and methodological adaptations in diverse educational contexts (Kokotsaki et al., 2016; Chen & Yang, 2019). Integrating international perspectives would strengthen the understanding of the optimal conditions for the implementation of PBL and facilitate the transfer of good practices between different educational systems.

In this sense, this review represents the first step in a broader research project whose next objective will be to conduct a systematic international analysis of Project-Based Learning in Early Childhood Education. This global study will contrast the experiences and results obtained in different educational systems, identifying common trends, barriers to implementation, and effective strategies for its optimization. The future international systematic review will contribute to a better understanding of PBL in different contexts and will facilitate the transfer of good practices between countries.

Integration of technologies in PBL in Early Childhood Education

The use of educational technologies within PBL has been explored in some studies, particularly in STEAM approaches. However, technology integration in PBL in Early Childhood Education

remains an under-researched area. Technologies can enrich PBL through tools that enhance collaborative and adaptive learning, particularly relevant in a post-pandemic educational context, where hybrid modalities and distance learning have gained importance (Hira & Anderson, 2021). The lack of comprehensive studies in this area suggests the need to explore how technologies can complement and strengthen PBL in Early Childhood Education, taking advantage of its possibilities to create more interactive and contextualized learning experiences (Domènech-Casal, 2018).

Implications of the findings and lines of future research.

This study reaffirms the importance of PBL in the development of fundamental competencies in Early Childhood Education, highlighting its transformative potential to foster active and meaningful learning. However, the identified limitations need to be addressed to maximize its effectiveness and understand its long-term impact. Future studies should focus on:

1. Conducting longitudinal studies to measure the sustained impact of PBL on the development of key competencies in students and to assess how these competencies

influence their learning over time (Ramey & Ramey, 2023).

2. Expanding research into more diverse geographic contexts, especially in rural and disadvantaged areas, to understand how PBL can contribute to educational equity and improve learning opportunities in less-resourced contexts (Barrera Arcaya et al., 2022; Lee, 2022).
3. Integration of technologies in PBL in Early Childhood Education, exploring how digital tools can enhance collaborative learning and the acquisition of digital competencies from an early age (Wulandani et al., 2022).
4. There should be a balance between qualitative and quantitative approaches, ensuring that both complement each other to provide a more comprehensive view of the impact of PBL. Qualitative studies provide valuable information on stakeholder perceptions, while quantitative studies are necessary to assess the impact on the development of specific competencies.

Addressing these areas will contribute significantly to both the research and practice of PBL in Early Childhood Education, providing tools and strategies for teachers to implement this methodology effectively and sustainably (Kołodziejski & Przybysz-Zaremba, 2017).

5. Conclusions

This systematic review has identified the effectiveness of Project Based Learning in Early Childhood Education and the challenges associated with its implementation. It is confirmed that PBL fosters fundamental competencies such as creativity, critical thinking, and collaboration (Lucenko et al., 2023); however, evidence suggests that its adoption requires favorable conditions, such as specific teacher training, adequate resources, and well-structured pedagogical approach (Barrera Arcaya et al., 2022).

The Project Approach significantly impacts students' academic performance and socio-emotional development, fostering an active and meaningful learning experience that connects knowledge with the student's immediate context (Chen & Yang, 2019). Despite these advances, its effective implementation requires teachers to be prepared to manage this integrative approach and consider educational technologies as an enrichment tool, an aspect still scarcely explored in Early Childhood Education (Wulandani et al., 2022).

From a practical perspective, the findings reinforce the need to strengthen initial and ongoing teacher training in active methodologies such as PBL. The lack of specific training may limit the effectiveness of this strategy, reducing its impact on student motivation and learning (Engel & Coll, 2022). Likewise, designing educational programs integrating PBL with interdisciplinary approaches, such as STEAM, is essential to enhance its applicability in the classroom (Santillán-Aguirre et al., 2023).

In summary, Project-Based Learning is revealed as a methodology with the potential to transform Early Childhood Education, promoting a personalized and contextualized educational experience that responds to students' individual needs. This review represents a first step in constructing a more solid empirical base on PBL in Early Childhood Education, laying the groundwork for studies of global scope that allow

contrasting experiences and implementation strategies in different educational systems.

Based on these findings, future research should focus on evaluating the impact of PBL in different educational realities, including large-scale analyses to identify common patterns and innovative approaches in diverse contexts. This study offers the first systematic review in the Spanish context of the Project Approach in Early Childhood Education, providing a key empirical basis for future research. Based on these findings, the next step will be to conduct a systematic review of the international scope, allowing the contrast of experiences, implementation strategies, and challenges in different educational systems. This future research will contribute to a better understanding of PBL in global contexts and facilitate the transfer of good practices between countries.

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Effect of incorporating an inert support for the production of poly-3-hydroxybutyrate (PHB) from cocoa bean shells by fermentation

Efecto de la incorporación de un soporte inerte para la producción de poli-3-hidroxibutirato (PHB) por fermentación a partir de cascarilla de cacao.

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Abstract

Poly(3-hydroxybutyrate) (PHB) can be used as substitute of non-biodegradable conventional plastics. In a context of circular economy, it is interesting the development of efficient fermentative technologies to produce these bioplastics from low-cost substrates, such as cocoa bean shell (CBS). The present research evaluates the beneficial effect of the presence of inert solid supports on PHB production by fermentation using *Bacillus firmus*. To this end, filtered CBS hydrolysates were employed as substrates for three different fermentations: (i) without solids, (ii) with polyester scouring sponge (PSS) and (iii) with basalt powder (BP). The best results were obtained when solid supports were added, with similar yields of around 36 mg of PHB/g of CBS in both cases. This value is ten times that obtained without solids. These results highlight the significant role that the presence of solids plays in microorganisms' metabolism, being essential for the production of PHB from CBS.

Keywords: *Bacillus firmus*, cocoa bean shell, hydrolysis, polyhydroxybutyrate (PHB), solid support.

Resumen

El poli(3-hidroxibutirato) (PHB) puede emplearse como sustituto de los plásticos convencionales no biodegradables. En un contexto de economía circular, resulta de gran interés el desarrollo de tecnologías fermentativas para producir estos bioplásticos a partir de sustratos como la cascarilla de cacao (CBS). Este trabajo evaluó el efecto de la presencia de un soporte sólido inerte en la producción de PHB utilizando *Bacillus firmus*. Se emplearon hidrolizados de CBS como sustrato para tres fermentaciones diferentes: (i) sin sólidos, (ii) con estropajo de polyester (PSS) y (iii) con polvo de basalto (BP). Los mejores resultados se obtuvieron en las fermentaciones en las que se añadió un soporte sólido, con rendimientos en torno a 36 mg de PHB/g CBS, valor aproximadamente 10 veces mayor que el obtenido sin sólidos. Estos resultados indican que la presencia de sólidos resulta esencial en el metabolismo de los microorganismos para la producción de PHB a partir de CBS.

Palabras clave: *Bacillus firmus*, cascarilla de cacao, hidrólisis, polihidroxibutirato (PHB), soporte sólido.

1. Introduction

Nowadays, the growing demand for plastic materials in every sector has led to an increase in plastic pollution, which is a major challenge in solid waste management (Mishra & Panda, 2023). It has been estimated that more than 400 million tons of plastics were produced worldwide in 2022, 40% of which come from the packaging sector (OECD, 2022; Statista Search Department, 2024). Globally, only 10% of these synthetic plastics are recycled, whereas more than 70% end up in landfills or are mismanaged, causing serious environmental threats, specifically in aquatic ecosystems (Saratale et al., 2021). In addition to environmental issues, plastic particles can provoke human health issues such as tissue damage, allergies or skin afflictions when inhaled or ingested (Arora et al., 2023).

Due to environmental concerns related to non-biodegradable plastic production and petroleum resources depletion, the interest in microbial-derived biodegradable polymers as a sustainable alternative is increasing (Briassoulis et al., 2021; Sohn et al., 2020). Polyhydroxyalkanoates (PHAs) are biodegradable and biocompatible bacterial polyesters, which can accumulate in the form of intracellular granules in response to stress conditions (Li & Wilkins, 2020; Sánchez et al., 2023a). Poly(3-hydroxybutyrate) (PHB), the most characteristic PHA, is a short chain length polymer accumulated as carbon and energy reserve by many microorganisms, including the genera *Bacillus*, *Pseudomonas*, *Cupriavidus*, *Azotobacter* and *Comamonas*, being *Bacillus* one of the main genera capable to produce PHB (Nath et al., 2024). Due to its high biodegradability (it can be completely degraded after 30 days), hydrophobicity, biocompatibility, and thermal and mechanical properties, PHB can be extensively applied in the food packaging industry and in the medical sector (specifically in tissue engineering) (Panda & Dash, 2023). In recent years, not only a wide range of bacteria species involved in the PHAs production have been studied, but also the use of different food wastes as substrates in its production has been addressed (Sirohi, 2021).

According to the Food Waste Index Report, more than 900 million tons of food waste were generated worldwide in 2021 throughout the food supply chain, from production to domestic consumption (Jaouhari et al., 2023). In this sense, the European Commission, through the Circular Economy Action Plan, has recently adopted the Sustainable Development Goals aimed at prioritizing residue prevention, recycling and valorization, considering waste disposal the most negative option. (Mariatti et al., 2021). The industrial scale-up of PHB production by microbial way is usually limited by the high cost of carbon sources, which accounts in some cases 50% of the total production expenditure (Saratale et al., 2021). Therefore, recently, there has been a growing interest in finding novel, cheap and easily available carbon sources. In this context, lignocellulosic biomass with proper treatment could be a promising renewable source to be employed as raw material for the production of bioplastics by fermentation. Cocoa bean shell (CBS) is the external part that covers the cocoa bean and is one of the main by-products derived from the chocolate industry. CBS is generally discarded as waste or used in low-value applications, i.e., as fertilizer or as animal food. This residue represents between 10-20% of the total cocoa bean weight and is mainly constituted by carbohydrates, phenolic compounds, dietary fibers, and fats (Sánchez et al., 2023b). In recent years, there has been a growing trend in using CBS to obtain value-added products with potential applications in the food, pharmaceutical and cosmetic sector, not only due to its interesting composition, but also because its valorization could be economically appealing (Okiyama et al., 2017).

Therefore, the aim of this work has been to evaluate the effect of inert supports (polyester scouring sponge and basalt powder) on PHB production by means of *Bacillus firmus* CECT 14, employing CBS hydrolysates as a carbon source.

2. Materials and methods

This work is an experimental research.

2.1.Raw material

CBS, which was obtained after roasting Forastero cocoa beans (Ivory Coast), was supplied by a local chocolate factory sited in Asturias (Spain).

2.2.Hydrolysis treatment

With the aim of obtaining a broth with a high content of fermentable sugars and considering previous works (Sánchez et al., 2023b, 2024), the following procedure was employed. Firstly, the raw material was milled in a blender (Braun 4041) to obtain 1-2 mm of particle size. A mixture of the milled CBS and 5% H₂SO₄ (Supelco, Bellefonte, PA, USA) (20% w/w) was introduced into a 1-L Pyrex bottle and hydrolyzed at 135°C and 2 bar in an autoclave (AES 110, Raypa, Spain) for 10 minutes. Once autoclaved, larger solids were removed with a sieve and the resulting liquid phase was filtered by a 20-μm cellulose sterile filter (Whatman™). The recovered supernatant was adjusted to pH 6-7 with 5M NaOH (Merck, Rahway, NJ, USA) and placed in a fermentation flask for inoculation.

2.3.Fermentation process

Prior to fermentation, two different supports were added to fermentation media in sterile conditions: polyester scouring sponge (PSS) and basalt powder (BP) (46.7% silica, 12.76% iron, 11.28% calcium, 9.5% magnesium, 0.4% phosphorus, 0.2% manganese, 0.02% copper and 0.02% zinc) (Cultivers, Spain). The preparation of polyester pieces followed the procedure described in Ruiz et al. (2015). The sponge was cut into cubes of approximately 1 cm side and 1 g of these fragments was added to the fermentation flask in sterile conditions. In the case of basalt powder, 36 g were added to the fermentation broth so that the solid content was similar to the substrate non-centrifuged. Figure 1 shows the support employed for the fermentation process. In addition, fermentation without solids and any support was carried out as a control. All fermentations were carried out at least in duplicate.

Broths were inoculated with *Bacillus firmus* CECT 14 supplied by CECT (Spanish Type Culture Collection) with an initial microbial load of 6×10^3 CFU/mL. Fermentations were conducted for 6 days at 37°C and 250 rpm and samples

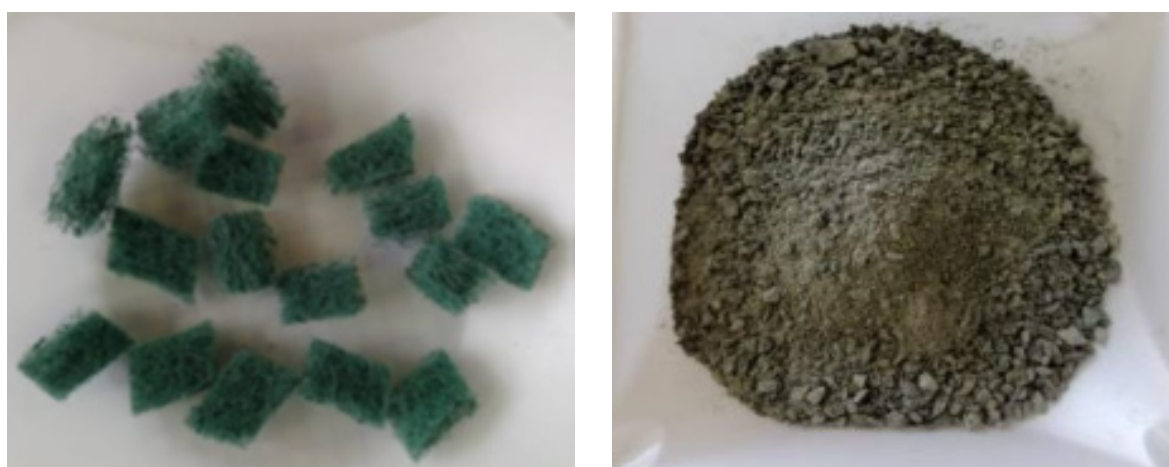


Figure 1: Supports employed in the fermentation process: polyester scouring sponge (left) and basalt powder (right).

were taken from the flasks periodically and centrifuged (Heraeus Multifuge X1 Centrifuge Series, Thermo Fisher Scientific, Waltham, MA, USA) at 10.000 rpm for 10 minutes. The pH of the supernatant was measured, and, after that, it was frozen until analysis of total carbohydrates and reducing sugars content. The pellet was also frozen until determination of PHB content. Additionally, microbial growth was followed by taking 1 g of sample, which was homogenized in a Stomacher (Stomacher 80 Biomaster, Worthing, West Sussex, UK) with 9 mL of 0.7% NaCl sterile solution. Serial dilutions were plated in triplicate onto nutrient broth agar medium and incubated at 30°C for 24 h before counting.

2.4. Analytical methods

All analyses were performed in triplicate and all reagents were supplied by Merck (Rahway, NJ, USA).

2.4.1. Total Carbohydrates

Total carbohydrates were quantified using the phenol-sulfuric acid method (Dubois et al., 1956) as described in Sánchez et al. (2022). For this assay, 1 mL of sample was mixed with 2.5 mL of 96% H₂SO₄ and 0.5 mL of 5% phenol solution and the mixture was incubated at room temperature for 1 h. Finally, the absorbance was measured at 492 nm using a spectrophotometer (DR/2500 HACH, CO, USA). Glucose was employed as the standard

2.4.2. Reducing sugars

The amount of total reducing sugars in the samples was measured as reported in Díaz et al. (2017), using an adaptation of the Dinitrosalicylic acid (DNS) method (Miller, 1959). For the analysis of reducing sugars, 0.5 mL of DNS reagent was added to 0.5 mL of sample and the mixture was incubated for 5 min in a water bath at 95°C. Then, samples were immediately cooled in an ice bath and the absorbance was measured employing a spectrophotometer (Thermo Scientific™ UV-Vis GENESYS™ 150, Waltham, MA, USA) at 540 nm. Glucose was employed as the standard.

2.4.3. Quantification of PHB

The extraction and quantification of PHB content in samples was carried out following the Law and Slepecky method (Law & Slepecky, 1960). Firstly, the pellet obtained in the fermentation was digested with 10 mL of 6-14% NaClO solution in a water bath at 37°C for 1 h. After that, the mixture was centrifuged for 30 minutes at 10.000 rpm (Heraeus Multifuge X1 Centrifuge Series, Thermo Fisher Scientific, Waltham, MA, USA) and the pellet was washed successively with distilled water, acetone, and ethanol. The supernatant was discarded, and the pellet was mixed with 10 mL of chloroform and the mixture was filtered through a 20 µm cellulose filter recovering the filtrate.

For the quantification of PHB content in samples, 100 µL of the filtrate was mixed with 10 mL of 96% H₂SO₄ and incubated at 95°C in a water bath. After 10 minutes, samples were cooled in an ice bath and the absorbance was measured employing a spectrophotometer (Thermo Scientific™ UV-Vis GENESYS™ 150, Waltham, MA, USA) at 235 nm. Crotonic acid was employed as standard.

2.4.4. Dry extract

To express the results on a dry weigh basis (dw) (w/w), the moisture content of CBS was determined gravimetrically. To this aim, 3 g of sample was weighed with sea sand in a stainless-steel capsule. The mixture was dried in an oven for 24 h at 105°C and, after cooling, was weighed again. The dried extract and moisture content were calculated considering the difference between the initial and final weight.

2.4.5. Statistical analysis

GraphPad Prism software (version 9.0; GraphPad Software Inc.) was used for statistical analysis. Results were expressed as average value ± standard deviation (SD). Analysis of variance (ANOVA) and Tukey's multiple comparisons tests were used for statistical analysis calculated with 95% confident interval ($p < 0.05$).

3. Results and discussion

It has been reported that the pretreatment of lignocellulose wastes is the first step to produce bacterial polyhydroxyalkanoates (Andler et al., 2021), consequently, with the aim to maximize the extraction of fermentable sugars, CBS was submitted to a hydrothermal treatment. In particular, PHB can be produced using different feedstocks, including agro-industrial wastes, as substrate (Sirohi et al., 2020). Concretely, the CBS hydrolysate obtained has a composition suitable for the production of PHB by fermentation (reducing sugars: 28.0 g/L, total nitrogen: 2.2 g/L and total phosphorus: 0.8 g/L) (Sánchez et al., 2023b). According to the literature, PHB is produced by microorganisms under restricted conditions of nitrogen and phosphorus and in the presence of an excess carbon source, for example, 22-30 g/L of carbon, 0.5 g/L of phosphorus and 2 g/L of nitrogen, similar values than those of the CBS hydrolysate (Hamdy et al., 2022). Ramos et al., (2023) studied the production of PHA from cocoa pod husk and reported a maximum PHA accumulation in a fermentation media with 20 g/L of glucose. Rebocho et al. (2019) employed a hydrolysate of apple pulp with a concentration of reducing sugars of 25.2 g/L for obtaining PHAs. In addition, Hamdy et al. (2022) evaluated the production of PHB by *Bacillus cereus* using different nitrogen sources and observed that the highest PHB concentration was achieved with 2.4 g/L of nitrogen in the initial medium. With respect to pH, Amulya et al. (2016) obtained the highest productivity of PHA under neutral conditions. The optimal pH for *Bacillus* growth is between 6.5 and 7, whereas for pH values below 5.8 a complete suppression of *Bacillus* growth was observed (Li & Wilkins, 2020). For these reasons, the initial pH of the medium employed in this work was initially adjusted to around 6.8.

Despite the apparent suitable characteristics for PHB production of the liquid medium obtained from hydrolyzing CBS, very low concentrations of PHB were obtained without solids (< 1 g/L). On the contrary, in previous works (Sánchez et al., 2023b), interesting PHB productivities were

achieved when the non-solubilized CBS was maintained in the media during fermentation. It has been demonstrated that the presence of solids in fermentation media can favor the formation of fermentation products due to the fact that these particles provide a solid surface for microorganism's attachment, which improves cell growth rate (Sánchez et al., 2023b; Bathgate, 2019).

3.1. Sugars consumption

The evolution of both total carbohydrates and reducing sugars were monitored during fermentation and results are shown in Figure 2. As can be appreciated, in the control the consumption of sugar was very low (approximately 5 g/L) compared to the results obtained in the broths with BP and PSS. In addition, the consumption took place just during the first 24 h of fermentation and significant differences ($p > 0.05$) were not observed between the sugar concentrations measured after 48 h. However, when a solid support was added, the concentration of sugars was reduced more noticeably. In both cases, with BP and PSS, a rapid consumption of sugars was observed during the first day of fermentation, decreasing onwards more slowly. The final concentrations of total carbohydrates and reducing sugars were very close for both fermentations, which means that, when solid particles were in the medium, the enzymes released by *B. firmus* could hydrolyze the dissolved complex carbohydrates into simple sugars. The total carbohydrates consumed at the final time (144 h) were 13.8 g/L and 14.6 g/L with BP and PSS, respectively (around 40%).

These results are in accordance with those reported in the literature for the production of PHB from other lignocellulosic residues. Pereira et al. (2021) studied the production of PHAs from apple pulp extracts by means of *Pseudomonas chlororaphis* and observed a maximum consumption of fermentable sugars of 15.2 g/L after 4 days of fermentation. In addition, Andler et al. (2024) evaluated the use of hydrolysates of grape residues

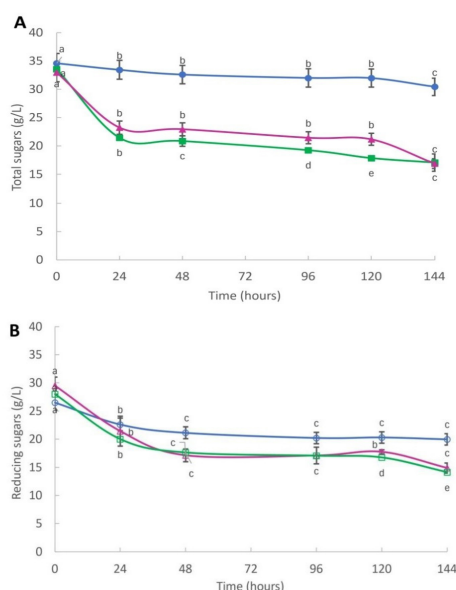


Figure 2: Evolution of (A) total carbohydrates (filled) and (B) total reducing (unfilled) sugars during fermentation for control (●, ○), BP (■, □) and PSS (▲, △), expressed in g/L. For each fermentation, the means followed by different letters indicates statistic differences ($p < 0.05$) by Tukey's test.

to produce PHB, using a suspended culture of *Azotobacter vinelandii*, and reported that over the course of fermentation, approximately 17 g/L of reducing sugars were consumed. Quintero-Silva et al. (2024) who studied the production of PHAs using cocoa mucilage as fermentation media, reported a consumption of 18 g/L of reducing sugars during the process and a maximum concentration of PHA of 2.3 g/L.

3.2. Microbial growth

As can be seen in Figure 3, a decrease in CFU counting in the control sample can be observed during the first 24 h of fermentation. In the fermentation with BP, the viability slightly increased during the first 48 h, decreasing drastically after this moment. On the contrary, in the broth with PSS a notable bacteria growth took place during the first 48 h of fermentation, which coincides with the fast consumption of sugars previously commented (Figure 2). Additionally, it is remarkable that sugar consumption was very similar for both BP and PSS broths, whereas the maximum bacterial concentration achieved was quite different, namely, 8.0×10^3 and 1.2×10^5

CFU/ml, respectively. No significant differences ($p > 0.05$) were observed in microbial viability after 48 h of fermentation in the control and PSS samples. Finally, it is noteworthy that the microbial growth behavior seems likely that some kinds of inhibitors were released during the fermentation process, since bacterial viability started to decrease when the concentration of reducing sugars was still high (Figure 2).

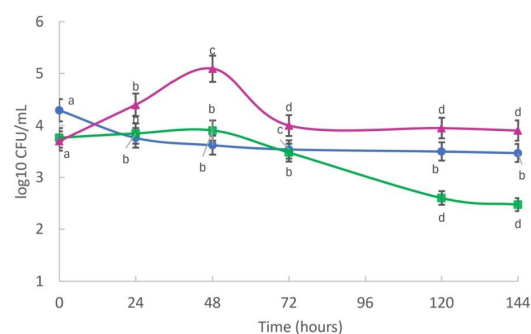


Figure 3: Evolution of microbial growth during fermentation process: control (●), BP (■) and PSS (▲). For each fermentation, the means followed by different letters means statistic differences ($p < 0.05$) by Tukey's test.

Results demonstrate that there is a clear relationship between the presence of a solid support in the fermentation media and bacterial growth. It has been reported that *Bacillus* genus can produce biofilms in response to stress, especially in presence of surfaces such as plastics, soil particles, and food (Viju et al., 2020). These structures enhance the metabolism and favor the survival of microorganisms under adverse conditions. Zhu et al. (2020) evaluated the effect of different culture parameters, i.e., pH, temperature, and carbon source, on the biofilm formation of *Bacillus pumilus*. They observed a stable biofilm structure on the surface of a solid medium (LB agar medium) and reported that a higher and more resistant biofilm was obtained at 37°C and pH 7, using glucose as carbon source, similar conditions than those employed here. Therefore, the differences observed when comparing fermentations with and without solids are due to the formation of bacterial biofilms on the surface of the solids, which protected the cells and increased the viability of *B. firmus*.

3.3. PHB production

The production of PHB by *B. firmus* during the fermentations without solids (control), with BP and with PSS, has been followed and results are shown in Figure 4.

As can be appreciated, notable differences in terms of PHB production were observed, depending on whether a solid support was or not added. After 144 h of fermentation without solids (control), a PHB concentration of only 0.6 g/L was obtained. These results are in accordance with the observed loss in cell viability above commented (from 104 to 103 CFU/mL) as low PHB production may be associated with reduced cell viability. However, when solid supports were present in the fermentation broth, PHB was produced by the bacterium and concentrations between 6 and 7 g/L were achieved after 72 h. Comparing the production of PHB in fermentations carried out with BP and PSS, significant differences were not observed ($p > 0.05$), even though the cell growth was much higher in the case of the PSS. In both cases, the maximum yield was obtained after 120 h of fermentation with values around 36 mg PHB/g CBS (dry weight). The highest rate of PHB production occurred simultaneously to the exponential cell growth, during the 1st and 2nd day of fermentation, with an average biopolymer productivity of 0.11 g/L h. It has been reported that some bacteria of the *Bacillus* genus present a growth-associated PHB production and accumulate the polymer during the exponential phase (Yanti et al., 2021).

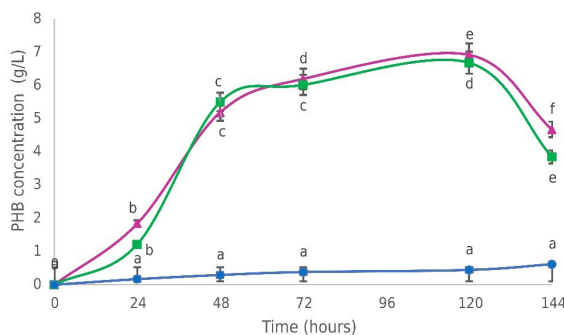


Figure 4: Concentration of PHB during fermentation process: control (●, ○), BP (■, □) and PSS (▲, △). For each fermentation, the means followed by different letters means statistic differences ($p < 0.05$) by Tukey's test.

Some other authors reported similar productions of PHB using as substrate other lignocellulosic residues. Amir et al. (2024) studied the addition of different dried and ground food wastes solids (i.e. potato peel, banana peel, corn peel and cassava bagasse) in the fermentation media for the production of PHB employing *Pseudomonas stutzeri* and reported a maximum concentration of PHB of 6.1 g/L after 5 days of fermentation. In addition, Soni et al. (2023) obtained approximately 0.9 g/L of PHB from banana peel waste hydrolyzed with 5% H_2SO_4 in a fermentation media without a solid support, values very similar to those obtained here with the medium without solids. Hassan et al. (2019) evaluated the use of different agrifood solid wastes (i.e., corn bran, corncob, wheat bran and rice bran) as a supplement to optimize the production of PHB by *Bacillus subtilis* and the maximum concentration achieved was only of 0.3 g/L of PHB when rice was employed as feedstock, almost the same concentration as that obtained here in the control broth.

This research has demonstrated that the availability of a solid support in the fermentation media, in which microorganisms can form a biofilm, improves not only bacterial growth and viability but also the production of PHB. However, the PHB concentrations obtained here with inert supports were still lower than those obtained in a previous work with CBS solids (20 g/L of PHB) (Sánchez et al., 2023b). Therefore, the presence of solids in the fermentation medium is indeed a key factor in the production of PHB, but also their composition and nature are fundamental since they can act as an additional source of micronutrients and/or growth factors for microorganisms.

4. Conclusions

CBS has been employed as feedstock for the production of PHB, a sustainable alternative to synthetic plastics, by fermentation with *B. firmus*. A very low production of PHB was observed when CBS hydrolysates without solids were employed, with a maximum concentration of PHB of 0.6 g/L. However, the use of inert supports (i.e., BP and PSS) notably increased the production and concentrations of PHB between 6 and 7 g/L were achieved after 72 h of fermentation, respectively. This production of PHB took place in parallel with an increase in *B. firmus* counts. In particular, in the PSS fermentation the concentration of viable cells increased notably from 6×10^3 to 1.2×10^5 CFU/mL. On the contrary, in absence of solids (control broth) microbial viability decreased from

the first day of fermentation. According to these results, it is clear the necessity of solid particles for bacterium growth and, therefore, to produce PHB from CBS. This is explained by the advantages derived from the formation of a biofilm on the surface of the solids, which protects bacteria from inhibitory compounds and adverse conditions.

The results obtained in this work highlight the potential of CBS to be employed as feedstock for fermentation with the objective of producing value-added products such as bioplastics. As future work, other fermentation conditions (i.e., inoculum, temperature, agitation, time, kind of solid particles, etc.) should be optimized in order to consider the possible scaling of the process.

5. Acknowledgments

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The History of Open-World Video Games: A Timeline from 1976 to 2023

La historia de los videojuegos de mundo abierto:
Cronología desde 1976 hasta 2023

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The History of Open-World Video Games: A Timeline from 1976 to 2023

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Abstract

This article analyzes the evolution of open-world video games from their origins to 2023, establishing a chronology that contextualizes their development in relation to technological advancements and industry trends. By examining the release pace, the study explores the progression of the open-world model and its consolidation across different console generations. A comparative approach is employed, linking the evolution of these games to hardware capabilities. Verification criteria were applied through the analysis of specialized sources and player discussions to ensure the coherence of the selected titles. The results indicate that the expansion of open-world games has been strongly tied to platform power, although it also reflects shifts in industry preferences. The recent decline in release frequency suggests a potential transition in their design and consumption.

Keywords: game design, game evolution, open world, video game history, game studies

Resumen

Este artículo analiza la evolución de los videojuegos de mundo abierto desde sus orígenes hasta 2023, estableciendo una cronología que contextualiza su desarrollo en relación con la evolución tecnológica y las tendencias del sector. A través del análisis del ritmo de lanzamientos, se examina la progresión del modelo de mundo abierto y su consolidación en distintas generaciones de consolas. El estudio emplea un enfoque comparativo, cruzando la evolución de los videojuegos con las capacidades del hardware. Se han aplicado criterios de verificación mediante el análisis de fuentes especializadas y comentarios de jugadores para garantizar la coherencia en la selección de títulos. Los resultados indican que la expansión de los mundos abiertos han estado fuertemente ligadas a la potencia de las plataformas, aunque también refleja cambios en las preferencias del sector. El reciente descenso en su ritmo de lanzamientos sugiere una posible transición en su diseño y consumo.

Palabras clave: diseño de videojuegos, evolución del videojuego, mundo abierto, historia de videojuegos, game studies.

1. Introduction: The open-world video game

From its earliest days, video games have demonstrated a clear narrative vocation. Early classics such as *Space Invaders* (Taito, 1978) or *Super Mario Bros.* (Nintendo-Creative-Department, 1985) already tried to tell stories, whether about an alien invasion or the abduction of a princess, using the limited resources available to the first titles. As the decades passed and the generations of consoles and platforms evolved, productions became progressively more complex, seeking to innovate in-game mechanics and storytelling.

In this constant search for new ways of interacting with the player, a trend emerged that granted greater agency, autonomy, and the ability to intervene within the video game universe, thus giving birth to open worlds. These titles moved away from linear experiences, in which the objective was simply to overcome a series of challenges in a predetermined order. Instead, open worlds were presented as a proposal that balanced the player's freedom to explore and develop their interests within the game while maintaining a narrative or objective structure to maintain coherence and gameplay direction.

Jesper Juul (Juul, 2005) explains that video games operate at the intersection between structured rules and fictional worlds, where the player's agency is the axis that articulates the experience. In open worlds, this balance is key, as the player has the freedom to set his or her own goals within the boundaries of the designed system.

This type of video game, far from being an experimental model or a passing trend, has established itself as one of the most influential proposals in the evolution of the medium and the industry over the last few decades. Its growing popularity has led many of the most emblematic sagas to adapt to this model, integrating explorable worlds and offering new forms of gameplay that

allow players to interact with the environment in a freer and more meaningful way.

This article analyzes the trajectory of open-world video games from their first manifestations to their consolidation as one of the predominant designs in the last decade, in which many of the most successful and highest-budget titles have adopted this approach. To this end, a chronology is presented detailing the publication figures of these video games and their evolution over the years. The results also show a close relationship between the design of open worlds and the technological power of the platforms on which these games are developed.

The open-world model has been one of the most influential trends in modern video game development. Its evolution has transformed the way players experience exploration, narrative, and interaction within virtual worlds. However, despite its relevance, no academic study has to date systematized the evolution of this design model in a detailed chronological framework, relating its advances to technological progression and changes in the industry.

Previous studies on video games have addressed various aspects of the open world, such as its impact on player immersion (Zimmerman & Salen, 2003) or its relationship with agency and interactivity (Juul, 2005). However, few works have attempted to draw a precise chronology to understand how this model has been consolidated over nearly five decades. This gap in the academic literature calls for research that systematically compiles and analyzes open-world video games from their earliest manifestations to their current development.

In addition, the rise of other design models, such as roguelike, battle royale, and hero shooters, has led to an apparent decline in the popularity of open

worlds in recent years. Therefore, this research documents not only their history but also their possible stagnation and the reasons behind this evolution in the industry. With this work, we will provide a reference for both researchers in Game

Studies and designers interested in understanding how open-world principles have evolved and what factors have conditioned their expansion and transformation over the years.

2. Materials and methods

The chronology of open-world video games has been based on the definition of this type of game proposed in the doctoral thesis *Open World Video Games: Definition, the Rationale of the Principles of ludonarrative Design, and Proposal of Analysis* (García, 2023). Thus, it is understood that an open-world video game offers a systemic and emergent game experience whose non-deterministic design places the player and his or her possibilities of action at the center of the experience, allowing substantial variations between games. It is not a genre but a design model that can be applied to video games of different genres, such as action, role-playing, or adventure.

The game's design is not structured in discontinuous levels or phases and favors freedom of transit, including backtracking. Its objectives promote the exploration of a wide scenario, which is a container space for other points of ludonarrative interest. Although often confused, an open world is not the same as a sandbox. While the open world offers a broad setting with objectives that can be approached flexibly, a sandbox emphasizes player creativity in a space without a predefined structure of progression, allowing experimentation with its systems without narrative or design constraints.

In narrative terms, the environment plays a key role in the construction of the story, functioning as a display medium that invites the player to actively discover the narrative elements. The player is expected to become an inhabitant of a plausible world populated by artificially intelligent characters who are often integrated into the story through personal micro-stories. The script allows the coexistence of two narratives: one designed by the developers and another emergent one shaped

by the player's decisions, which enables a unique narrative experience in each game.

Careful design of the player experience through an interaction system is critical to the creation of meaningful play. To generate instances of meaningful play, the experience must incorporate not only explicit interactivity but also choices that are relevant within the context of the game, which implies that the player's decisions have a tangible impact on the development of the game (Zimmerman & Salen, 2004). This ability to choose is fundamental within the structure of open worlds, as it allows each game to be unique and different from the others.

Finally, immersion, which plays a fundamental role in open worlds, does not depend solely on the graphical quality or the size of the setting. According to Zimmerman and Salen (2004), immersion is not an inherent property of the game or the medium but is the result of the interaction between the player and the game. This emphasizes that true immersion arises from the player's experience of interacting meaningfully with the virtual world beyond the aesthetic aspects of the game.

Based on these definitions, lists of video games have been compiled that span from the earliest titles to the end of 2023. According to the same thesis, *Grand Theft Auto III* (DMA-Design, 2001) is considered the starting point of the modern open-world video game, i.e., the first title to fully incorporate all the elements we associate today with this game model. However, although titles prior to *Grand Theft Auto III* do not fully fit the current definition, it is possible to observe

characteristics and evolutions that influenced the development of the open-world concept, so they have also been included in the chronology.

The compilation of the video games included in this study was carried out through progressive search and verification of diverse sources. Initially, lists published in specialized media and websites that published articles on what they considered to be the best open worlds in history or from specific eras or platforms were consulted (Byrd & Greenbaum, 2023; IGN, 2023; MacReady, 2024; Pursey & Sammut, 2024; Sawyer & Sammut, 2024; Stubbs, 2025; Vandal, n. d.). We also used the “open world” tag on the Steam platform to identify relevant titles (Valve, n. d.) and reviewed gamer community forums where lists of open-world games have been shared (DaLejd, 2023; ShouldIbuythisgame, 2024), allowing us to identify lesser known or discussed titles within the community.

For cases where doubts arose as to whether a title met the definition of open world, an additional verification process was carried out. This included consulting specialist reviews and player feedback on forums and discussion platforms, examining aspects such as world structure, degree of freedom of exploration, and game progression. If a title did not meet the principles set out in the definition used in this study, it was discarded from the final list.

From this initial base, the selection process was expanded through a more detailed analysis of the sagas and development teams identified in the first searches. In many cases, the lists consulted included only the most recognized installments of some franchises, which led to further research into the evolution of these sagas to include earlier, later, or related titles. Other games developed by the same studios were also explored, as they have often applied similar design principles in different projects. This approach allowed us to discover and incorporate a wider variety of titles that, although not always the most representative within the open world model, have contributed to its evolution and expansion.

To ensure the consistency and validity of the selection, each game was evaluated according to

the definition of the open world established in this work. Since there is no unified and universally accepted database of open-world video games, this selection may be subject to certain limitations. While multiple sources have been consulted and consistent evaluation criteria have been applied, it is possible that some titles have been left out or that the selection reflects, to some extent, the availability of information from inaccessible sources. Nevertheless, the aim of this chronology is to provide as complete a reference as possible within the possibilities of the field of study.

Thus, we take as a starting point *Colossal Cave Adventure* (Crowther & Woods, 1976) in the mid-1970s and continue with various text, graphic and role-playing adventures on computers over the following years. Subsequently, the console generations of the following decades are covered, until finally reaching the last sixteen titles counted from 2023.

In total, 372 video games have been analyzed, classified both by their year of release and by the generation of platforms on which they were released. In some cases, games have been released for multiple platforms over time, but to get a more accurate picture of their impact each year, the original launch platform was considered. For example, *Minecraft* (Mojang, 2011) was initially released for PC, and although it later expanded to other consoles, it is counted as a PC game due to its original release on this platform.

Likewise, when a title has been originally released for platforms of different generations, it has been considered the most recent among those offered at the time of release, as it represents the current generation and the one that offers an optimized gaming experience. Cross-generational games for more current consoles often incorporate enhanced functionalities, such as improved graphics capabilities, reduced loading times, and additional features that enrich the player's experience. Although the titles are available on older platforms, the focus has been on the most recent generation, as it better reflects current trends and technological advances.

To facilitate the understanding of this chronology and the list of games, the research is based on

the commonly used classification of consoles by generations. This classification groups the platforms according to their technical capabilities and technological advances, which makes it possible to establish the distinctive characteristics of each generation.

Although there are several studies on console generations (Juul, 2020; Persson & Medin, 2009), and the dates may vary slightly, most agree in identifying the fundamental characteristics of each:

- First generation (1972-1980): Consoles with pre-installed games that could not be interchanged. Their graphics were simple, based on dots and lines—featured consoles: Magnavox Odyssey and Pong.
- Second generation (1976-1992): Introduction of cartridges as a format to store games. 8-bit graphics and more complex sound. Featured consoles: Atari 2600, Intellivision and ColecoVision.
- Third generation (1983-2003): More complex controllers and 8-bit graphics with advanced sound. Featured consoles: Nintendo Entertainment System (NES), Sega Master System, and Atari 7800.
- Fourth generation (1987-2004): More advanced chips for 16-bit graphics with improved animations and visual effects, as well as stereo sound. Featured consoles: Super Nintendo Entertainment System (SNES), Sega Mega Drive (Genesis) and TurboGrafx-16.
- Fifth generation (1993-2006): 32-bit and 64-bit processors that enabled the transition to 3D graphics and the use of CD-ROM as a storage format. Featured consoles: PlayStation, Nintendo 64 and Sega Saturn.
- Sixth generation (1998-2013): Consoles with processors that allowed 480p resolutions and three-dimensional graphics, in addition to the adoption of DVD as the physical format.

This generation also marked the beginning of online gaming and the first download services—featured consoles: PlayStation 2, Xbox, Nintendo GameCube, and Sega Dreamcast.

- Seventh generation (2005-2017): High-definition graphics, with resolutions ranging from 720p to 1080p. Expansion of online functionalities, networked games, additional content downloads, and digital games. Featured consoles: Xbox 360, PlayStation 3 and Nintendo Wii.
- Eighth generation (2012-present). Introduction of 4K resolutions, virtual reality, cloud gaming, and game subscriptions. Development of hybrid consoles that combined the functions of a desktop and a handheld. Featured consoles: PlayStation 4, Xbox One, Wii U, and Nintendo Switch.
- Ninth generation (2020-present). They support high resolutions and frame rates, enabling gaming up to 4K and 60 frames per second. Incorporate ray tracing and the use of high-speed SSD storage that enhances the user experience. Expansion of subscription services and cloud gaming. Featured consoles: PlayStation 5, Xbox Series X, and Xbox Series S.

There are a few exceptions to this generational classification. Firstly, computers, due to their ability to be constantly updated with the latest technologies, cannot be pigeonholed into any specific generation but have accompanied all generations from the beginning. Secondly, handheld consoles, which have traditionally had lower technological power than desktops, although included in the same generations, have not been as prone to the emergence of open worlds. Nevertheless, in order to provide the most complete representation of open-world video games, this research has sought to include all relevant titles, including those fundamental to handheld consoles.

3. Results and discussion

Open Worlds published by year

Based on the previously established criteria, the search and analysis of open-world video games has resulted in a list of 372 titles. These are distributed in an increasing manner from

their beginnings to the present day, reflecting the development and evolution of this design model. The numbers of releases are detailed in Table 1:

Tabla 1: Open world publication by year.
Source: Own elaboration.

Year	Number of games	Year	Number of games
1976	1	2002	8
1979	1	2003	7
1981	1	2004	9
1982	2	2005	10
1983	1	2006	13
1984	1	2007	7
1985	1	2008	14
1986	2	2009	13
1988	2	2010	13
1989	1	2011	13
1990	1	2012	12
1991	1	2013	12
1992	1	2014	20
1993	2	2015	14
1994	1	2016	16
1995	1	2017	25
1996	1	2018	24
1997	2	2019	23
1998	1	2020	22
1999	8	2021	15
2000	4	2022	22
2001	7	2023	16

The distribution shows a limited production of open-world video games during the first decades, with one or two releases per year and periods without outstanding novelties. However, from 1999 onwards, titles were considerably increased, reaching a first peak of eight games. This change is closely related to the arrival of the sixth generation of consoles, and the advances achieved thanks to a greater mastery of fifth-generation technology laid the foundations for the emerging design of these games.

Although the growth in the production of open-world video games can be seen since 1999, the most significant change occurred in 2001. This year marks the real turning point when open-world videogames ceased to be a simple exercise to show off the capabilities of consoles and consolidated as a genuine trend within the videogame industry. From then on, developers began to see this type of design not only as an innovative option but also as a way to offer deeper game experiences with a greater focus on player freedom.

This trend is clearly linked to the release of *Grand Theft Auto III* and its immediate success. The title not only defined the open-world video game model as we understand it today but also inspired a wave of titles that sought to replicate its success. Games such as *Saints Row* (Volition, 2006), *Mafia* (Illusion-Softworks, 2002), *The Getaway* (Team-Soho, 2002), as well as some established franchises that veered towards this model, such as *Jak II: The Renegade* (Naughty-Dog, 2003), *Driver 3* (Reflections-Interactive, 2004) or *The Simpsons: Hit & Run* (Entertainment, 2003), were some of the examples that followed in this wake, showing the lasting impact of the *Grand Theft Auto III* proposal.

The 372 video games counted have been published over 47 years, from 1976 to 2023,

resulting in an average of almost eight titles released per year. However, given the uneven distribution of releases and the lower relevance of the first decades, it is observed that if we discard these early years and calculate the average from 1999, the year in which open-world video games began to have a significant impact, the figure rises to almost 14 titles per year. If we focus on the last ten years, the average number of releases between 2013 and 2023 rises to nearly 21 open-world games per year.

The distribution of open-world video games would be graphically represented in Figures 1 and 2. In order to improve readability, the graph has been divided into two parts, one from the origins until 1999 and the other from 2000 to the present:

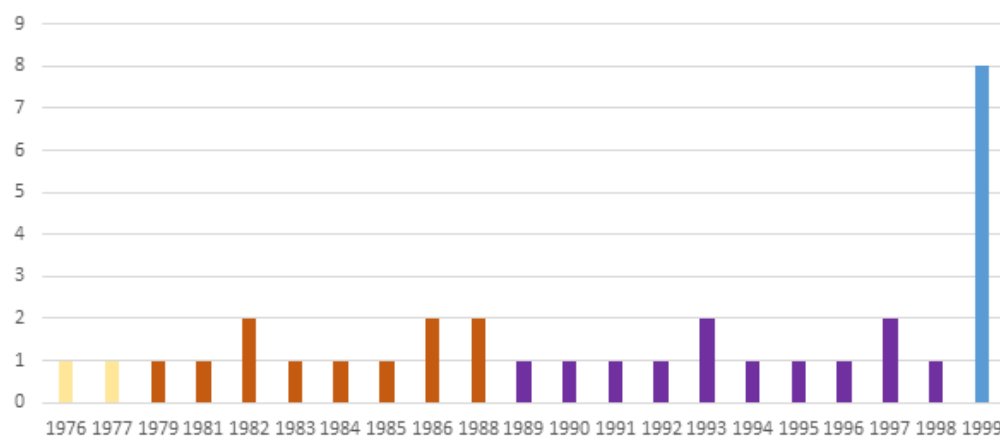


Figure 1: Open worlds published by year (1976-1999).

Source: Own elaboration.

Figure 1 shows a scarce production of open-world games until 1999. During the first decades, the video game industry was dominated by fast-paced, control-demanding genres such as platformers, arcade games (linked to arcade machines and their short-game dynamics), and fighting games. Open-world games did not enjoy the same popularity due to technological limitations, and design preferences focused on more linear and straightforward experiences.

Prior to 1999, the years with the highest number of open-world game releases barely reached two titles. However, that year, the figure rose to

eight thanks to the first Dreamcast titles (the first console of the sixth generation), such as *Shenmue* (Sega-AM2, 1999) and *Crazy Taxi* (Sega-AM3, 1999), as well as the major productions that marked the end of the PlayStation life cycle, such as *Grand Theft Auto 2* (DMA-Design, 1999) or *Driver* (Reflections-Interactive, 1999).

From 2000 onwards, the rise of desktop consoles, which surpassed arcades in popularity, encouraged the creation of more narrative and extensive titles. These platforms made a more leisurely and detailed design possible, where concepts such as freedom of exploration and interaction

in open worlds took center stage. Figure 2 shows the evolution in the number of open-world titles published per year, highlighting a gradual and

significant increase since the beginning of the new millennium, reaching its peak in the second half of the last decade:

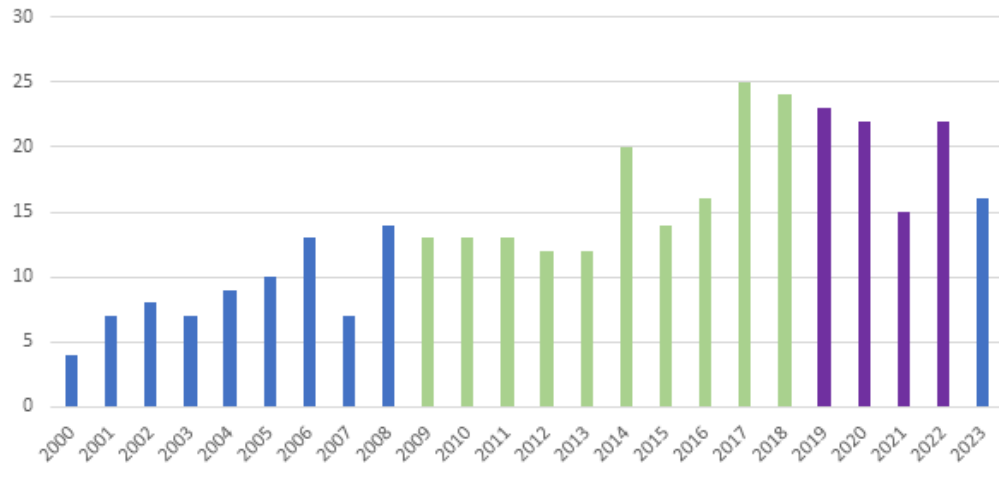


Figure 2: Open worlds published by year (2000-2023).

Source: Own elaboration

The figure shows a clear upward trend in open-world game releases from the beginning of the millennium to the present. However, some occasional setbacks seem to be related to the generational shifts of consoles. For example, in 2007, developers shifted from working on the sixth generation of consoles to focusing on the seventh generation, which caused a slight pause in releases as teams had to adapt to the new technologies and capabilities of the seventh generation. In 2006, titles were released for both generations, but in 2007 most productions were focused on the seventh generation, which explains the decrease in releases in that year.

A similar pattern occurred in 2013, with the switch from the seventh to the eighth generation. That year, many games were released intergenerationally, i.e., they were available for seventh- and eighth-generation consoles. However, in 2014, eighth-generation exclusive releases increased significantly, reflecting studios' adaptation to the new consoles and their enhanced capabilities. This generational transition explains, in part, the one-off declines in releases as developers took time to adjust to the new platforms.

However, the decrease in titles in 2021 seems to be linked not only to the generational replacement of consoles but also to a significant external factor: the global crisis caused by COVID-19. This situation limited work in the industry across the board, forcing numerous releases to be delayed to later years (Sirani, 2021). This also explains the high number of open-world games released in 2022, one of the years with the highest number of such titles in history. This period brought together both games originally planned for 2022 and those that had been postponed due to the pandemic.

Launches by technology generation:

Looking at the chronology of games in terms of console generations, interesting patterns emerge. Until 1983, all open-world video games were developed exclusively for the PC, and that year marked a turning point with the release of *Elite* (Braven & Bell, 1984), a title that, although it came to PCs, was also adapted for third-generation consoles, such as the Nintendo Entertainment System. Two years later, in 1986, *The Legend of Zelda* (Nintendo-EAD, 1986) was released exclusively for consoles of the same generation. With the exception of a few notable titles, such as *The Legend of Zelda: A Link to the*

Past (Nintendo-EAD, 1991) for Super Nintendo (fourth generation) and two other games for the fifth generation, most of the open worlds until 1999 were tied to the PC.

From Colossal Cave Adventure to 2023, 77 PC-exclusive titles have been counted, representing

21% of the registered open-world games. However, from the sixth generation onwards, a significant change in this trend was observed. Since 1999, console releases grew steadily, reaching their peak during the eighth generation, which accumulated a total of 118 titles, equivalent to 32% of the total.

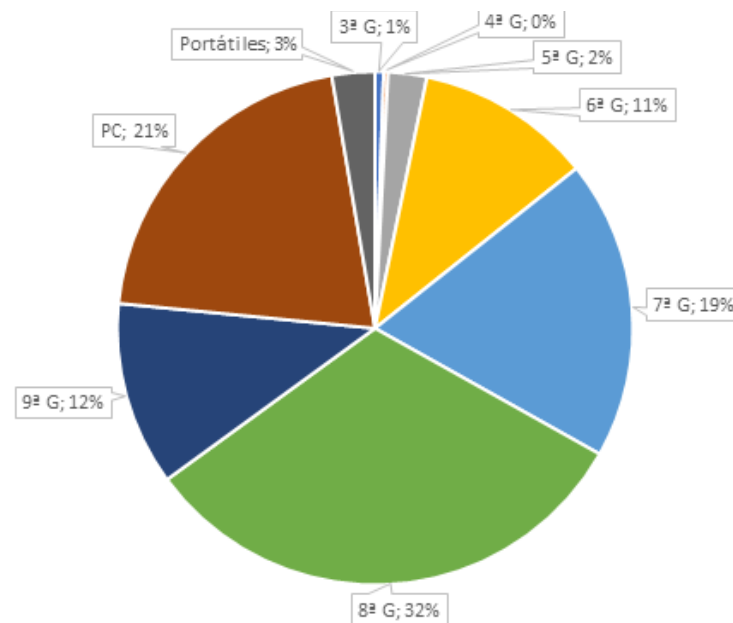


Figure 3: Open worlds published by technology generation.

Source: Own elaboration.

Figure 3 shows how each generation's percentage of open-world titles has increased. This phenomenon reflects both the growing interest in this type of video game and the advancement of the technological capabilities that make them possible. The ninth generation, represented by consoles such as PlayStation 5 and Xbox Series X/S, shows a lower percentage because it is still in the middle of its life cycle. It is possible that, in time, releases in this generation will equal or surpass those of their predecessors, although the pace of production seems to have slowed in recent years.

Lastly, the number of releases for portable consoles is minimal. The most notable are the last two installments of The Legend of Zelda (Breath of the Wild (Nintendo-EPD, 2017) and Tears of the Kingdom (Nintendo-EPD, 2023))

for Nintendo Switch, a hybrid console with both portable and desktop features.

Portrait of the open-world video game over the years:

a. 1980s: The first steps of the open world

In the 1980s, the open world concept was still rudimentary and limited by the technical capabilities of the platforms of the time. Most video games did not offer the freedom of exploration we associate with today's open worlds, but some of their early features began emerging. While not "open worlds" in the modern sense, these titles allowed players to explore a non-linear world with some freedom of action. In the 1980s and up to the mid-1990s, the Ultima saga (Garriot & Systems, 1981) stood out, which, thanks to its first

eight installments, progressively developed ideas on how a story could be designed within an open and explorable world.

This type of game introduced the idea of large maps. However, restrictions were evident, mainly due to hardware limitations such as memory or graphics power, resulting in small and rather limited worlds. Despite this, players already experienced a sense of exploration without a fixed path, laying the groundwork for future developments.

b. 1990s: Expansion and Experimentation

During the 1990s, open-world video games began to take more defined forms thanks to the progress of technology, especially with the advent of 3D graphics and greater technological capabilities of consoles. Here were born the first examples of truly open-world games, with large maps and more freedom of action.

A key milestone was *The Elder Scrolls II: Daggerfall* (Bethesda-Softworks, 1996), which at the time offered a gigantic map, albeit very primitive in terms of design and gameplay, as it featured a huge geographical expanse, but simple gameplay by later standards. This type of game put the emphasis on exploration, but the missions were still largely linear.

c. 2000s: Consolidation of the Open World as a Core Concept

In the 2000s, open-world design was consolidated with flagship titles that offered much more polished and richer gameplay. Games such as *The Elder Scrolls III: Morrowind* (Bethesda-Game-Studios, 2002) and *GTA: San Andreas* (Rockstar-North, 2004) pushed the boundaries of exploration even further, integrating more complex stories, more detailed worlds, and more complex systems of interaction and progression.

Advanced technology enabled the creation of more detailed and dynamic maps. *The Elder Scrolls IV: Oblivion* (Bethesda-Game-Studios, 2006) and *Fallout 3* (Bethesda-Game-Studios, 2008) incorporated more realistic graphics and more complex gameplay systems, including

player decisions that affected narrative and world development. In turn, the arrival of *Assassin's Creed* (Ubisoft-Montreal, 2007) marked an innovation in using the open world by integrating historical exploration of vast urban environments within a fluid gameplay system that combined action, stealth, and interactive narrative. This evolution of the concept allowed the open world to be recognized not only as a space for exploration but also as a platform for dynamic and organic storytelling.

d. 2010s: Innovations in Interactivity and Complexity

The 2010s brought the open world to maturity, with examples of games that redefined what could be achieved in these spaces. *The Witcher 3: Wild Hunt* (CD-Projekt-Red, 2015) and *Red Dead Redemption 2* (Rockstar-Games, 2018) are two of the most prominent examples of how narrative, gameplay and world design were integrated in a coherent and detailed way. These games offered vast maps with environments that were not only large in scale but also deeply detailed and full of life.

During this decade, there was also a major step towards interactivity and reactivity of the world, with systems that allowed for greater immersion, from day and night cycles to dynamic story changes based on the player's decisions.

In addition, titles such as *Minecraft* (Mojang, 2011) and *No Man's Sky* (Hello-Games, 2016) featured open worlds that relied on procedural generation, allowing players to experience infinite worlds unique to each game. This marked a shift in the conception of the open world, not just as a fixed representation but as a constantly evolving universe.

e. The 2020s: Realism, Immersion, and Expansion of Technical Capabilities

The 2020s have been marked by the ambition to create even more realistic, immersive, and detailed worlds, taking advantage of the capabilities of next-generation consoles and high-performance PCs. Games such as *Elden Ring* (FromSoftware, 2022) have continued the

tradition of vast and complex worlds but with an emphasis on free exploration and environmental narrative, leaving the players to discover the story for themselves, needing the need for a fixed narrative.

Open-world design has been enriched by the introduction of worlds that react more realistically

to player actions. Developers have also begun experimenting with more complex AI systems, creating NPCs that interact more consistently with players and with each other and help bring these worlds to life.

4. Conclusions

The remarkable number of open-world video games released between 1976 and 2023 demonstrates the great interest this design model has generated among players and developers. This interest is closely linked to the technological evolution of the platforms, especially their power. Since its inception, the computer has been the natural territory of open worlds, thanks to its ability to outperform contemporary consoles. In the earliest games of this type, prior to *Grand Theft Auto III*, many of the fundamental features of open-world design were already present, albeit in a more rudimentary form. These titles were developed exclusively for the PC for decades, prioritizing the most powerful computers capable of handling three-dimensional graphics. Likewise, most of the open worlds released for consoles have also been available for PC, consolidating their position as the main platform for this design model.

The relationship between the power of platforms and the rise of open worlds is evident. As consoles have advanced technologically, the number of such titles has grown significantly, especially in the eighth generation, which reached the highest numbers. This growth has also reflected a preference for desktop consoles and PCs, with handhelds relegated to an almost anecdotal role. Although the Nintendo Switch, as a hybrid console, has been home to some outstanding open worlds, its limited performance compared to desktop consoles has restricted the number of releases for this platform, especially against PlayStation 4 and Xbox One during the eighth generation.

The current figures for the ninth generation should be interpreted with caution, as these consoles are still in the middle of their life cycle. However, the pace of open-world releases has slowed compared to the previous generation. This decline could indicate a shift in consumer and development trends, with the open-world model becoming less popular compared to other design models and genres, such as roguelikes, battle royales, and hero shooters.

One of the factors that could be influencing this decline is player fatigue with open worlds. In recent years, there has been a growing debate about how a high reliance on map markers and repetitive mechanics has turned exploration into an exercise closer to systematic icon collection than true immersion in the game world. As noted in multiple reviews (CaptainBinky, 2020; Henley, 2022), many open-world games have ceased incentivizing organic exploration and natural interaction with the environment, reducing their appeal to a structured formula prioritizing efficiency over experience. This exhaustion may be driving both players and developers to seek alternatives that offer fresher structures and are less reliant on conventions established in the previous decade.

The rise of online multiplayer games, such as battle royale and hero shooters, has considerably impacted this trend. Both genres have gained increasing popularity in recent years (Powell, 2023; Schwarz, 2024; Wawro, 2016), not only among players but also among developers, who have bet on mechanics that favor competitive

interaction and teamwork. These titles, characterized by intense and dynamic matches, have captured the public's attention for their ability to offer unique experiences in each session and their progression structures that keep players engaged in the long term. By offering a survival experience combining strategy, exploration, and action, battle royale games have won over mass audiences and competitive gamers, creating a global phenomenon that has transformed the online gaming landscape.

On the other hand, hero shooters, which focus their gameplay on characters with unique abilities and a strategic team approach, have brought a renewal within multiplayer games. These games have encouraged competition through specific roles within the team, which has allowed for greater variety and depth in matches. The popularity of titles such as *Overwatch* (Blizzard-Entertainment, 2016) or *Valorant* (Riot-Games, 2020) has consolidated this subgenre, capturing an audience that seeks intense action and the need for cooperation and strategy. Their success has been reflected in steady growth in active players, frequent updates, and large-scale events, consolidating them as benchmarks in online gaming.

Although these genres are not new, their growing popularity in recent years has redirected interest toward different game experiences,

where replayability and active participation are key factors. Thus, both battle royale and hero shooters have occupied an important space within video game development, partially shifting the focus away from open worlds. The gaming community and streaming platforms, such as Twitch and YouTube, have helped to amplify this phenomenon, contributing to the global expansion of these titles and, more importantly, to their integration into popular culture.

As for the roguelike phenomenon, originally linked to indie developments, this growth has transcended to a larger dimension (Gailloro, 2020): major game developers have also adopted roguelike mechanics in big-budget titles such as *Diablo* (Blizzard-North, 1997), *Minecraft* (Mojang, 2011) and *Dark Souls* (FromSoftware, 2011). These additions have helped roguelike elements, such as random level generation and permanent death, to be integrated into AAA games, further popularizing this type of gameplay. By mixing these features with other genres, developers have been able to capture the interest of a larger player base, which has contributed to the rise and expansion of the subgenre in the industry. Examples of this include high-budget titles such as *Returnal* (Housemarque, 2021), published by PlayStation's in-house development teams, which bet on the roguelike format, demonstrating its growing popularity even in more commercial games.

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The influence of internalizing problems on social media addiction in young adults: An empirical study

La influencia de los problemas internalizantes en la adicción a las redes sociales en adultos jóvenes: Un estudio empírico

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The influence of internalizing problems on social media addiction in young adults: An empirical study

La influencia de los problemas internalizantes en la adicción a las redes sociales en adultos jóvenes: Un estudio empírico

Abstract

As social media use continues to expand, its potential effects on mental health have become a growing concern, especially for young adults who are among the most active users. This study explores the relationship between internalizing problems—anxiety, depression, and stress—and social media addiction among young adults. A total of 170 participants (aged 18–22 years) completed self-report measures for anxiety, depression, stress and social media addiction. Results indicated a significant relationship between internalizing problems and social media addiction. Participants with higher levels of anxiety, depression, and stress were significantly associated with greater social media addiction. Conversely, those with minimal or no internalizing symptoms had the lowest addiction scores, indicating a direct link between psychological distress and social media addiction.

Keywords: internalizing problems, social media addiction, behavioral addiction, young adulthood, psychological distress.

Resumen

A medida que el uso de redes sociales sigue expandiéndose, sus efectos en la salud mental preocupan cada vez más, especialmente a los adultos jóvenes, que son de los usuarios más activos. Este estudio explora la relación entre problemas internalizantes—ansiedad, depresión y estrés—y adicción a redes sociales en adultos jóvenes. Un total de 170 participantes (18-22 años) completaron medidas de autoinforme sobre ansiedad, depresión, estrés y adicción a redes sociales. Los resultados indicaron una relación significativa entre problemas internalizantes y adicción a redes sociales. Los participantes con niveles más altos de ansiedad, depresión y estrés estuvieron significativamente asociados con mayor adicción. Por el contrario, aquellos con síntomas mínimos o inexistentes presentaron los puntajes más bajos, indicando un vínculo directo entre malestar psicológico y adicción a redes sociales.

Palabras clave: problemas internalizados, adicción a las redes sociales, adicción conductual, adultez joven, distrés psicológico.

1. Introduction

With social media usage growing rapidly across the world (WHO, 2024), understanding the psychological factors and underlying mechanisms of social media addiction is imperative from both research and clinical perspectives. This study aims to clarify the role internalizing problems play, with the goal of informing interventions that, could be applied to reduce mental health problems that involve the overuse or addiction to social media.

In recent years, the growing social media usage and raised concerns over psychological effects, especially regarding mental health problems (Keles et al., 2020). Social media platforms went through a fundamental change from communication and socialization instruments to environments that promote harmful psychological consequences, including addiction-like behaviors (Sun & Zhang, 2021). Social media addiction (SMA) is conceptualized as a form of behavioral addiction, similar to gambling or gaming disorder, where individuals exhibit compulsive use of social media despite negative consequences on their personal, professional, or academic lives (Andreassen et al., 2017; Rahma & Setiasih, 2021). SMA is largely defined by compulsive use, withdrawal symptoms, and disruption of normal functioning; with results consistent with behavioral addictions (Karakose et al., 2023; Kuss & Griffiths, 2017). Due to the vast use of social media and its highly reinforcing nature, considerable efforts are being made toward the understanding of psychological constructs and the underlying problem of social media use (Karakose et al., 2023; Kuss & Griffiths, 2017; Leménager et al., 2018; Hussain & Starcevic, 2020; Shannon et al., 2022; White-Gosselin & Poulin, 2024).

Internalizing problems are generally defined as inwardly directed psychological difficulties that lead to anxiety, stress, depression, and emotional distress (Achenbach et al., 2016; Effatpanah et al., 2020). Internalizing problems, such as anxiety and depression, have been associated

with a variety of forms of maladaptive behaviors, including substance abuse, gambling, and, more recently, excessive social media use (Aalbers et al., 2019; Barrault et al., 2019; Devi, & Singh, 2023; Huang, 2020; Primack et al., 2017). Internalizing symptoms and disorders can have lasting effects, especially if they are left untreated, on social and emotional well-being, including educational underachievement, social and occupational problems, reduced life satisfaction, drug use, and suicide attempts (Kessler, 2012). The association between internalizing symptoms and problematic social media use has been established by many studies (Andreassen et al., 2017; Bányai et al., 2017; Brailovskaia, et al., 2020; Hussain, & Griffiths, 2021; Rahma & Setiasih, 2021; Kircaburun & Griffiths, 2019; Lin, et al., 2016; Marino et al., 2018; Puukko et al., 2020; White-Gosselin & Poulin, 2024; Yaqoob, et al., 2024). Research has demonstrated that individuals experiencing high levels of anxiety and depression are more likely to engage in problematic social media behaviors, including excessive usage and addiction (Andreassen et al., 2017; Boniel-Nissim et al., 2024; Brailovskaia, et al., 2020; Hussain, & Griffiths, 2021; Rahma & Setiasih, 2021; Marino et al., 2018).

The underlying mechanisms of this relationship have been suggested to involve the use of social media as a coping strategy for managing or regulating negative emotions, anxiety, stress, depression and generally internalizing emotions and behaviors, leading to the reinforcement of addictive behaviors (Andreassen et al., 2017; Brailovskaia, et al., 2020; Hussain, & Griffiths, 2021; Kircaburun & Griffiths, 2019; Lin, et al., 2016; Marino et al., 2018; Puukko et al., 2020). However, while social media use can offer short-term relief from these negative emotions, compulsive use can reinforce an addictive cycle, ultimately escalating emotional distress (Kircaburun et al., 2018; Keles et al., 2020; te Brinke et al., 2021).

The Gratification Theory (Katz et al., 1973) may be used to provide a useful framework for understanding the relationship between internalizing problems and social media addiction. According to this theory, individuals may actively seek out media content to satisfy specific needs, such as entertainment, socialization, or escape from reality. For individuals experiencing anxiety and depression, social media may serve as a tool for mood regulation, offering an easily accessible and socially accepted outlet for managing negative emotions (Elhai et al., 2017; Keles et al., 2020). However, while social media may fulfill these needs in the short term, over-reliance on this medium can lead to compulsive usage patterns that resemble addiction (Kircaburun et al., 2020).

Another way to explain the relationship between Internalizing problems and SM is that, for individuals suffering from anxiety, stress, and depression, social media may offer a way to mitigate feelings of social isolation or FoMO (Fear of Missing Out), as they can stay connected with peers and access real-time information without engaging in direct social interactions that might provoke further stress or discomfort (Gupta & Sharma, 2021; Przybylski et al., 2013; Wegmann et al., 2017). The continuous engagement with SM platforms allows for immediate feedback and a perceived sense of social inclusion, which can temporarily alleviate anxious and depressed feelings. However, over time, this reliance on social media for anxiety management and emotional regulation can evolve into excessive or compulsive behavior, contributing to the development of addiction (Elhai et al., 2017).

It's evident that previous research consistently highlights the complex interplay between internalizing symptoms and social media addiction. Anxiety, stress, and depression have been identified as strong emotional drivers of problematic behaviors on social media platforms. Individuals with elevated anxiety symptoms often experience heightened fear of missing out (FoMO), prompting compulsive checking behaviors and continuous engagement to ease their anxious feelings temporarily (Gupta & Sharma, 2021; Przybylski et al., 2013; Wegmann et al., 2017). Similarly, depressive symptoms have

been associated with maladaptive use of social media as individuals seek emotional relief, social validation, or distraction from negative feelings, thus reinforcing addictive cycles (Brailovskaia et al., 2020; Marino et al., 2018). Furthermore, chronic stress has been linked with the intensified use of social media as a coping mechanism, providing immediate but short-lived emotional respite (Andreassen et al., 2017; Rahma & Setiasih, 2021; Keles et al., 2020). While social media might initially offer emotional comfort, persistent engagement typically intensifies psychological distress, developing a reciprocal cycle wherein internalizing symptoms both initiate and reinforce addictive usage patterns.

Despite the growing interest in this area, the specific contribution of different internalizing symptoms to social media addiction remains underexplored, particularly about the roles of anxiety, stress, and depression as independent predictors. The present study seeks to address this gap, by examining the impact of internalizing problems, specifically anxiety and depression, on social media addiction.

The focus of this study is the association between internalizing problems like anxiety, stress, and depression and social media addiction. This study aims to provide a comprehensive analysis of how these internalizing symptoms contribute to problematic social media use.

Internalizing problems and social media/network addiction seem to be linked. The aforementioned antecedents underscore the interplay of Internalizing problems and social media/Network use in the psychological adjustment of youths. The present study aims to further explore the contemporary relationship between Internalizing problems (anxiety, stress, and depression) in young adults and social media/network addiction. Participants with Internalizing problems were expected to show significantly higher levels of social media/network addiction. Also, the participants who appeared to experience low or not all Internalizing problems were expected to show better control over social media/network use compared with the participants who experienced higher levels of stress, anxiety, and depression. Thus, higher levels of Anxiety, Depression, and

Stress will be associated with greater social media addiction, independently predicting social media addiction. Also, higher levels of anxiety will be associated with greater social media addiction. This study specifically aims to analyze how anxiety, depression, and stress contribute to social media addiction among young adults, providing

a clear understanding of these internalizing symptoms as potential predictive factors, with its clear objective being to examine whether and how specific internalizing symptoms, such as anxiety, stress, and depression, predict social media addiction behaviors among young adults.

2. Materials and methods

2.1. Participants

The participants were selected by convenience sampling among undergraduate English-speaking students, of the exclusively English departments of the university, from a variety of different disciplines (e.g. students of: software engineering, psychology, architecture, physiotherapy, etc.), of Athens Metropolitan College in Greece, from 18 to 22 years-of-age ($M = 19.75$, $SD = 1.36$). The total sample of the study is 170 ($n = 170$). 46.5% of the sample are men ($n = 79$) and 52.4% ($n = 89$) are women, and no participant is Transgender/Non-binary. The vast majority 97.6% of the sample is Caucasian ($n = 166$) and the rest ($n = 4$) is either Asian, African, or Mixed. The annual family income of the participants is 34.7% of the lower economic class, 28.2% of the middle class, 23.5% of the upper middle class, and 7.6% of the upper economic class. The participants resided in Athens and surrounding areas. Convenience sampling was used because it is the most common non-probabilistic sampling strategy (Jager et al., 2017).

2.2. Instruments

The study incorporated three standardized psychological instruments forming a battery of questionnaires to receive the desired datasets.

The Depression Anxiety Stress Scale-21 (DASS-21), was developed by Lovibond and Lovibond in 1995 and has been widely used in research and clinical practice to measure psychological distress. It is a self-report questionnaire measuring levels of depression, anxiety, and stress in individuals. This is a 4-point Likert-type scale that consists of

21 items that form 3 subscales ($\alpha = .92$, $\omega = .92$). Subscale of Anxiety ($\alpha = .86$, $\omega = .86$), Stress ($\alpha = .79$, $\omega = .79$) and Depression ($\alpha = .87$, $\omega = .87$). This is a shortened version of the original DASS, which consisted of 42 items. This instrument has consistently been validated across various cultural contexts (Lovibond & Lovibond, 1995).

Developed by Spitzer et al. (2006) the Measure for Assessing Generalized Anxiety Disorder (GAD-7) is a brief, 7-item, self-report questionnaire designed to assess the severity of generalized anxiety disorder (GAD), in a 4-point Likert-type scale. Each item asks the respondent how often they have experienced various anxiety-related symptoms over the past two weeks, such as feeling nervous, uncontrollable worry, or physical symptoms like restlessness, the GAD-7 has demonstrated excellent internal consistency ($\alpha = .90$, $\omega = .90$) and strong validity (intraclass correlation = .83) when compared with clinical evaluations by mental health professionals. The scale is widely recognized as reliable for screening generalized anxiety disorder symptoms across clinical and research settings (Spitzer et al., 2006).

The Social Media Addiction Scale Student Form (SMAS-SF, Sahin, 2018), the SMAS-SF is a 5-point Likert-type scale which consists of 29 items and they are forming 4 sub-dimensions (Sahin, 2018). Each addressed behaviors and experiences related to social media use, such as preoccupation, mood modification, withdrawal symptoms, and the impact on daily life. Respondents rate their agreement with each statement on a Likert scale ranging from 1 (strongly disagree) to 5

(strongly agree). The SMAS-SF demonstrated excellent internal consistency overall ($\alpha = .91$, $\omega = .91$). Subdimensions also presented robust psychometric properties. The items 1-5 are within the “Virtual Tolerance” subdimension ($\alpha = .70$, $\omega = .71$), 6-14 items are within the “Virtual Communication” subdimension ($\alpha = .79$, $\omega = .79$), 15-23 items are under “Virtual Problem” ($\alpha = .82$, $\omega = .82$), sub-dimension and 24-29 items are under “Virtual Information” sub-dimension ($\alpha = .79$, $\omega = .79$). All of the items in the scale are positive. The highest point that can be scored on the scale is 145, and the least is 29. The higher scores indicate that the participant perceives themselves as a “social media addict” (Sahin, 2018). The original version showed good internal consistency ($\alpha = .91$) and the scale’s reliability has been consistently supported in diverse populations (Sahin, 2018).

2.3. Procedure

Before entering the study, the participants gave their informed consent through a form adapted to this study with the aid of the Ethics Committee of the National University of Distance Education (UNED for Universidad Nacional de Educación a Distancia). The Ethics Commission of UNED authorized the study (Reference: 01-SEC-PSI-2023) and its compliance with the ethical and data protection standards required by European legislation. The median time for survey collection was 30 minutes and the participants didn’t receive any compensation for their participation, the confidentiality and anonymity of the data were maintained at all times, and the

participation in the study was voluntary. The data collection from the participants took place in the classrooms of the university campus. The researcher shared data links with the participants via QR codes. The importance of responding honestly and answering all questions was also emphasized.

Data analysis

For this study and their variables an ex-post facto prospective design was used (Fontes de Gracia et al., 2001). The dependent variables are the Social Media Addiction Scale Student Form (SMAS-SF). The independent or predictor variables are the Measure for Assessing Generalized Anxiety Disorder (GAD-7), and Depression Anxiety Stress Scale-21 (DASS-21). All the statistical analyses were performed in SPSS, version 21.0 for Windows. The researchers performed a multivariate analysis of variance (MANOVA) using the Measure for Assessing Generalized Anxiety Disorder (GAD-7), and Depression Anxiety Stress Scale-21 (DASS-21), as predictors. To interpret the magnitude of the effect size, the criteria of Cohen (1998), were followed ($\eta^2 = 0.01$ indicates a small effect; $\eta^2 = 0.06$ medium effect; $\eta^2 = 0.14$ large effect). MANOVA was chosen due to its robustness in analyzing multiple dependent variables simultaneously, reducing Type I error and efficiently capturing interactions among variables. This method is especially relevant given the interrelated nature of internalizing symptoms (anxiety, depression, stress) in predicting the multifaceted dimensions of social media addiction.

3. Results

3.1. Internalizing problems (GAD and DASS as independent variables) and social media-addiction

A multivariate analysis of variance was conducted to analyze the effects of Generalized

Anxiety Disorder (GAD-7) and Depression Anxiety Stress (DASS-21), on social media addiction. Table 1 presents, the main effects of GAD-7 and Depression, Anxiety, and Stress on social media Virtual Tolerance, Communication, and Problem (Subscales of SMAS)

Table 1: Main effects of Generalized Anxiety Disorder (GAD-7) and Depression, Anxiety, and Stress (DASS-21) on Social Media Addiction (SMAS-SF subscales).

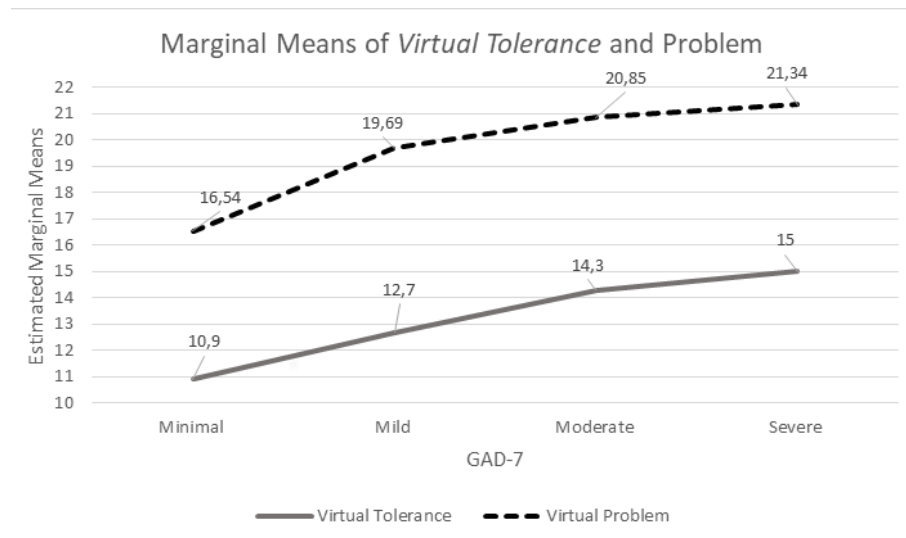
Source: Own elaboration

Variable	N	Tolerancia virtual				Problema virtual				Comunicación virtual			
		M (SD)	F	p	η²	M(SD)	F	p	η²	M(SD)	F	p	η²
GAD-7													
Minimal GAD	31	10.9 (3.61)				16.54 (5.45)							
Mild GAD	49	12.7 (3.42)	8.46	<.01	.13	19.69 (5.21)	4.51	< .01	.076				
Moderate GAD	47	14.3 (3.40)				20.85 (6.22)							
Severe GAD	41	15.0 (4.35)				21.34 (6.72)							
DASS-Stress													
Low	57	11.8 (3.75)				17.25 (5.44)				18.41 (4.52)			
Moderate	74	13.9 (3.71)	8.07	< .01	.09	20.15 (5.72)	24.0	< .01	.11	20.67 (5.39)	12.07	< .01	.12
DASS-Anxiety													
High	35	14.8 (4.01)				22.86 (6.35)				24.26 (7.13)			
Low	50	11.86 (4.08)	5.82	< .01	.08	16.78 (4.90)	10.4	< .01	.11	18.90 (5.26)	3.96	.02	.02
Moderate	38	14.02 (3.83)				20.18 (5.58)				20.51 (4.86)			
High	80	13.66 (6.52)				21.54 (6.39)				21.88 (6.52)			
DASS-Depression													
Low	54	12.57 (4.03)	2.35	< .01	.02	17.12 (4.63)	10.2	< .01	.11	18.40 (4.40)	7.95	< .01	.08
Moderate	70	13.49 (3.85)				20.21 (6.27)				20.98 (5.96)			
High	43	14.30 (3.95)				22.40 (6.32)				23.00 (6.62)			

Note: Table 1: GAD-7 = Generalized Anxiety Disorder Scale; DASS-21 = Depression Anxiety Stress Scale-21; SMAS-SF = Social Media Addiction Scale-Student Form. η^2 indicates effect size (small = .01, medium = .06, large = .14, Cohen, 1988). Significant values ($p < .05$) are in bold. Low, moderate, and high categories reflect clinical cutoffs defined by respective authors. Source: Own elaboration.

Regarding the effect of GAD on Social Media addiction the MANOVA analysis (Figure 1) indicated significant results (Wilks' $\Lambda = 0.82$, $F = 2.72$, $p = .001$). The tests of the between-subjects effect showed a significant effect of GAD for the

“Virtual Tolerance” subdimension ($F = 8.46$, $p = <.01$, $\eta^2 = .13$), and for Virtual Problem ($F = 4.51$, $p = <.01$, $\eta^2 = .076$). The effect size for both variables was medium. It is clear that, the higher the anxiety levels the higher “Virtual Tolerance” and “Virtual Problem”.



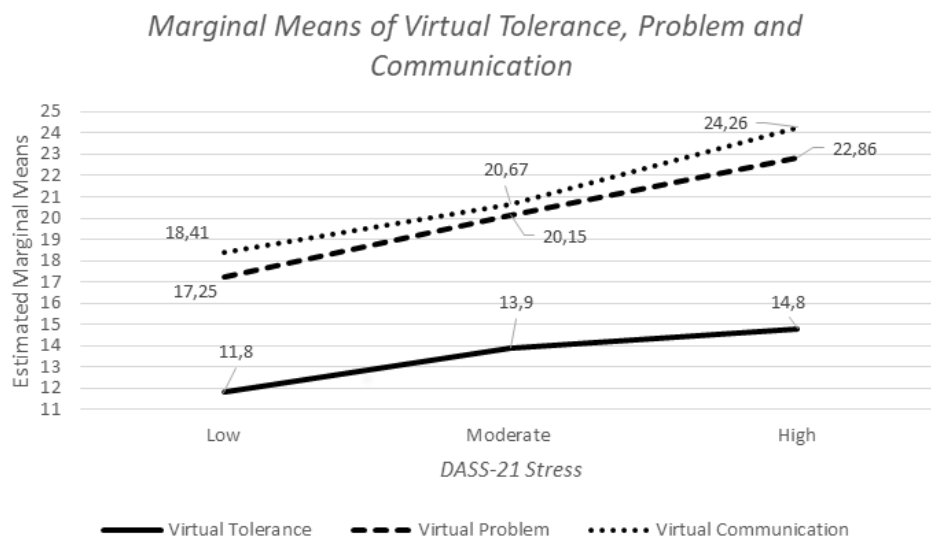
Note. Higher GAD severity is significantly associated with increased scores in social media addiction dimensions. GAD severity categories are based on standardized cutoffs: Minimal (0-4), Mild (5-9), Moderate (10-14), Severe (15-21).

Figure 1: Levels of Social Media Addiction (“Virtual Tolerance” and “Virtual Problem” subscales) by Generalized Anxiety Disorder severity (GAD-7).

Source: Own elaboration.

Also, the MANOVA results (Figure 2) showed significant effects of the DASS-21 subdimensions, namely of Stress (Figure 2) (Wilks' $\Lambda = 0.82$, $F = 3.99$, $p = .000$, $\eta^2 = .09$), of Anxiety (Figure

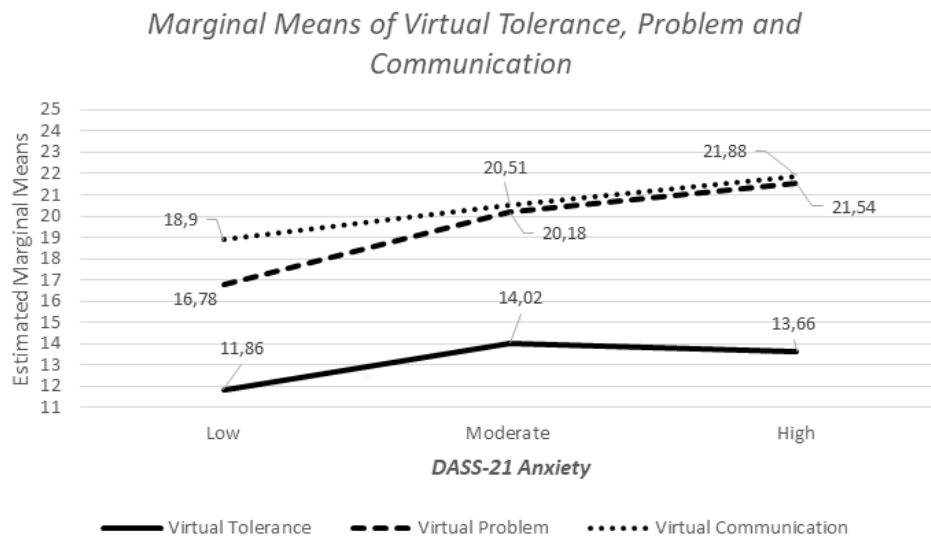
3) (Wilks' $\Lambda = 0.86$, $F = 3.13$, $p = .002$, $\eta^2 = .07$) and of Depression (Figure 4) (Wilks' $\Lambda = 0.86$, $F = 3.14$, $p = .002$, $\eta^2 = .07$) on Social Media Addiction, with a medium effect size.



Note. Higher stress levels correspond significantly to increased scores across all measured social media addiction subscales (Virtual Tolerance, Virtual Communication, Virtual Problem). Stress categories are classified as Low, Moderate, and High according to DASS-21 recommended cutoffs.

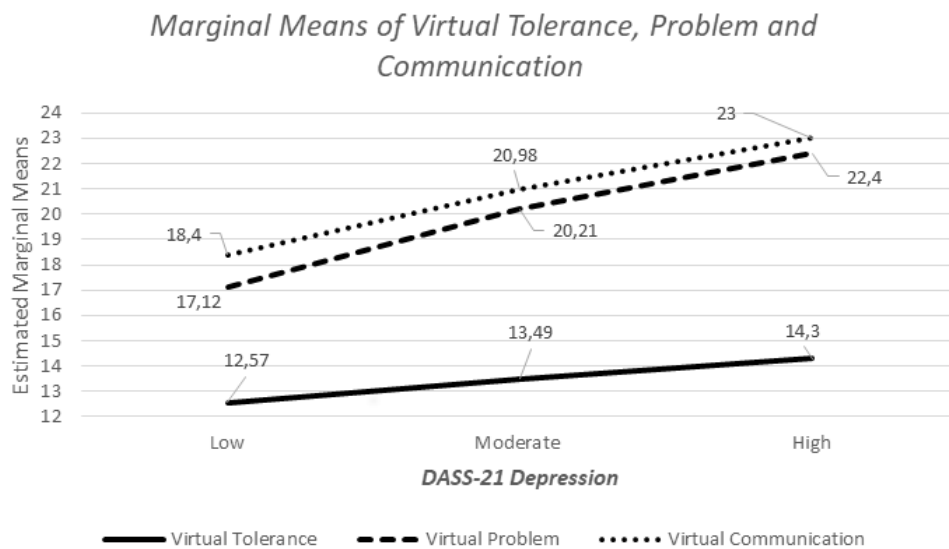
Figure 2: Levels of Social Media Addiction by Stress Severity (DASS-21 Stress subscale).

Source: Own elaboration.



Note. Elevated anxiety significantly predicts greater addiction to social media across all subscales. Anxiety severity is categorized into Low, Moderate, and High based on standardized DASS-21 clinical thresholds

Figure 3: Levels of Social Media Addiction by Anxiety Severity (DASS-21 Anxiety subscale)
Source: Own elaboration.



Note. Increased depression levels significantly relate to higher social media addiction scores. Depression categories (Low, Moderate, High) follow standard clinical cutoff points from the DASS-21.

Figure 4: Levels of Social Media Addiction by Depression Severity (DASS-21 Depression subscale).
Source: Own elaboration.

The results showed that higher levels of DASS-21 had a significant effect on Social Media Addiction behaviors. The stress, anxiety, and depression pairwise comparison, indicates that for

“Virtual Tolerance”, “Virtual Communication” and “Virtual Problem” the participants who experienced higher levels of stress, anxiety, and depression tended to be more social media addicted.

4. Discussion

The results of this study provide a better understanding of the relationship between internalizing problems— anxiety, stress, and depression—and social media addiction. The findings offer empirical support for the hypothesis that anxiety, stress, and depression, as measured by the Generalized Anxiety Disorder-7 (GAD-7) and Depression Anxiety Stress Scales-21 (DASS-21), significantly predict social media addiction, as assessed by the Social Media Addiction Scale – Short Form (SMAS-SF). Especially for the three subscales of SMAS-SF, Virtual Tolerance, Virtual Communication, and Virtual Problem. These results align with prior research suggesting that individuals with internalizing problems are more likely to engage in excessive social media use as a form of emotional regulation (Karakose et al., 2023; Kuss & Griffiths, 2017; Marino et al., 2018).

The study found that anxiety and stress, as measured by the GAD-7 and DASS-21, are linked to social media addiction. This finding supports earlier work by Vannucci et al. (2017) and Kircaburun and Griffiths (2018), which showed that individuals with high levels of anxiety are more likely to develop problematic social media usage patterns. A possible explanation for this relationship lies in the very nature of social media platforms. Individuals with anxiety and stress often experience heightened levels of Fear of Missing Out (FoMO) and social comparison, which drive them to frequently check their social media accounts and trends (Gupta & Sharma, 2021; Przybylski et al., 2013; Wegmann et al., 2017). In addition, all social media platforms may provide an environment where users can receive immediate feedback, validation, and support from peers, or serve as an escape from reality which may, at least temporarily, alleviate stress and anxiety symptoms (Elhai et al., 2017; Karakose et al., 2023; Keles et al., 2020; Kuss & Griffiths, 2017; Leménager et al., 2018; Hussain & Starcevic, 2020; O'Day & Heimberg, 2021; Shannon et al., 2022; White-Gosselin & Poulin, 2024).

As previously discussed, anxious or stressed individuals may find solace in social media as a means of avoiding real-world social interactions, which by many, can be perceived as overwhelming and out of their control. This avoidance of real-world social stimuli may further worsen their reliance on social media as a coping mechanism (Elhai et al., 2017; Keles et al., 2020). The compulsive needs to check social media and the emotional reliance on feedback from these platforms reinforce addictive behaviors, which may lead to social isolation, and a vicious cycle of increased anxiety and stress, leading to further addiction (Andreassen et al., 2017; Rahma & Setiasih, 2021; Keles et al., 2020).

It is also worth mentioning that some studies have found that social media aggravates existing anxiety and stress symptoms. For example, Escobar-Viera et al. (2018) suggest that individuals who already experience high levels of anxiety may become further distressed by negative or ambiguous social interactions on social media platforms, such as receiving fewer likes or negative comments, especially when using them passively. This can increase feelings of insecurity and worry, contributing to a vicious cycle where social media use both relieves and worsens anxiety and stress (Keles et al., 2020).

As the results suggest, depression as measured by the DASS-21 was found to be significantly linked to social media addiction, as expected. This finding is consistent with the literature, which suggests that individuals with depressive symptoms are more likely to use social media as a means of escapism and to seek social support (Bányai et al., 2017; Marino et al., 2018; Yaqoob, et al., 2024), similar feelings of anxiety and stress. Additionally, depressed individuals more often lack motivation to engage in face-to-face social interactions, and social media may be used as a less demanding and “relaxed” alternative for seeking social connection or self-validation. The so-called convenience of social media allows users to participate in social activities without

any of the physical and emotional effort required for in-person interactions, which may seem particularly appealing for those experiencing low mood, fatigue, and lack of motivation, symptoms usually associated with depression (Primack et al., 2017).

As for anxiety and stress, also for depression, social media use may evolve into a vicious cycle, where individuals, use social media to alleviate symptoms of depression and at the same time exacerbate these exact symptoms and feelings. One possible mechanism for the relationship between depression and social media addiction is the upward social comparison. Because, depressed individuals might be particularly vulnerable to comparing themselves with others on social media, where users often present idealized versions of their lives (Appel et al., 2016; Feinstein et al., 2013). Therefore, social media use guarantees constant exposure to these seemingly perfect portrayals, and that can lead to feelings of inadequacy and low self-worth, further worsening depressive symptoms and feelings (Appel et al., 2016; Feinstein et al., 2013; Lin et al., 2016). In such a manner, social media use may not only fail to reduce depressive symptoms but could also worsen them, resulting in greater reliance on social media platforms and the development of addictive behaviors (Andreassen et al., 2017; Brailovskaia, et al., 2020; Hussain, & Griffiths, 2021; Rahma & Setiasih, 2021; Kircaburun et al., 2020; Marino et al., 2018).

Another matter lies in the modern way that social media platforms perform to captivate users' attention, time, and use. Therefore, the algorithms used by social media platforms to tailor content to users' preferences, most likely contribute to the reinforcement of depressive thinking patterns (Tufekci, 2015). Thus, depressed individuals may be more likely to interact and draw in negative content, such as news about disasters, personal failures, or other distressing topics, which can further preserve and even amplify negative mood and ironically increase their probability of turning to social media for comfort (Appel et al., 2016; Feinstein et al., 2013; Lin et al., 2016; Stirnberg et al., 2024). This mechanism creates a feedback loop in which social media usage deteriorates depressive symptoms, leading individuals to use

social media platforms more frequently to escape from these negative emotions and amplify their negative way of thinking.

A key contribution of this study is that it identifies the distinct roles that anxiety and depression may play in social media addiction. While both are internalizing symptoms and were found to be significantly linked to social media addiction, it can be argued that they follow two different pathways. Individuals who experience anxiety may turn to social media to stay constantly connected to others, which can temporarily reduce their fears of missing out on important social information or events (Gupta & Sharma, 2021; Przybylski et al., 2013; Wegmann et al., 2017). Meanwhile, depression appears to contribute to social media addiction through different mechanisms, such as escapism and emotional avoidance. Depressed individuals may use social media to distract themselves from their negative emotions or to seek validation from others, which can short-term improve their depressive symptoms but ultimately reinforce addictive behaviors and worsen the symptoms (Andreassen et al., 2017; Brailovskaia, et al., 2020; Hussain, & Griffiths, 2021; Karakose et al., 2023; Kircaburun & Griffiths, 2019; Kuss & Griffiths, 2017; Lin, et al., 2016; Marino et al., 2018; Puukko et al., 2020). Therefore, while anxiety may drive more compulsive and frequent use of social media, depression may contribute to a longer-term pattern of reliance on these platforms for emotional support and mood regulation. However, ultimately, both anxious and depressed individuals seem to be developing a vicious cycle with social media use, that in the end reinforces both the social media addiction and the anxiety and depressive symptoms respectively (Keles et al., 2020).

This study has several limitations. First, the sample is small and data collection was conducted only in Athens (Greece), so the findings of this study should be generalized with caution to other cultures or countries. In this regard, the measurements were conducted in English and the participants use English as a second language, although all of them are university-level English speakers and can read and understand the statement of the items. Second, the range of age of

participants was small, and would be interesting to compare their results with wider age ranges that allow us to compare the process of internalizing problems from younger and older age groups. It also could be improved using longitudinal data instead of cross-sectional one. Third, the students that participated, were from a private university with mainly medium-high socioeconomic status, thus certain socioeconomic groups might be excluded from participating. Fourth the results may be affected by social desirability, for the self-reports of both internalizing problems and social media addiction. Finally, the role that culture, beliefs, and attitudes play in internalizing problems should be considered. Interpretation of internalizing behavior could be different from an adult or an adolescent perspective. For example, in that context, studies on social media use show that many young people even justify the abuse as a common everyday practice, normalizing the possible addiction as part of adolescent social life, which is blurring the lines between the perceived healthy social engagement and problematic addicted usage for the users (Karakose et al., 2023; Kuss & Griffiths, 2017).

Despite its limitations, the present study sheds light on the roles of anxiety stress, and depression in social media addiction. The results highlight the importance of understanding the motivations behind excessive social media use and suggest that individuals with internalizing problems may be particularly vulnerable to developing addictive behaviors. The implications of these findings are far-reaching. The findings can be used to strengthen the current scientific knowledge in the area of mental health and social media and to better understand the underlying mechanism of the vast array of behaviors, symptoms, and conditions that are connected and may lead to social media addiction and mental health problems. The results of the study may also be used in clinical interventions on adolescents and young adults, to form educational programs and interventions to improve both their academic achievement as well as their personal and social life. Also, these findings may contribute to the design of prevention programs for different disorders or behavioral problems. Particularly, clinicians working with individuals suffering from anxiety, stress, and depression should be

aware of the potential for social media addiction to develop as a maladaptive coping mechanism. Hence, integrating assessments of social media use into clinical practice could help identify those at risk and guide interventions aimed at promoting healthier digital habits. Moreover, the development of psychoeducational programs targeting FoMO and upward social comparison may help reduce the reliance on social media among individuals with internalizing symptoms. From a practical standpoint, the current findings underscore significant implications for mental health professionals, educators, and policymakers involved with young adults. Recognizing that internalizing symptoms such as anxiety, depression, and stress substantially increase vulnerability to social media addiction, targeted interventions could significantly benefit this population. Specifically, integrating strategies aimed at enhancing emotional regulation skills, mindfulness-based interventions, and cognitive-behavioral techniques within educational and clinical settings may serve to mitigate the excessive reliance on social media as a maladaptive coping mechanism. Additionally, psychoeducational campaigns highlighting the negative impacts of compulsive social media use, coupled with programs designed to improve resilience, could help individuals manage their emotional states effectively, thereby reducing their susceptibility to developing problematic social media behaviors

This study employed convenience sampling among university students, predominantly of medium-high socioeconomic status within a specific geographic area (Athens, Greece). Consequently, caution must be exercised in generalizing these findings broadly to diverse populations or cultures. Future research would benefit significantly from employing more representative sampling methods, such as stratified or random sampling, across varied demographic groups, socioeconomic statuses, and cultural contexts. Additionally, broader age ranges and longitudinal designs could offer valuable insights into how the relationship between internalizing symptoms and social media addiction evolves over time, potentially identifying critical developmental periods for targeted intervention.

As the world becomes increasingly digital, understanding the psychological underpinnings of social media addiction will become ever more critical. This study provides a foundation for future research into the emotional and cognitive processes that drive social media addiction and offers valuable insights into the development of

interventions aimed at mitigating the negative mental health effects of excessive social media use. By further exploring the interplay between internalizing problems and social media addiction, researchers and clinicians can better support individuals in navigating the challenges of the digital age while safeguarding their mental health.

5. Conclusions

As the digital landscape continues to expand, understanding the psychological mechanisms underlying social media addiction has become increasingly important. This study provides empirical evidence of significant associations between internalizing symptoms—specifically anxiety, stress, and depression—and social media addiction among young adults. The findings clearly highlight the need to address emotional difficulties through targeted preventive interventions and therapeutic strategies designed to enhance emotional regulation and resilience. However, due to the study's reliance on self-report measures, subjective biases may have influenced results, highlighting the value of integrating objective measurements, such as tracking actual social media usage or employing physiological indicators, in future research. Additionally, while this study clarifies a robust relationship between internalizing symptoms and social media addiction, longitudinal research is essential to establish causality and directionality.

Future investigations should also explore the role of personality traits and demographic variables, further refining intervention strategies.

Ethical Approval

All procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Besides, the Research Ethics Board of the National University of Distance Education (UNED) authorized this research (Reference: 01-SEC-PSI-2023). This article does not contain any studies with animals performed by any of the authors.

Informed Consent

Informed consent was obtained from all individuals who participated in the study.

6. Acknowledgments

The authors wish to thank all participants for their willingness to take part in the study and for their collaboration.

7. Additional information

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Medidas efectivas para adaptar los hoteles a futuras crisis sanitarias

Effective measures to adapt hotels to future health crises

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Effective measures to adapt hotels to future health crises

Medidas efectivas para adaptar los hoteles a futuras crisis sanitarias

Resumen

La pandemia de COVID-19 impactó profundamente al sector de alojamiento turístico, condicionado por la reducción de la movilidad y el cierre de fronteras. Los hoteles se adaptaron para cumplir con las directrices sanitarias. Este estudio, analiza las diferencias en las percepciones de turistas y gerentes sobre las medidas adoptadas, a partir de una encuesta a 521 turistas y 14 gerentes de hoteles en Córdoba, España. Utilizando un contraste de medias y una prueba de Mann-Whitney, se identifican discrepancias significativas cuando las medidas consideradas son menos críticas para ambos grupos. Existe consenso en cuanto a los protocolos de limpieza, pero las medidas tecnológicas muestran opiniones divergentes. Estos hallazgos proporcionan información útil para los profesionales del sector, permitiéndoles priorizar inversiones para garantizar la seguridad de los clientes, mejorar la preparación ante futuras pandemias y alinearse mejor con las expectativas de los clientes durante las crisis.

Palabras clave: control de riesgos sanitarios, consumidores, gerentes, grupos de interés, crisis

Abstract

The COVID-19 pandemic has deeply affected the tourism accommodation sector, reducing mobility and closing international borders. Hotels have adapted by implementing sanitary measures to meet mandated guidelines, addressing growing health security concerns. This study, based on Stakeholder Theory, analyzes differences in perceptions of COVID-19 measures between 521 tourists and 14 hotel managers in Córdoba, Spain. Using a contrast of means and a Mann-Whitney test, it identifies significant disparities in the importance assigned to these measures, particularly when both groups view them as less critical. There is consensus on the value of cleanliness protocols, but technology-related measures reveal contrasting opinions. These findings provide practical insights for industry professionals guiding prioritization of investments that enhance preparedness for future pandemics, enabling hotels to better align with customer expectations and foster trust during crises.

Keywords: health risk control, consumers, managers, stakeholders, crisis

1. Introducción

Aunque varias epidemias ya habían afectado al turismo en determinadas zonas del mundo durante el siglo XXI, ninguna había causado efectos tan devastadores como la aparición del SRAS-CoV-2 a principios de 2020. La reciente crisis sanitaria ha alterado los comportamientos de las personas y ha generado una mayor preocupación por la seguridad, sobre todo en lo que respecta a la seguridad sanitaria. La sociedad y los gobiernos han tomado conciencia de la necesidad de establecer medidas para prevenir y controlar la propagación de enfermedades. Las recomendaciones para prevenir la transmisión del COVID-19 incluyen mantener una distancia de seguridad, usar mascarillas, lavarse las manos con frecuencia y desinfectar los espacios compartidos, entre otras medidas.

La aparición del SRAS-CoV-2 ha afectado gravemente al sector turístico. Las restricciones a la movilidad, el cierre de fronteras y el aislamiento geográfico provocaron un descenso sin precedentes de los viajes. Las llegadas de turistas internacionales a nivel mundial cayeron un 73% en 2020 (OMT, 2021), mientras que en España el descenso fue aún mayor, con una disminución del 80,7% en el número de turistas (INE, 2021). El turismo, que contribuye en más de un 12% al Producto Interior Bruto (PIB) español, sufrió pérdidas significativas. Los alojamientos hoteleros experimentaron un descenso medio mensual del 82% en pernoctaciones, en contraste con el crecimiento del 1,5% registrado antes de la pandemia.

Más allá del impacto económico, el sector tuvo que aplicar amplias medidas sanitarias para garantizar la seguridad de los viajes. Las autoridades impusieron normas como el distanciamiento social, el uso obligatorio de mascarillas, la higiene de las manos y la desinfección de los espacios compartidos (ICTE, 2020).

La industria hotelera respondió con cierres temporales, inversiones en adaptaciones sanitarias

y diversificación de sus servicios. Algunos hoteles readaptaron sus espacios para alojar a teletrabajadores o colaboraron con las autoridades para acoger a empleados sanitarios y personas que necesitaban aislamiento (Hoang et al., 2021). En España, los acuerdos gubernamentales facilitaron el uso de alojamientos hoteleros para trabajadores esenciales (HOSTELTUR, 2020). Los hoteles no estaban preparados para una crisis de este tipo, y la aplicación urgente de medidas durante la pandemia de COVID-19 no permitió una evaluación previa de su impacto en la percepción de seguridad de los clientes o los directivos.

Esta revisión bibliográfica pone de manifiesto la falta de estudios que analicen las diferencias entre los gestores hoteleros y los clientes en cuanto a la importancia de las medidas para prevenir el contagio y garantizar una estancia segura. El objetivo de este estudio es colmar esta laguna, aportando información valiosa para los profesionales del sector mediante la identificación de medidas que puedan mejorar la percepción de seguridad de los clientes y aumentar la ocupación. Utilizando la Teoría de las Partes Interesadas (Freeman, 1994), la investigación pretende explorar las diferencias y similitudes entre las perspectivas de los clientes y los gestores.

Es esencial determinar si existen diferencias. Si existen, los gestores podrán desarrollar estrategias operativas y de marketing más eficaces. Con este objetivo, se plantean las siguientes preguntas:

RQ1: En relación con las medidas aplicadas en los hoteles para hacer frente a la COVID-19, ¿existen diferencias entre clientes y gestores en su percepción de la importancia de estas medidas?

Durante la pandemia de COVID-19, las autoridades instruyeron a los establecimientos hoteleros sobre las medidas que debían aplicar para prevenir la transmisión del virus. Estas medidas estaban relacionadas principalmente con la limpieza, la higiene y el mantenimiento de una

distancia de seguridad entre clientes y empleados (Del Chiappa et al., 2022). Además, los hoteles han introducido algunas medidas relacionadas con el uso de la tecnología, también destinadas a minimizar el contacto entre clientes y empleados. Considerando las características de estas medidas, se propone también la siguiente pregunta:

RQ2: Considerando que las medidas pueden agruparse en asegurar el distanciamiento social, promover la limpieza y utilizar la tecnología, ¿existen diferencias entre clientes y gestores en la importancia que atribuyen a estas tres dimensiones?

Comprender las disparidades entre gestores y clientes sobre la importancia percibida de las

medidas aplicadas para evitar el contagio puede orientar decisiones de inversión eficaces y, en última instancia, mejorar la satisfacción, la fidelidad y la rentabilidad de los clientes. Cuando los intereses de directivos y clientes coinciden, la satisfacción general del cliente se ve afectada positivamente, lo que se traduce en un aumento de la lealtad y la rentabilidad (Kwok & Huang, 2019). Por lo tanto, comprender las diferencias en la importancia percibida de las medidas proporciona información valiosa para tomar decisiones de inversión y garantizar el éxito del establecimiento.

2. Revisión de la literatura

Como enfermedad altamente infecciosa que puede propagarse rápidamente entre los seres humanos, la pandemia desencadena un intenso miedo y pánico entre el público. Ni el sector turístico ni los gobiernos estaban preparados para una crisis de la magnitud de la pandemia de COVID-19.

Al principio de la pandemia, la investigación se centró en el efecto de las medidas de control de la infección, como la distancia física, el aislamiento y el rastreo de contactos (Kucharski et al., 2020; Chang et al., 2021; Hsiang et al., 2020). A medida que avanzaba la pandemia, los estudios se centraron en analizar sus efectos en el sector turístico y las estrategias que las empresas debían aplicar para recuperarse y fortalecer su negocio tras la crisis (Garrido-Moreno et al., 2021; Su, 2022). Dadas las frecuentes epidemias causadas por virus respiratorios en este siglo -SARS (2002), gripe A (H1N1) (2009), MERS (2012) y SARS-CoV-2 (2019)-, es esencial estar preparados para futuros brotes con el fin de mitigar sus efectos en el sector y mantener la ocupación hotelera.

Zhang y Lu (2022) ofrecen estrategias recomendadas para gestionar la crisis sanitaria, mientras que Garrido-Moreno et al. (2021)

analizan la opinión de los gestores sobre las medidas necesarias para la recuperación de la actividad tras el COVID-19. Davras & Durgun (2022) examinan la satisfacción e insatisfacción de los clientes con las medidas aplicadas en los hoteles en respuesta a la COVID-19.

Los directivos, en particular los de PYME, no suelen considerar la preparación ante las crisis un elemento esencial de su negocio (Mikušová & Horváthová, 2022). Sin embargo, la literatura sobre gestión de crisis destaca la importancia de contar con un plan para gestionar este tipo de situaciones (Ritchie & Jiang, 2019; Fink y American Management Association, 1986; Hidalgo et al., 2022).

Desde finales del siglo XX, las empresas operan en un entorno cada vez más dinámico e inestable, lo que les obliga a adaptarse a los cambios que afectan a sus actividades y relaciones con grupos externos. La Teoría de los Stakeholders pretende conciliar los intereses de todas las partes interesadas, definidas como “grupos e individuos que pueden influir o son influidos por los objetivos de una organización” (Freeman, 1994,

p. 25). Con esta definición, Freeman se aleja del concepto tradicional de beneficios e introduce la idea de grupos que pueden verse afectados por las actividades de la empresa, aunque no estén directamente implicados.

En el sector turístico, varios autores han explorado la gestión de destinos y establecimientos turísticos, considerando los intereses de los distintos agentes implicados en la oferta turística y destacando el valor que aportan (Stewart & Cole, 2017; Yang & Wall, 2009; Douglas & Lubbe, 2006). Currie et al. (2009) amplían el análisis de la viabilidad de los proyectos incorporando los intereses de terceros, junto a los de los gestores. Sus conclusiones sugieren que el análisis sistemático de las partes interesadas resulta beneficioso y valioso en el contexto de las evaluaciones de viabilidad.

Concretamente, en el sector del alojamiento turístico, Chang y Lam (2013) examinan la divergencia entre las opiniones de los huéspedes y las perspectivas de los gestores de seguridad sobre las instalaciones de seguridad de los hoteles, un factor crucial en la selección de hoteles. Wang et al. (2014) centran su investigación en la identificación de los factores que influyen en la formación de la confianza entre las partes interesadas en los establecimientos hoteleros.

La decisión de viajar implica incertidumbre, ya que a menudo requiere visitar lugares desconocidos (Yang et al., 2017). La percepción del riesgo y el turismo están estrechamente vinculados, influyendo en el comportamiento de los turistas, especialmente en los viajes posteriores a catástrofes (Cró & Martins, 2017; Floyd et al., 2004; Zheng et al., 2021). Factores como la motivación, la preocupación por la seguridad y el riesgo percibido desempeñan un papel crucial en la toma de decisiones sobre viajes (Rittichainuwat, 2008).

Un alto nivel de riesgo percibido reduce la satisfacción del viajero e influye negativamente en la probabilidad de repetir la visita (Hasan et al., 2017). Así pues, comprender el riesgo percibido es esencial para mantener la demanda turística. Diversos investigadores han explorado el riesgo en el turismo (Sheng-Hsiung et al., 1997; Fuchs & Reichel, 2011), mostrando cómo los riesgos percibidos influyen en las actitudes, decisiones y comportamientos, incluso cuando los riesgos reales son mínimos (Reichel et al., 2007). Andreu et al. (2020) definen el riesgo percibido como la valoración que hace un viajero de un peligro potencial que supera su umbral aceptable, lo que puede influir en su elección de destino más que las condiciones reales.

Valencia y Crouch (2008) señalan una relación inversa entre la confianza del consumidor y su influencia en la decisión de visitar un destino. Afirman que los consumidores rechazarían viajar a la zona en caso de que se produjeran casos de SRAS, y este rechazo es incluso mayor que el provocado por un acto terrorista. Sin embargo, el estudio confirma que la confianza de los consumidores modera este efecto negativo. Esta decisión de viajar se asocia, entre otros factores, al alto riesgo de contraer un virus (como el SRAS o el VIH) o una enfermedad peligrosa (como la malaria, el cólera o el dengue), así como a las posibles dificultades para acceder a la asistencia sanitaria en el destino (Andreu et al., 2020).

Identificar las medidas que los turistas valoran para reducir el riesgo de contraer la enfermedad permite conocer los factores que influyen en su intención de viajar y elegir alojamientos específicos. Esta información podría ayudar al sector a introducir mejoras en los establecimientos que respondan a los intereses de todas las partes interesadas, contribuyendo así a la recuperación de la demanda.

3. Metodología

Para recabar las valoraciones de clientes y gestores sobre las medidas de seguridad sanitaria, se administraron dos cuestionarios en enero

de 2021. Los cuestionarios se centraron en las medidas que podrían aplicarse en los hoteles para hacer frente a la reciente pandemia. El primer

cuestionario iba dirigido a clientes de hoteles mayores de 18 años residentes en España que se hubieran alojado en un establecimiento hotelero en los últimos dos años. El segundo cuestionario iba dirigido a los directores de establecimientos hoteleros en España.

Se desarrolló un conjunto inicial de 40 medidas basado en estudios previos relevantes para el objetivo del estudio (Gursoy et al., 2021; Yu et al., 2021) y considerando las características de los establecimientos junto con las especificidades de la epidemia en España.

Posteriormente, se reunió un panel de expertos compuesto por dos directores de hotel y dos clientes que se habían alojado en estos establecimientos durante la pandemia de COVID-19. Mediante deliberación entre los expertos, la lista se condensó en 28 ítems, que fueron los utilizados en este estudio (Tabla 2).

A continuación se pidió a los participantes que evaluaran la importancia de estas medidas utilizando una escala Likert de 5 puntos, en la que 1 representaba “nada importante” y 5 indicaba “muy importante”. Se realizó una prueba previa en la que participaron 30 clientes potenciales del hotel para perfeccionar y diseñar adecuadamente las preguntas.

El cuestionario dirigido a los clientes se administró en línea. Este método facilitó la recogida de datos, sobre todo teniendo en cuenta el contexto

pandémico en el que se llevó a cabo, y tuvo un coste menor (Jennings, 2001). Dada la crisis sanitaria nacional e internacional, las restricciones de movilidad y los cierres recurrentes, se empleó un muestreo de conveniencia. El muestreo por conveniencia es el tipo de muestreo no probabilístico más utilizado entre los científicos sociales. En un estudio de Clark (2017) sobre el tipo de muestreo no probabilístico empleado en 1.812 estudios, el muestreo por conveniencia se utilizó en el 70% de ellos, una frecuencia muy superior a la de otros métodos no probabilísticos.

En concreto, el cuestionario se distribuyó a través de foros de viajes y redes sociales en enero de 2021. En ese momento, acababa de iniciarse el proceso de vacunación contra el COVID-19 en España, se estaba produciendo una tercera oleada de infecciones a nivel nacional y había surgido una nueva variante del virus, conocida como Alpha o B.1.1.7, en el Reino Unido. Finalmente, se recogieron 568 cuestionarios y, tras un proceso de depuración de datos, se consideraron válidos 521, que es la muestra en la que se basa este estudio.

En términos de representatividad, era necesario un tamaño de muestra de al menos 385 para alcanzar un nivel de confianza del 95% y un error de muestreo del 5% ($p=0,50$ y $q=0,50$). Los 521 cuestionarios de clientes válidos permiten considerar exactos los resultados de la encuesta, con un error de muestreo del 4,29% y un nivel de confianza del 95% (Cuadro 1).

Tabla 1: Descripción de la muestra de clientes Descripción de la muestra de clientes

Fuente: Elaboración propia

Population	Population: Potential hotel customers residing in Spain, over 18 years old, who have stayed in a hotel in the last 2 years.
Sample	521
Confidence level	95.0%; $p = q = 0.5$
Sampling error	± 4.29
Procedure	Convenience sampling
Research period	1st week January. 2020

Simultáneamente, contactamos con 14 directores de hoteles de la ciudad de Córdoba, el 70% de los cuales supervisaba un establecimiento de tres estrellas o superior. En Córdoba, los hoteles de

estas categorías representan el 49% del total de establecimientos y suponen el 77% de la oferta de camas disponibles (Junta de Andalucía, 2022). La comparación de sus opiniones con las de los

clientes encuestados resulta adecuada, dado que el 64% de los clientes declararon haberse alojado en hoteles de esta categoría.

Se realizó un análisis de comparación de medias para identificar las medidas con mayores discrepancias en importancia percibida entre clientes y gestores. Se aplicó la prueba de Mann-Whitney para detectar diferencias significativas en las distribuciones de las respuestas de los dos

grupos de interés. Esta prueba es una alternativa no paramétrica a la prueba t para muestras independientes (Ruxton, 2006) y se recomienda para muestras de pequeño tamaño, como las de este estudio.

Para categorizar las medidas en dimensiones según sus objetivos previstos, se realizó un Análisis Factorial Confirmatorio (AFC) para evaluar la fiabilidad de la agrupación.

4. Resultados

En cuanto a las características sociodemográficas de la muestra, cabe destacar que la distribución entre hombres y mujeres está equilibrada. La mayoría de los encuestados reside en Andalucía (83%), tiene más de 35 años (83%), posee estudios superiores (82%) y gana más de 1.500 euros al mes (64%). En cuanto a sus hábitos de viaje, el 56% de los encuestados viaja más de una vez al año, principalmente por motivos de ocio (94%), aunque el 35% también viaja por trabajo.

El 37% de los encuestados indicó que sólo viajaría cuando hubiera cierta seguridad de que las infecciones están bajo control, y el 36% declaró que pertenece o podría pertenecer a un grupo de riesgo. Estos resultados confirman la importancia que tienen para los huéspedes las medidas que garantizan su seguridad en los alojamientos.

Pasando a las características demográficas de la muestra de directores utilizada, todos supervisan establecimientos en Andalucía, y la mayoría son hombres (78,6%). El 71,4% de los encuestados tiene entre 35 y 49 años, mientras que el resto se sitúa en la franja de edad de 50 a 69 años. Además, el 78,6% de los encuestados tiene estudios universitarios o superiores.

4.1. Importancia media de las medidas

Para comparar la importancia asignada por los clientes y los directivos a las medidas destinadas a

aumentar la seguridad de la estancia en los hoteles, se comparan las medias observadas en cada grupo. Ambos grupos consideran importantes las medidas, siendo los clientes los que les asignan una valoración ligeramente superior -una media de 4,04 (en una escala de 1 a 5)-, lo que supone 0,18 puntos más que la valoración media de los gestores, que es de 3,86. Por término medio, los clientes valoran más de 18 de las medidas y les asignan con mayor frecuencia la puntuación máxima. En 20 de los ítems, la moda es 5 para los clientes, mientras que en el grupo de directivos esto ocurre en 13 ítems (Tabla 2).

Cabe destacar que la medida z_Robots de servicio es la menos valorada por ambos grupos. Los directivos le asignan una valoración media de importancia de sólo 2,21. En consecuencia, su implantación no mejoraría significativamente la seguridad percibida del establecimiento, como sugieren estudios anteriores (Chiang & Trimi, 2020). Por lo tanto, es una medida que puede aplazarse, evitando así gastos sustanciales en una medida no probada en esta fase.

En general, las medidas analizadas tienen mayor importancia para los clientes, y a medida que aumenta la importancia asignada por ambos grupos, disminuye la disparidad en sus evaluaciones (Figura 1).

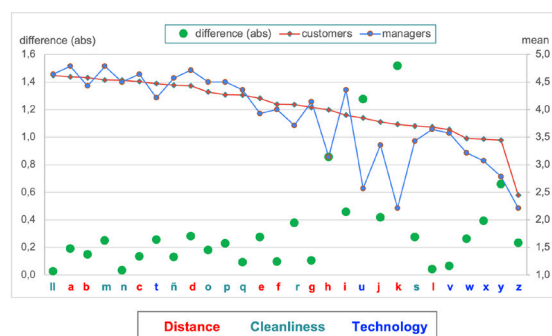


Figure 1: Average Importance ranked by Customer Rating.

Source: Own elaboration.

Customers				
	rk	mean	SD	mode
Average DISTANCE	4.13			
a Employees always wear masks.	2	4.60	0.90	5
b Separate tables and seating in common areas, restaurants, bars	3	4.58	0.86	5
c Employees are aware of health and safety protocols.	6	4.051	0.91	5
d Promote the use of masks by clients	9	4.43	1.02	5
e Limits on the number of clients served	13	4.20	1.00	5
f Temperature checks of employees upon arrival at work	14	4.10	1.19	5
g Employees to maintain a minimum distance from their coworkers	16	4.04	1.06	5
h Monthly Covid-19 screening of employees	17	4.00	1.16	5
i Methacrylate protection screen on countertop	18	3.90	1.04	4
Temperature control for customers at the entrance	20	3.78	1.25	5
k Keep the rooms empty one night after the client's departure	21	3.73	1.24	5
l Signage on the ground to remind of minimum physical distance	23	3.69	1.09	4
Average CLEANLINESS	4.31			
ll More rigorous and frequent cleaning of surfaces in common areas	1	4.62	0.85	5
m Employees are meticulous in washing and disinfecting hands.	4	4.54	0.91	5
n Clean the restaurant facilities (tables and chairs) with disinfectants.	5	4.53	0.86	5
ñ Sufficient cleaning and disinfection in the rooms	8	4.44	0.95	5
o Cleaning with disinfectants of staff work areas (desks and tables)	10	4.32	0.98	5
p Cleaning with disinfectants of work equipment	11	4.27	0.99	5
q Hand sanitizer stations throughout the facility	12	4.26	1.04	5
r Periodic management by professional hygiene companies	15	4.09	1.07	5
s Optional daily maid service: no cleaning if towels outside the door	22	3.70	1.15	4
Average TECHNOLOGY	3.54			
t Heating, ventilation, air conditioning system, air quality controls	7	4.47	0.92	5
u Rooms equipped with special air purifiers	19	3.85	1.15	5
v Contactless payment, mobile application, or contactless bank cards	24	3.64	1.20	4
w Non-contact elevator use	25	3.48	1.15	4
x Auto check-in and auto check-out	26	3.46	1.23	4
y Keyless entry or digital room keys	27	3.45	1.19	4
z Service robots	28	2.45	1.14	3
Total average		4.04	1.05	

rk= Clasificación; SD= Desviación estándar

Sig.* Existen diferencias en la distribución de las variables para ambos grupos de interés a un nivel de significación de 0,10. Se rechaza.

Table 2. Health measures. Comparison of average importance of the evaluation given by Clients and Managers
Source: Own

Managers				Mann-Whitney U test		Reliability
rk	mean	SD	mode	Mean difference	Sig.	Cronbach's alpha
3.95				0.18		0.94
1	4.79	0.43	5	-0.19	0.76	
10	4.43	0.51	4	0.15	0.04*	
4	4.64	0.63	5	-0.13	0.80	
3	4.71	0.47	5	-0.28	0.61	
16	3.93	1.00	4	0.27	0.19	
15	4.00	1.24	5	0.10	0.65	
14	4.14	0.86	4	-0.10	0.92	
23	3.14	1.29	3	0.86	0.01*	
11	4.36	0.93	5	-0.46	0.07*	
21	3.36	1.34	5	0.42	0.21	
27	2.21	1.05	2	1.52	0.00*	
18	3.64	1.55	5	0.04	0.70	
4.33				-0.02		0.94
5	4.64	0.50	5	-0.02	0.43	
2	4.49	0.43	5	-0.25	0.47	
7	4.50	0.51	4	0.03	0.26	
6	4.57	0.51	5	-0.13	0.83	
8	4.50	0.52	5	-0.18	0.96	
9	4.50	0.52	5	-0.23	0.075	
12	4.36	0.50	4	-0.09	0.48	
17	3.71	1.38	4	0.38	0.28	
20	3.43	1.22	3	0.28	0.36	
3.09				0.45		0.89
13	4.21	4.21	4	0.26	0.04*	
26	2.57	2.57	2	1.28	0.00*	
19	3.57	3.57	3	0.07	0.79	
22	3.21	3.21	4	0.26	0.60	
24	3.07	3.07	5	0.39	0.40	
25	2.79	2.79	3	0.66	0.04*	
28	2.21	2.21	2	0.23	0.47	
3.86		0.92		0.18		

za la hipótesis nula

4.2. Diferencias relevantes entre las valoraciones de clientes y directivos

Para abordar la RQ1, se realizó una prueba de Mann-Whitney para la comparación de medias con un intervalo de confianza del 90%. Los resultados revelaron diferencias significativas entre los dos grupos para varias variables (valor $p < 0,10$), lo que indica disparidades en las distribuciones de la muestra y conduce al rechazo de la hipótesis nula (Figura 2).

La medida con mayor disparidad en las valoraciones medias entre los dos grupos es *k_Mantener las habitaciones vacías durante al menos una noche después de la salida del huésped*. Es evidente la falta de asociación entre las dos distribuciones (valor $p = 0,00$). Aunque no figura entre las medidas más valoradas por los clientes (puntuación media de 3,73), es la que menos importancia tiene para los directivos (2,21), lo que arroja una diferencia sustancial de 1,52.

La segunda diferencia más importante se observa en la medida *u_Habitaciones equipadas con purificadores de aire* (p -valor = 0,00), a la que los clientes atribuyen una importancia media de 3,85, mientras que los directivos la valoran con 2,79.

También se identificaron diferencias significativas en las distribuciones de las siguientes medidas: *h_Prueba mensual de COVID-19 para los empleados*, *b_Mesas y asientos separados en zonas comunes, restaurantes y bares*, *t_Sistema de calefacción, ventilación y aire acondicionado* y *control de la calidad del aire*, y *Entrada sin*

llave o llaves digitales para las habitaciones, e *i_Pantalla de protección de metacrilato en la recepción*.

En cuanto a las medidas *b* y *t*, los gestores deben tener en cuenta la gran importancia atribuida por los clientes a estas medidas (valoraciones medias de 4,58 y 4,47, respectivamente). Su aplicación puede contribuir a mejorar la percepción de seguridad e influir potencialmente en la selección de alojamientos por parte de los clientes.

Destaca la medida *i_Pantalla de protección de metacrilato en la recepción* como la única valorada como más importante por los gestores, con una puntuación de 4,36 frente al 3,90 de los clientes. Esta medida se alinea con las directrices y recomendaciones emitidas por la Secretaría de Estado de Turismo (ICTE, 2020) y tiene como objetivo específico proteger a los empleados, lo que explica la mayor preocupación de los gestores.

4.3. Diferencias de valoración agrupadas por dimensiones.

Las 28 medidas fueron categorizadas en función de su relevancia para mantener el distanciamiento social (Distancia), garantizar la limpieza de las instalaciones y la higiene personal (Limpieza) o utilizar la tecnología para implementar protocolos de seguridad (Tecnología).

La validez de estas agrupaciones se evaluó mediante el Análisis Factorial Confirmatorio (AFC), y su consistencia interna, mediante el alfa de Cronbach. Los resultados superaron 0,7 para todas las categorías, confirmando la idoneidad de las agrupaciones e indicando una consistencia interna relativamente alta entre los ítems (valor propio > 1). La Tabla 2 presenta las medidas incluidas en cada categoría junto con sus correspondientes valores de alfa de Cronbach.

Las medidas relacionadas con la Limpieza fueron consideradas las más importantes, recibiendo valoraciones medias similares por parte de los clientes (4,31) y de los directivos (4,33) (Figura 3). No se observaron diferencias significativas en la distribución de las respuestas entre los dos grupos para ninguna de las medidas de esta categoría, ya que todos los valores p superaban 0,10.

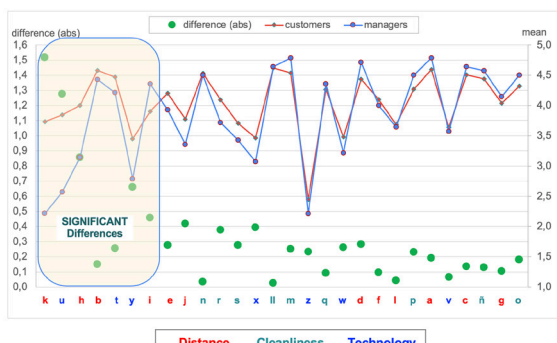


Figura 2: Diferencias significativas

Ordenadas por valor p (Mann-Whitney ascendente)

Fuente: Elaboración propia

Las medidas asociadas a la Distancia también fueron consideradas importantes por ambos grupos, aunque los clientes les asignaron una importancia ligeramente superior, con una puntuación media de 4,13, 0,18 puntos por encima de las puntuaciones de los directivos (Figura 3).

Se detectaron diferencias significativas en cuatro medidas de esta categoría. Una de ellas, *k_Mantener las habitaciones libres al menos una noche después de la salida del cliente*, no sólo mostró diferencias significativas en la distribución de las respuestas (valor $p = 0,000$), sino también la mayor discrepancia en las puntuaciones medias de importancia entre clientes y directivos (1,52 puntos). Esta medida fue una de las menos valoradas por los directivos, con una puntuación media de 2,21 puntos.

Además, otras tres medidas dentro de esta categoría mostraron diferencias significativas: *i_Pantalla de protección de metacrilato en la recepción*, *b_Separación de mesas y asientos en zonas comunes, restaurantes y bares*, y *h_Prueba mensual de COVID-19 para los empleados*. En cuanto a esta última, la limitada disponibilidad y el elevado coste de las pruebas diagnósticas en el momento de la encuesta (enero de 2021) pueden haber contribuido a la reticencia de los gestores a dar prioridad a esta medida, lo que se tradujo en una calificación más baja (ocupando el puesto 23 de las 28 medidas en la evaluación de los gestores).

Las mayores discrepancias en las valoraciones de importancia se observaron en las medidas relacionadas con el uso de la tecnología, que, de media, fueron las menos valoradas por ambos grupos. Estos resultados concuerdan con investigaciones anteriores (Garrido-Moreno et al., 2021). Sin embargo, debido a su papel a la hora de facilitar el distanciamiento social, los hoteles han incorporado cada vez más modelos de servicio basados en las tecnologías de la información y la comunicación (TIC) durante la pandemia (Su, 2022).

Dentro de esta categoría, tres medidas mostraron diferencias significativas en la distribución de respuestas entre los dos grupos. Una de las más notables fue *u_Habitaciones equipadas con*

purificadores de aire, que mostró una discrepancia sustancial en las valoraciones medias de importancia (1,28 puntos). Los directivos asignaron a esta medida una puntuación media de sólo 2,57, situándola en el puesto 26. Además, se observaron diferencias significativas en las distribuciones de *y_Entrada sin llave o llaves digitales para las habitaciones* y *t_Calefacción, ventilación, sistema de aire acondicionado y controles de calidad del aire*. La primera de estas medidas (*y*) no sólo presentaba diferencias en la distribución de las respuestas, sino que también fue calificada como relativamente poco importante por ambos grupos, ocupando el puesto 27 entre los clientes y el 25 entre los gestores.

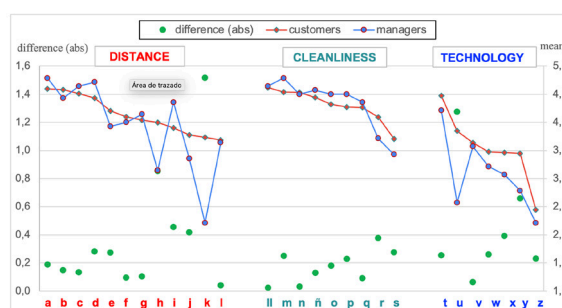


Figura 3: Importancia media. Clasificación por dimensiones

Fuente: Elaboración propia

En cuanto a la RQ2, que examina las diferencias en la importancia atribuida por clientes y gestores a las medidas que garantizan el distanciamiento social, la promoción de la limpieza y la incorporación de tecnología, se pueden destacar las siguientes conclusiones:

Las medidas relacionadas con la LIMPIEZA de las instalaciones son consideradas las más importantes tanto por los clientes como por los gestores. Además, existe un alto nivel de acuerdo entre ambos grupos, sin que se observen diferencias significativas para ninguna de las medidas dentro de esta categoría.

En cuanto a las medidas asociadas al DISTANCIA social, aunque también se consideran importantes, cuatro medidas presentan diferencias significativas en su distribución entre los dos grupos.

Por último, las medidas que implican el uso de TECNOLOGÍA para el control de la infección

son las menos valoradas por ambos grupos, identificándose diferencias significativas en tres de estas medidas.

5. Discusión y conclusiones

Desde principios del siglo XXI han surgido varias epidemias, como el SRAS (2002), la gripe A (H1N1) (2009), el MERS (2012) y el SRAS-CoV-2 (2019) (Škare et al., 2021). El brote de COVID-19 tuvo un profundo impacto en el sector turístico debido a las restricciones de movilidad y al miedo al contagio, lo que provocó un descenso global de más del 70% en el número de turistas. En España, esta reducción alcanzó el 87% en febrero y marzo de 2021 (INE, 2021). Estas circunstancias subrayan la necesidad de realizar investigaciones que ayuden al sector a prepararse para futuras crisis sanitarias y mitigar consecuencias igualmente devastadoras.

Este estudio aporta valiosas ideas a los profesionales de la hostelería sobre las medidas clave que mejoran la seguridad de los clientes y mantienen la ocupación hotelera durante una crisis sanitaria. Aunque las autoridades han publicado directrices sanitarias, muchos establecimientos han aplicado medidas adicionales sin evaluar previamente las perspectivas de los clientes y la dirección. Dados los elevados costes operativos del sector hostelero, mantener la demanda es fundamental para su supervivencia. Este estudio analiza 28 medidas sanitarias y de seguridad que influyen en la elección de alojamiento.

Utilizando el marco de la Teoría de las Partes Interesadas (Freeman, 1994), esta investigación es la primera que compara las perspectivas de los clientes y los directivos sobre las medidas de salud de los hoteles. La creación de valor a largo plazo depende de la colaboración y el entendimiento mutuo entre las partes interesadas (Kujala, 2016). Así pues, las inversiones en medidas de seguridad están justificadas si añaden valor para los clientes al tiempo que se alinean con las prioridades de gestión. Dicha alineación aumenta la satisfacción del cliente, fomenta la lealtad y mejora la rentabilidad, permitiendo inversiones

estratégicas para el éxito a largo plazo. Song et al. (2022) destacan la importancia de tener en cuenta la perspectiva del cliente, dado que la calidad del servicio es un factor clave en el sector de la hostelería.

Según nuestra encuesta, el 37% de los clientes indicaron que sólo viajarían cuando tuvieran la seguridad de que las infecciones estaban bajo control. Más allá de los factores mencionados anteriormente, estas respuestas refuerzan la necesidad de seguir investigando estrategias que mejoren la seguridad del viajero y la experiencia general del cliente.

La aplicación de medidas de prevención de infecciones puede influir positivamente en la disposición de los huéspedes a alojarse en los hoteles, lo que pone de relieve la importancia de identificar tanto los intereses comunes como las posibles divergencias entre los huéspedes y los gestores, como han señalado diversos estudiosos (Chang y Lam, 2013; Wang et al., 2014; Pérez y Rodríguez, 2014).

Implicaciones prácticas

Este estudio identifica diferencias entre las opiniones de clientes y gestores, lo que puede ayudar a los administradores hoteleros a diseñar estrategias eficaces para hacer frente a las crisis sanitarias. En general, los clientes tienden a asignar mayor importancia a las medidas analizadas. En particular, cuando ambos grupos otorgan una alta prioridad a una medida concreta, la discrepancia en sus perspectivas disminuye. Existe consenso en cuanto a las medidas más críticas, como la limpieza rigurosa de las zonas comunes, el uso de mascarillas y el lavado frecuente de manos.

Los resultados revelan diferencias significativas en las percepciones de siete medidas, que los

gestores deberían evaluar cuidadosamente, teniendo en cuenta tanto los costes como los beneficios. Las medidas se han agrupado en tres dimensiones: LIMPIEZA del establecimiento y normas de higiene; distanciamiento social (DISTANCE) mantenimiento, según lo dispuesto por las autoridades para controlar la COVID-19; y el uso de TECNOLOGÍA adoptada por los establecimientos durante la pandemia para prevenir infecciones.

Se observó una gran coincidencia entre ambos grupos en cuanto a las medidas de limpieza e higiene. Ninguna de las medidas de esta categoría mostró diferencias significativas en la percepción, y esta dimensión recibió la calificación global más alta (puntuación media: 4,3). Hung et al. (2018) encontraron que el control de la higiene en los hoteles ayudaba a mitigar el impacto de las enfermedades infecciosas, alineándose con los objetivos de las medidas examinadas en este estudio.

Por el contrario, surgieron diferencias significativas en cuatro medidas de distanciamiento social. Por ejemplo, *k_Mantener las habitaciones vacías durante al menos una noche tras la salida de los huéspedes*, se situó entre las menos valoradas por los gestores (27º de 28 en importancia percibida). En lugar de seguir este planteamiento, los hoteles podrían proporcionar a los huéspedes información detallada sobre los procedimientos de desinfección de las habitaciones para aliviar la preocupación por los riesgos de infección.

Otra medida con diferencias notables fue la *i_Pantalla de protección de metacrilato en la recepción, así como la b_Separación de mesas y asientos en zonas comunes, restaurantes y bares*. Aunque se aplican ampliamente siguiendo las recomendaciones oficiales, estas barreras dificultan la comunicación, afectan a la primera impresión de los huéspedes y pueden dar lugar a malentendidos en las interacciones del personal. Los directivos mostraron una fuerte preferencia por esta medida (+0,46), asignándole una puntuación media de importancia de 4,36, mientras que los clientes la situaron en el puesto 18 de importancia. A pesar de su obligatoriedad durante la pandemia, la eficacia real de estas barreras en la prevención de infecciones debería reevaluarse, teniendo en

cuenta su impacto negativo en la experiencia de los clientes.

El requisito de *realizar pruebas mensuales de COVID-19 a los empleados* también reveló diferencias significativas entre las evaluaciones de los clientes y las de los directivos. Investigaciones anteriores indican que el uso de mascarillas por parte de los empleados influye positivamente en la percepción que tienen los clientes de la seguridad sanitaria y la calidad general de un establecimiento (Liang y Wu, 2022). Por lo tanto, se puede reconsiderar la realización de pruebas periódicas si los empleados llevan máscaras de forma sistemática.

Entre las tres dimensiones, las medidas tecnológicas recibieron las valoraciones globales más bajas de ambos grupos y mostraron las mayores discrepancias. Las cinco medidas menos valoradas del estudio pertenecían a esta categoría. De las siete medidas tecnológicas analizadas, tres mostraron diferencias sustanciales entre las perspectivas de los clientes y los directivos: *u_Habitaciones equipadas con purificadores de aire*, *y_Entrada sin llave o llaves digitales para las habitaciones*, y *t_Sistema de calefacción, ventilación, aire acondicionado y control de la calidad del aire*.

Los gestores deben evaluar cuidadosamente la relación coste-beneficio, dada la significativa divergencia entre los dos grupos y el bajo nivel general de importancia percibida, excepto en el caso del control de la calidad del aire, que recibió una valoración más alta.

Ciertas medidas tecnológicas también contribuyen a la limpieza (por ejemplo, purificadores de aire, sistemas de ventilación) y al distanciamiento social (por ejemplo, check-in/check-out automatizados, pagos sin contacto). Es aconsejable que los gestores hoteleros evalúen el impacto potencial de estas tecnologías en la percepción de seguridad de los huéspedes, al tiempo que tienen en cuenta las recomendaciones de los expertos sobre su eficacia para prevenir infecciones.

En conclusión, evaluar el coste económico y el impacto en la calidad del servicio es esencial

para determinar la eficacia de cada medida y su influencia en la percepción de seguridad de los clientes. Estas conclusiones ofrecen una valiosa orientación a los profesionales del sector a la hora de realizar inversiones en seguridad con conocimiento de causa y preparar sus instalaciones

para futuras crisis sanitarias. Este enfoque permite al sector de la hostelería mitigar los efectos adversos de la pandemia de COVID-19 al tiempo que refuerza su capacidad de recuperación a largo plazo.

6. Limitaciones y estudios futuros

El estudio se llevó a cabo durante la tercera oleada de la pandemia, en medio de estrictas restricciones de movilidad, lo que dio lugar a una muestra de conveniencia, que puede introducir sesgos. Por lo tanto, los resultados deben interpretarse con cautela.

Las investigaciones futuras deberían incorporar las perspectivas de otras partes interesadas, como los empleados, las autoridades sanitarias y los proveedores turísticos, para obtener una comprensión más amplia de las medidas sanitarias relacionadas con los hoteles. Además, sería valioso explorar las razones que subyacen a la importancia percibida de estas medidas y su papel en la promoción del turismo sostenible.

Los efectos de la crisis COVID-19 en el sector turístico fueron especialmente significativos en países con una alta incidencia de la pandemia y en los que el turismo constituye una importante fuente de ingresos, como es el caso de España, en el que se centra este estudio. La pandemia afectó a todas las economías (WTTC, 2021), provocando descensos en el PIB anual en 2021 en todas las regiones del mundo, incluyendo un descenso del 58% en el Caribe, del 56% en el noreste de Asia y

del 41% en América Latina.

Muchas de las medidas analizadas se alinean con las recomendaciones del WTTC (2020) sobre los protocolos que los establecimientos hoteleros deben implementar para garantizar una estancia segura. Este estudio se centró en clientes y directivos de España; sin embargo, futuras investigaciones podrían comparar estos resultados con las perspectivas de directivos y clientes de otros países, incorporando como variable la ubicación geográfica del establecimiento. Esto ayudaría a determinar si las diferencias culturales, sociales y políticas arrojan resultados distintos o, por el contrario, si las conclusiones pueden generalizarse a otros países.

Futuros estudios también podrían examinar la relevancia a largo plazo de estas medidas tras la crisis sanitaria y evaluar si las perspectivas de clientes y directivos siguen alineadas o han cambiado. Otra línea de investigación podría explorar el impacto normativo en los establecimientos hoteleros comparando las medidas aplicadas en distintas regiones del mundo.

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Needle removal favors the survival of *Oreocallis grandiflora* in *Pinus* plantations in southern Ecuador

La remoción de acículas favorece la supervivencia de *Oreocallis grandiflora* en plantaciones de *Pinus* al sur del Ecuador

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Needle removal favors the survival of *Oreocallis grandiflora* in *Pinus* plantations in southern Ecuador

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Abstract

Pine plantations have negatively impacted biodiversity and the establishment of native flora in Ecuador. We evaluated whether needle removal facilitates the establishment of *Oreocallis grandiflora* in a plantation in the south of the country; we performed direct sowing of seeds in plots with and without needles. Our results showed that removal had no statistically significant effect on emergence ($p > 0.05$), but did have a significant effect on survival ($p < 0.0001$). After 22 weeks, we recorded $>86\%$ survival without aculeus and 7% with aculeus. Two years later, survival was close to 80% for the treatment without aculeus, and the growth of these plants was significant ($p < 0.0001$). We conclude that direct seeding is viable, but we recommend removing the needles monthly during the first months.

Keywords: direct seeding, emergence, establishment, gañal, native flora, pine needles.

Resumen

Las plantaciones de pino han impactado negativamente la biodiversidad y el establecimiento de flora nativa en Ecuador. Evaluamos si la remoción de acículas facilita el establecimiento de *Oreocallis grandiflora* en una plantación del sur del país; realizamos siembra directa de semillas en parcelas con y sin acícula. Nuestros resultados mostraron que la remoción no tuvo efecto estadísticamente significativo sobre la emergencia ($p > 0.05$), pero sí sobre la supervivencia ($p < 0.0001$). Después de 22 semanas, registramos una supervivencia $>86\%$ sin acícula y 7% con acícula. Dos años después, la supervivencia fue cercana al 80% para el tratamiento sin acícula, asimismo, se evidenció que el crecimiento de estas plantas fue significativo ($p < 0.0001$). Concluimos que la siembra directa es viable, pero recomendamos remover mensualmente las acículas durante los primeros meses.

Palabras clave: acícula de pino, emergencia, establecimiento, flora nativa, gañal, siembra directa.

1. Introduction

Pine is a native species of the northern hemisphere, belonging to the Pinaceae family, with both arboreal and shrubby habits (Richardson, 2000). It has valuable timber characteristics, fast growth, and easy cultivation, which is why it has been introduced and spread to several countries around the world for several decades (Hofstede et al., 2002). In Ecuador, the first plantations were established in the second half of the 20th century for both commercial and recreational purposes (Narváez et al., 2017), primarily using species such as *Pinus patula* and *Pinus radiata* due to their adaptation to diverse climatic and edaphic conditions (Quiroz et al., 2019). However, these plantations have caused problems in biogeochemical and hydrological processes, as well as in fire regimes, and have modified the availability of soil nutrients, affecting both surface and subsurface biotic communities (Richardson, 2000; Simberloff et al., 2010).

For example, the accumulation of pine needles in the soil inhibits the emergence, germination, and development of other understory species due to the natural oils present in these tissues and the dense canopy cover, which leads to a reduction in plant diversity, generating a less complex and more homogeneous ecosystem (Chacón et al., 2003; Yirdaw & Luukkanen, 2004). Additionally, it has been discovered that the dense layer of needles on the soil can have adverse effects on the germination process, acting as both a physical and chemical barrier. Therefore, it has been suggested that their removal can benefit natural restoration (Bueno & Baruch, 2011).

As a consequence, it has been a challenge to restore native vegetation within the pine plantations. Therefore, potential species have been sought, such as *Oreocallis grandiflora* (gañal), which, in previous research, is a species with the capacity to adapt to adverse conditions (Pretell et al., 1985; Vinuela et al., 2018a) and to provide suitable conditions for plant succession (Cotler & Maass, 1999). This species stands out for its

ecological importance (Crespo & Inga, 2020); its shrubby life form and abundant flowers are the functional traits that give it a key role in mutualistic networks (Crespo et al., 2021) since it is visited by birds, insects, bats, and even rodents have been recorded feeding on its nectar (Cárdenas et al., 2017). In addition, it has potential for use in the cosmetics industry and food industry due to the amount of flavonoids it has (Vinuela et al., 2018b). It is also known that rural communities use their flowers in traditional medicine and the creation of handicrafts (Minga & Verdugo, 2016).

The humid montane scrubland of southern Ecuador is currently covered by hundreds of hectares of pine plantations that could be restored. Information on the restoration of native biodiversity in pine plantations is scarce. For example, it has not been reported which native species persist and develop within these plantations, nor have the management strategies that facilitate their successful establishment under these conditions been identified. However, to reduce the costs of these programs, it is essential to optimize the use of available resources (Shoo & Catterall, 2013). An effective strategy in this regard is the implementation of no-tillage methods (Engel & Parrotta, 2001), which have proven to be a viable alternative. This technique is particularly suitable for the financial and geographic reality of farmers in the south of the country, as it makes it possible to dispense with the costs associated with the production and maintenance of seedlings in nurseries, thus facilitating its application on a larger scale and with less initial investment (Crespo Inga, 2020). In this study, we evaluated (i) whether needle removal influences the emergence and survival of *Oreocallis grandiflora* seedlings and (ii) whether the growth of *Oreocallis grandiflora* seedlings after 24 months of establishment is significant under experimental conditions in a pine plantation. This work constitutes an initial contribution to understanding the viability of restoring native Andean vegetation in forest contexts dominated by exotic species.

2. Methodology

2.1. Study site

The study was carried out in pine plantations in southern Ecuador, within the El Gullán Scientific Station ($3^{\circ}19' S$, $79^{\circ}09' W$), located in the parish of Las Nieves, in the canton of Nabón, on the southern border of the province of Azuay (Figure 1). The average annual temperature ranges between $7^{\circ}C$ and $21^{\circ}C$, while annual precipitation varies between 400 mm and 600 mm (MAE, 2013). The area corresponds to a humid montane scrub ecosystem, located between 2,500 and 3,000 m above sea level, characteri-

zed by high floristic diversity. The predominant vegetation includes species such as *Hesperomeles ferruginea* (Rosaceae), *Myrcianthes rhopaloides* (Myrtaceae), and *Myrsine* depends (Myrsinaceae). In addition, important species such as *Miconia aspergillois* (Melastomataceae), *Rhamnus granulosa* (Rhamnaceae), *Maytenus verticillate* (Celastraceae), *Piper barbatum* (Piperaceae), *Oreocallis grandiflora* (Proteaceae), *Oreopanax andreanus* (Araliaceae), and *Myrsine Andina* (Myrsinaceae) are also found (Minga et al., 2021).

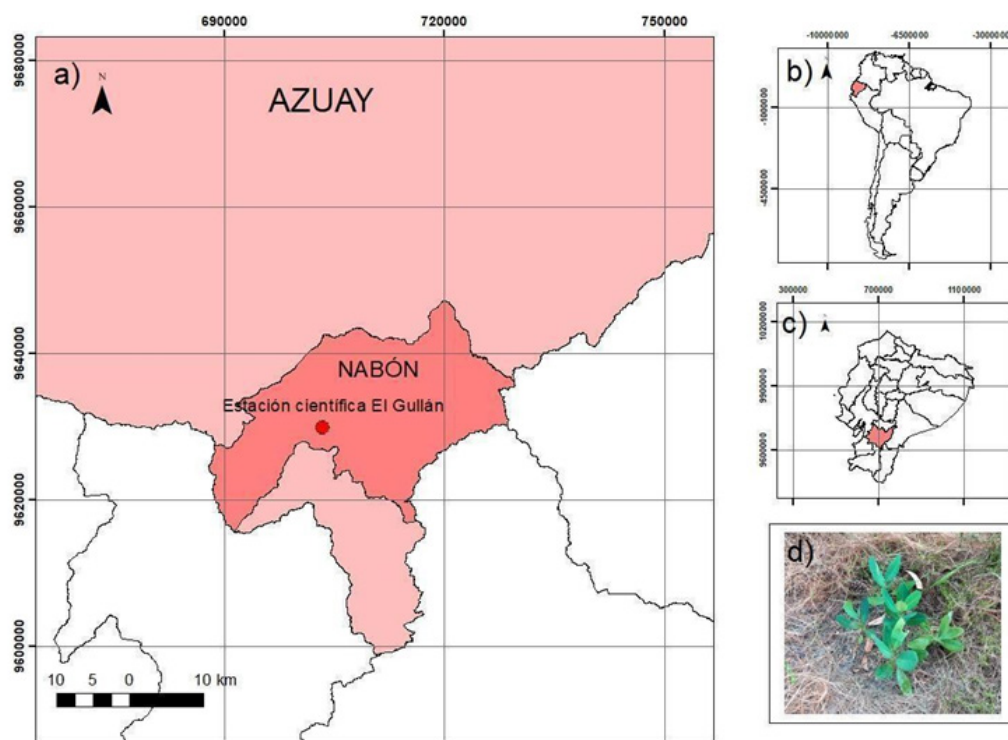


Figure 1: El Gullán Research Station, Azuay province, southern Ecuador. a) El Gullán Research Station ($3^{\circ}19' S$, $79^{\circ}09' W$); b) Map of South America; c) Map of Ecuador; d) Individual of *O. grandiflora*; e) Map of Ecuador; f) Individual of *O. grandiflora*.

Source: Own elaboration.2025.

2.2. Experimental design

We installed three experimental blocks in a *Pinus patula* plantation that had been thinned by 25% prior to the start of the experiment. We did not carry out previous physical-chemical analyses of the soil. However, for the establishment of the blocks, we considered elements such as slope, tree cover, and exposure, all of which were relatively homogeneous between plots. The vegetation cover consisted exclusively of the pine tree layer, along with mosses and epiphytic bromeliads, but lacked a native understory. The ground litter corresponded only to pine needles, with no other visible plant remains.

We positioned the blocks vertically with respect to the terrain's slope, ensuring a minimum distance of 50 m between each one to minimize interference. Each block was 24×10 m in size. Within these, we established experimental units of 2×2 m, with two treatments: direct seeding with and without pine needles, randomly assigned. Each treatment was repeated eight times per block to ensure replicability and minimize data loss due to external factors, such as accidental damage or environmental disturbances. Additionally, this distribution enabled a more accurate assessment of the effects of the presence or absence of aculeus on seedling emergence and initial growth.

For the experiment, we collected seeds of *O. grandiflora* between March and May 2022 from eight mother plants located in remnants of natural vegetation near the study area. For the selection of mother plants, we performed a randomized sampling, considering only individuals in the active fruiting stage and maintaining a minimum distance of 20 meters between them to reduce the probability of close kinship. In total, we sowed 240 seeds, five per experimental unit, distributed equally between the two treatments (120 per treatment).

Germination was recorded as the emergence of seedlings visible above the soil surface. We collected these data every 15 days for 18 weeks, while seedling survival was assessed monthly until week 22 post-sowing. To analyze initial growth, we measured seedling height at the end of the observation period (week 22) using a caliper, taking the distance from the base of the stem to the apex as a reference. In addition, we performed a second height measurement two years after planting using a flexometer under the same protocol to evaluate their long-term development. However, the number of plants monitored was 30, these belonging to the treatment without aculeus, due to the null survival of plants from the treatment with aculeus.

2.3. Statistical analysis

Both emergence and survival were evaluated in final percentages. Therefore, we considered the ratio of emerged seeds to sown seeds and multiplied by 100. Next, the normality and homogeneity of the variables were evaluated using the Shapiro-Wilk and Levene's tests, respectively. Since these statistical assumptions were not met, an attempt was made to achieve normality by transforming the data; however, these two assumptions were still not met. Therefore, to determine whether there are statistical differences in the emergence and survival of seeds sown in plots covered with or without aculeus, the Wilcoxon rank sum statistical test was performed ($p\text{-value} < 0.05$) (ISTA, 2002; Dao, 2022). Likewise, the same statistical test was applied to determine if the growth of these plants (without aculeus) was significant after two years of planting. However, it was necessary to consider the variables as paired samples. This analysis is represented through bar graphs with the standard error of the treatments (emergence and survival), as well as size (initial and current), and tables with measures of central tendency and dispersion. The analyses and graphs were conducted using the statistical program R (R Core Team, 2024).

3. Results

Concerning emergence, the averages of the treatments were not similar, although their medians were. As shown in Table 1, the average emergence in plots with aculeus was higher, reaching 43.3% (with 51 plants emerging), while in plots without aculeus, it was 33.3% (with 39 plants emerging). Moreover, in plots with acicula,

emergence occurred in all replicates, whereas in plots without acicula, some replicates had no emerged seeds. On the other hand, the coefficient of variation in the treatment with needles was 43%, a lower value compared to the plots without needles, which reached 53%, suggesting greater variability in emergence in the absence of needles.

Table 1: Measures of central tendency and dispersion for emergence in the evaluated treatments. CAS treatment: with aculeus and SA: without aculeus
Source: Own elaboration (2025).

Treatment	Mean %	Median	Median	Minimum	Maximum	EE	CV
CAS	43.33	40	20	80	18.75	0.43	
SA	33.33	40	0	60	17.75	0.53	

SE: standard error. CV: coefficient of variation.

Survival showed the opposite behavior to emergence; in this variable, the treatment with needles recorded an average of 7.14% (14 plants), while the average for the treatment without needles was 86.6% (33 plants), which was higher than the

previous one. However, in both treatments, there were replicates with null and 100% percentages. Hence, the coefficient of variation of the plots with needles was higher (3.74) than that of the treatment without needles (0.4) (Table 2).

Table 2: Measures of central tendency and dispersion for the survival of *O. grandiflora* plants in the evaluated treatments. Treatment CAS: with aculeus and SA: without aculeus.
Source: Own elaboration (2025)

Treatment	Mean %	Median	Median	Minimum	Maximum	EE	CV
CAS	7.14	0	0	100	26.73	3.74	
SA	86.67	100	0	100	34.57	0.40	

SE: standard error. CV: coefficient of variation.

According to Figure 2a, the mean percentages of emergence for the two treatments were similar. After applying the Wilcoxon rank sum test, it was found that there were no statistical differences between the two treatments ($p\text{-value} > 0.05$), as the difference between the two treatments was only 10%. Meanwhile, in the bar graph for survival (Figure 2b), a clear difference between the means can be observed. Therefore, after applying the Wilcoxon rank sum test, significant differences were found between the evaluated treatments ($p\text{-value} < 0.0001$). In this case, the difference between treatments was 79%.

After 24 months, we measured the plants again to determine if their growth was significant over this period. The Wilcoxon rank sum for paired samples showed that the growth of the plants in the treatment without aculeus in the last two years was significant ($p\text{-value} < 0.0001$). The average initial height of the plants was 1.30 cm, which increased to 8 cm over the two years, indicating a growth of approximately 6.7 cm. This suggests that the species develops and grows slowly (Figure 3).

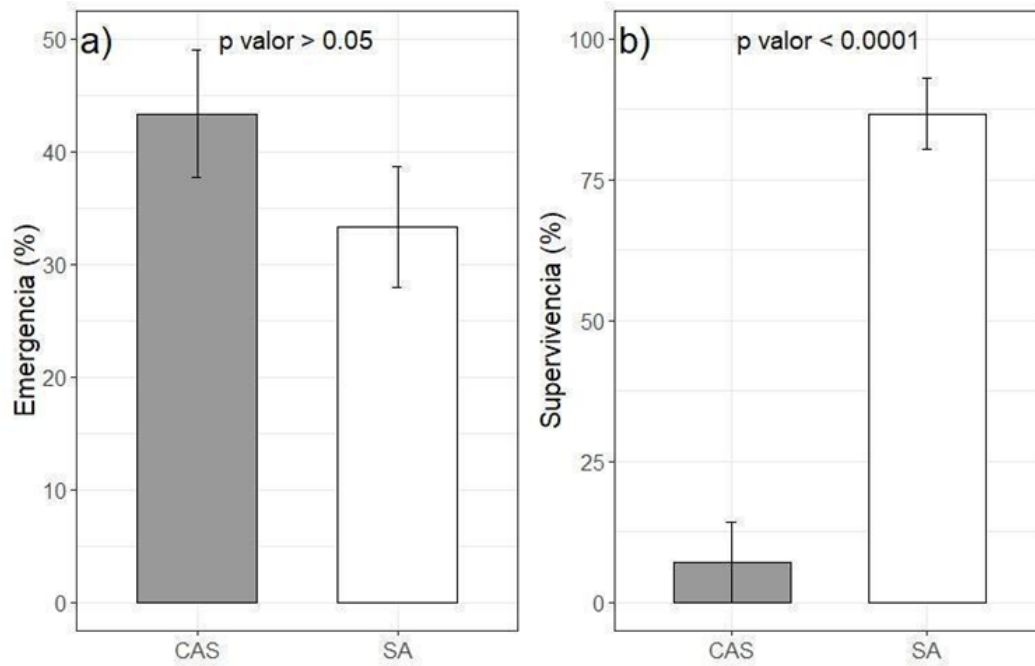


Figure 2: Final mean emergence (a) and survival (b) for *O. grandiflora* seeds after direct seeding into a pine plantation. Seeding treatments applied included keeping the aculeus intact (CAS) or removing the aculeus (SA). Figure 2a shows seedling emergence after 18 weeks of direct seeding, while Figure 2b shows seedling survival after 22 weeks of observation. Bars with different letters denote significant statistical differences.

Source: Own elaboration.2025.

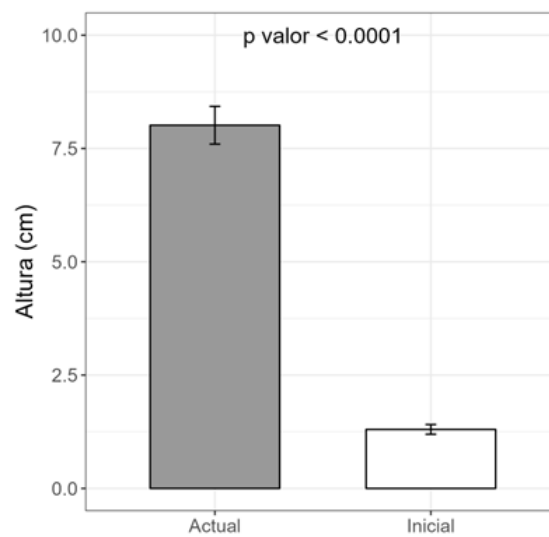


Figure 3: Comparison of means of *O. grandiflora* plant growth recorded in two years.ion. Bars with different letters denote significant statistical differences.

Source: Own elaboration.2025.

4. Discussion

In this study, we evaluated the hypothesis that the removal of *Pinus patula* needles favors the emergence, survival, and growth of *Oreocallis grandiflora* seedlings in plantations in southern Ecuador. The results partially support this hypothesis: although no statistically significant effect on emergence was observed, removal did improve survival, both in the short and medium term.

The findings of this study suggest that direct seeding of *O. grandiflora* is a viable strategy to recover native vegetation cover within pine forest plantations when needles are removed. It is recommended to complement this practice with management actions such as thinning, which was part of the experimental context, to facilitate adequate light conditions. Additionally, it is recommended to perform needle removal every month during the first 4 to 6 months after planting, based on the results observed in this study.

One of the most remarkable results was the marked contrast between relatively high emergence and low survival in the presence of needles. *O. grandiflora* seeds exhibited an emergence rate of over 40%, which is consistent with previous studies reporting high germination percentages under natural conditions, provided that the seeds have not been stored for more than three months (Palomeque et al., 2020). In this study, seeds were sown shortly after collection without exceeding this storage threshold. Emergence occurred in a staggered manner over 18 weeks, which is consistent with the presence of physiological dormancy in the species (Villena-Ochoa et al., 2024).

Emergence in plots with needles could be related to a phenomenon of herbicidal hormesis, where low concentrations of compounds present in the needle stimulate germination (Portuguez-García et al., 2020). Additionally, the needle cushion may have contributed to conserving moisture and temperature in the microsite. However, it has also been reported that when the accumulation is not controlled, these needles generate a

hydrophobic layer that prevents water infiltration (Chacón et al., 2003). Although we did not experimentally identify which of these mechanisms predominated, the positive effects observed are likely due to an initial favorable balance between moisture retention and chemical stimulus.

Despite this initial positive effect, seedling survival was significantly lower in the presence of needles. Our results reveal that this same substrate affects the survival of *O. grandiflora* seedlings, which is in agreement with research evidencing phytotoxic effects of compounds released by needles, such as phenols (Fernandez et al., 2013; Portuguez-García et al., 2020; Valera-Burgos et al., 2012). The adverse effects on survival can be attributed to the leachates generated by the needle and their associated allelopathic effects (Panca-Jevera et al., 2024). Studies have shown that fresh needle exudates contain high concentrations of phenolic compounds that inhibit both germination and radicle elongation (Zhang et al., 2018). Although these effects are reduced with senescent needles (Santonja et al., 2019), in our experiment, we did not control for the age of the material present in the plots so that both types may have coexisted.

In addition, several studies suggest that the presence of needles in the soil may alter nutrient availability, partly by inhibiting nitrifying microorganisms (Tyukavina et al., 2019) and by contributing to substrate acidification (Fan et al., 2023; Oliva et al., 2014). This could have generated adverse edaphic conditions for *O. grandiflora*. Additionally, the mechanical effect of the needles may have hindered seedling rooting by limiting contact with the soil (Cano et al., 2008).

On the other hand, although needle removal had a positive effect on survival, seedling growth was slow. Two years after planting, plants reached a maximum height of 8 cm. This slowness may be due to the absence of continuous needle removal during that period, as this practice was only per-

formed during the first 22 weeks of the study. We consider that subsequent accumulation may have influenced the growth of individuals. However, this hypothesis still requires experimental verification. It is worth mentioning that *O. grandiflora* is adapted to acidic and shallow soils (Minga & Verdugo, 2016), which could explain its ability to persist despite restrictive conditions.

The morphological characteristics of native tree and shrub seedlings can also influence their initial growth. In the early stages, many species present functional traits that respond to the environment, modifying as they progress through their life cycle (Rocas, 2001). In this context, abiotic factors such as the availability of light, nutrients, and water, as well as competition with other species, are key determinants for the development of seedlings of woody species (Moreno & Cuartas, 2015).

Additionally, abiotic factors such as light incidence and topography are key determinants of seedling survival and growth in forest ecosystems (Park et al., 2018). For this reason, thinning is a complementary activity to needle removal, as it facilitates greater light input to the understory. Previous studies have shown that the amount and duration of light received by seed-

lings are key factors for their survival and development (García-Castro et al., 2018). In particular, the effects of light spans are critical in the early stages of growth; however, microenvironmental characteristics also vary according to the specific requirements of each species and its phenological stage (Moretti et al., 2019).

Despite these findings, studies on the interactions between pine plantations and native species regeneration in the tropical Andes remain limited, particularly in terms of long-term growth dynamics. This knowledge gap presents an opportunity for future research to explore the ecological mechanisms that influence the adaptation of *O. grandiflora* within forest plantations with exotic species. Understanding these processes will enable the design of more effective strategies to optimize its establishment, favor biodiversity, promote the recovery of degraded ecosystems, and ensure the sustainability of managed forest systems.

Ultimately, the findings of this study can serve as a basis for developing restoration protocols tailored to local conditions. The implementation of simple, sustainable practices supported by scientific evidence represents a crucial step toward effective ecological restoration and biodiversity conservation in highly disturbed landscapes.

5. Conclusions and recommendations

This study demonstrates that direct seeding of *Oreocallis grandiflora* is an effective strategy to facilitate the establishment of native flora within *Pinus patula* plantations in the southern Andes of Ecuador. Although the presence of needles did not significantly affect seedling emergence, it did reduce seedling survival, which highlights the importance of properly managing the surface substrate. The removal of needles during the first months after planting significantly increased survival, so it is recommended to perform this practice at least monthly during the first 4 to 6 months. It was also confirmed that, in the

treatment without needles, plant height after two years of establishment was significantly higher. Likewise, these practices should be implemented on a larger scale in restoration programs, prioritizing the immediate sowing of fresh seeds and conducting continuous follow-up to adjust strategies according to local conditions. Finally, it is recommended that we continue to investigate the long-term effects of these interventions and explore the responses of other native species in contexts dominated by exotic plantations in order to strengthen ecological restoration in high Andean ecosystems.

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Gastronomic uses of forgotten foods such as chacha fruit and loquat

Usos gastronómicos de los alimentos olvidados como el chachafruto y el níspero

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Gastronomic uses of forgotten foods such as chacha fruit and loquat

Usos gastronómicos de los alimentos olvidados como el chachafruto y el níspero

Abstract

Forgotten foods are species relegated from the gastronomic scene as a consequence of a series of economic, historical and cultural changes that have caused them to be undervalued. The objective of this research was to investigate the uses of the Chachafruto (*Erythrina edulis*) and the Medlar (*Manilkara zapota*).

The research was divided into phases: 1. Interviews in market squares in the city of Bogotá seeking to establish the level of knowledge and availability; 2. Physical and bromatological analyses. 3. Application of recipe transformation and standardization techniques. 4. Sensory panel. The results obtained highlight the lack of knowledge of the two species and low availability. Products such as wrappers, chancacas, fritters, pasta, cookies, pickles were generated; which presented a high level of acceptance, evidencing a preference for the consumption of sweet preparations made from Níspero. In conclusion, both species have a high potential to be transformed

Keywords: native foods, endemic species, regional cuisine, gastrobotany

Resumen

Los alimentos olvidados son especies relegadas del panorama gastronómico como consecuencia de una serie de cambios de carácter económico, histórico y cultural que ha generado que sean subvaloradas. El objetivo de esta investigación fue indagar sobre los usos del Chachafruto (*Erythrina edulis*) y el Níspero (*Manilkara zapota*).

La investigación se dividió en fases: 1. Entrevistas en plazas de mercado de la ciudad de Bogotá buscando establecer el nivel de conocimiento y disponibilidad. 2. Análisis físicos y bromatológicos. 3. Aplicación de técnicas de transformación y estandarización de recetas. 4. Panel sensorial.

Los resultados obtenidos, destacan el desconocimiento de las dos especies y baja disponibilidad. Se generaron productos como envueltos, chancacas, buñuelos, pasta, galletas, encurtidos; los cuales presentaron un alto nivel de aceptación, evidenciando una preferencia por el consumo de preparaciones dulces hechas a partir de Níspero. En conclusión, las dos especies cuentan con un alto potencial para ser transformadas.

Palabras clave: alimentos nativos, especies endémicas, cocina regional, gastrobotánica.

1. Introduction

The term "forgotten foods" refers to plant species that have been relegated from the diets of the world's population and, as a consequence of a series of political, historical, environmental, economic, and cultural changes, are in danger of extinction (Global Forum on Agricultural Research [GFAR], 2011). These changes over the years have led to the loss of food species worldwide (Gonzales, 2008), which is why organizations such as the Food and Agriculture Organization of the United Nations (FAO), the World Health Organization (WHO), and the Global Forum on Agricultural Research (GFAR), pioneers in agriculture, nutrition and food security, have allocated resources and efforts for the revitalization of undervalued crops. The aim is to preserve the genomes of plant species with high nutritional value, thereby ensuring food security for vulnerable populations, mitigating food shortages, and strengthening the economies of small farmers through the trade of these plant species in local markets (GFAR, 2021).

However, these efforts have been overshadowed by various factors, including the low supply and demand for these foods in the market, as well as a partial lack of knowledge about the gastronomic and nutritional value provided by their consumption (GFAR, 2021). In Colombia, 22 plant species were recorded until 2019, including fruits and tubers such as *Erythrina edulis* (chacha fruit), *Manilkara zapota* (loquat), and *Hieronyma macrocarpa* Müll.Arg. (motilón), *Chrysobalanus icaco* L. (icaco), *Annona cherimola* Mill (custard apple), and *Annona squamosa* L. (anón), just to mention a few examples. These species, due to their low yields or the lack of knowledge among villagers, have seen a gradual decline in production in recent years, as they do not generate significant profits for small producers and farmers. Consequently, they have opted to replace these crops with more commercially viable ones (Alvarez et al., 2019).

The world's largest seed bank, located in Svalbard, houses more than 65,000 food species. It

promotes the cultivation of these plant species in small farming communities through entrepreneurship and crop substitution programs, which include hundreds of varieties of beans, cassava, and forages, aimed at preventing their extinction and encouraging their consumption (Gonzales, 2022). Other entities, such as the Botanical Garden of Bogota (JBB), promote the cultivation and propagation of some undervalued species, which, through research on their benefits, allow the identification of possible uses at the gastronomic and industrial level in order to promote their local consumption (Botanical Garden of Bogota, 2022). According to the above, of the 22 plant species identified at the national level, two were selected as the objects of study: the chacha fruit (*Erythrina edulis* Triana ex Micheli) and the Loquat (*Manilkara zapota* (L.) P.Royen).

The chachafruto, also known as balú, nupo, baluy, poroto, sachaporoto, jite, frisol calú or frijol de árbol (Acero et al., 1992). It is a native food of South America; its scientific name is *Erythrina edulis*, and it belongs to the Fabaceae family.

Its tree can reach heights of between 14 and 25 meters, and its fruit is spherical, ranging from reddish to brown, depending on its ripening stage. Its average diameter ranges from 2.5 to 7 cm (Molano, 2005). Its cultivation extends along the Andes mountain range in the sub-Andean forest zone (Prieto & Colonia, 2018). Regarding the ancestral uses attributed to chacha fruit, we find its sowing associated with the propagation of coffee or lulu crops, as it helps fix nitrogen in soils, an essential nutrient for the cultivation of other plant species. Its consumption as feed for fattening animals is widespread nowadays. However, there are records of its use for the preparation of sancochos, custard, recipes, salads, cakes, coladas, fried foods, compotes, empanadas, and cookies (Acero et al., 1992).

The loquat, on the other hand, is an exotic fruit; its scientific name is *Manilkara zapota*, and it belongs to the Sapotaceae family, genus *Mani-*

lkara (Royen, 2007), which comprises more than 700 species and over 40 genera. A tree native to the Americas, its growing area is in tropical and subtropical climates at an altitude of 1200 m or less above sea level (Karle Pravin & Dhawale Shashikant, 2019). Its tree can reach 25 to 40 meters in height, and its fruit presents an ovoid or circular shape with a diameter of approximately 6 to 9 cm. Its pulp is fibrous, juicy, sweet, and reddish brown; its peel is brown with a rough texture (Karle Pravin & Dhawale Shashikant, 2019). Each fruit contains 2 to 12 seeds. These have a flat oval shape and a shiny black color, approximately 1 cm in diameter (Carrillo, 2022). It is also known as zapotilla, níspero de monte, níspero de anís, chicle, or chicozapote. Regarding its gastronomic uses, it is usually consumed fresh in juices, ferments, jams, and preserves (Buitrago et al., 2004). According to figures

from the Ministry of Health, loquat consumption at the national level is 1%; the departments where this fruit is most produced and consumed are Guajira and Atlántico with 2.2% of people, Sucre with 1.4% at the regional level and Magdalena with 0.3% (Ministry of Health and Social Protection, FAO, (2013)).

The purpose of this research was to investigate the gastronomic uses of two vegetable species cataloged as forgotten foods, such as chacha fruit (*Erythrina edulis*) and Loquat (*Manilkara zapota*), to apply transformation techniques (dehydration, addition of sugar, thermal treatments, pH modification, described in the document Transformation and Culinary Preparations of High Andean Species (Torres & Corzo-Barragán, 2019), in order to diversify their form of consumption.

2. Materials and methods

Species selection

Two species were identified: Chachafruto (*Erythrina edulis*) and Níspero (*Manilkara zapota*). These were selected based on two criteria: first, they were classified as forgotten foods according to the group of endangered native species mentioned in the article by Álvarez et al. (2019), and second, their availability in the local capital market.

Experimental design

The development of this research was divided into four stages: (1) interviews in marketplaces in Bogotá, and (2)

species in question.

This format enabled the collection of both qualitative and quantitative data, including knowledge of cultivation areas, gastronomic and medicinal uses, memories associated with consumption, common names, harvest seasons, and consumption preferences, as well as quantitative data such as the level of knowledge, weekly sales in kilograms, frequency of consumption, and sales prices.

The sampling method was non-probabilistic, intentional, or convenience-based and was applied with prior informed consent. A previous survey was conducted among the sales stalls of the selected marketplaces to identify the distributors of the selected species. Thus, the interview was conducted with those who attended the sales stalls, comprising a sample of 60 people distributed as follows: 17 people at Paloquemao Market Square, 13 people at Siete de Agosto District Market Square, and 30 people at Las Ferias District Market Square.

2.1. Interview in marketplaces

For the development of this stage, a semi-structured interview was used as a data collection instrument with 16 open and closed questions to measure the level of knowledge about the two

2.2. Physicochemical and bromatological analyses

Physicochemical and bromatological analyses were conducted to determine aspects such as Brix degrees, pH, firmness (kg/cm), moisture content (%), total ash, crude protein (g), and fiber percentage, following the procedure described by Corzo and Plazas (2019). These data were obtained through primary and secondary sources.

2.3. Application of food preservation techniques and recipe generation.

For this stage, a total of 18 recipes were selected that obeyed three essential criteria: affinity with applied transformation techniques described in the document transformation and culinary preparations of high Andean species (Hernández et al., 2019); classification as high consumption products according to reports from ([ANDI], Asociación Nacional de Empresarios de Colombia, 2023) the gastronomic identity associated with the regional cuisines of Colombia ([ANDI], Asociación Nacional de Empresarios de Colombia, 2023). These recipes were: capacity negra fritters, envueltos, yogurt, chachalacas, pickled, chutney, arequipe, jam, bocadillo, fruit sauce,

fruit cheese, flavored oatmeal, bean casserole, frijoles cream, flavored rice pudding, sponged, starch extraction for panders elaboration, composite flours for making roscón with a substitution percentage of 15%, Ojo de buey cookie with a substitution percentage of 15%, pasta with a substitution percentage of 50% and buñuelos de Antioquia with a substitution percentage of 50%.

2.4. Sensory evaluation in untrained panel

The first group consisted of 20 children aged 7 to 13 years, for whom a format based on the 5-point facial hedonic scale was used. The second group consisted of 50 visitors to the Botanical Garden of Bogotá, aged between 18 and 65 years, who, after filling out the informed consent form, used the format based on the 5-point mixed hedonic scale, where criteria of taste, aroma, texture, appearance, and preference were evaluated.

After data collection, a factor analysis of variance (ANOVA) was performed to determine the significant differences in the average evaluation of each rating attribute (aroma, appearance, flavor, and texture) across at least two products at a significance level of 0.05. For this purpose, the 13 products subjected to the sensory panel were grouped into two categories according to their sensory qualities, specifically sweet and savory.

3. Results

3.1. Interviews in marketplaces

The results of the interviews revealed that of the 60 stalls interviewed, only 10 sell chacha fruit, of which 20% claim to sell between 11 and 14 kilos per week; in the case of loquat, of the 60 stalls surveyed, only three stalls sell loquat, of which 33% claim to sell only 3 kilos per week. The cost per kilogram of chacha fruit ranges between \$6,000 (1.35 USD) and 7,000 pesos (1.56 USD), while loquat is between \$9,000 (2.03 USD) and \$12,000 (2.71 USD) per kilogram; these prices vary according to the harvesting season.

Only 32% of those interviewed claimed to know either of the two species. Of these, 9% know the loquat, and 23% know the chachafruto. Respondents were asked about the names they use to identify these two plant species; for the species *Manilkara zapota*, 37% said they knew it as sweet sapote, another 37% knew it as loquat, and 13% said they recognized it as zapotilla. On the other hand, the species *Erythrina edulis* was recognized as Balú (62%), Chachafruto (29%), and 6% recognized it as proto, pites or chugas.

Regarding the frequency of consumption, 40% of the respondents stated that they consume chacha fruit once a month, followed by special occasions with 27%. As for loquat, 43% stated that they consume it according to its availability in the market.

As reported by the respondents on the origin of the species, (11.67%) reported that the chacha fruit came from Boyacá, and loquat (5%) reported that it came from the Caribbean zone. Regarding the harvest season for chacha fruit, most interviewees stated that it is grown throughout the year, while the loquat harvest was reported for December (5%) and June (3.33%).

The most common uses of the two species are human and medicinal consumption. The most popular forms of consumption of chacha fruit are soups and cooked dishes (43%) and sweetened beverages (33%); as for loquat, its most common consumption is associated with juices (72%) and jellies (14%).

3.2. Physical and bromatological analysis:

The results of the physicochemical and bromatological analyses are listed in (Table 1).

Table 1: Characterization of chacha fruit and Loquat.

Source: a. Corzo-Barragán D.C. (2023) b. (Karle Pravin & Dhawale Shashikant, 2019).

PHYSICAL CHARACTERIZATION		
	CHACHAFRUTO	NESPERO
Brix degrees	5.76	13.0
pH	6.5	5.4
Firmness (kg/cm ²)	2.46	5.6
Edible part (%)	44	80
Total fruit weight (g)	165.76	275.4
Polar diameter (cm)	4.5	100.0
Equatorial diameter (cm)	2.02	50.0
BROMATOLOGICAL CHARACTERIZATION		
	CHACHAFRUTO ^a	NESPERO ^b
% humidity	84.59	77.7
Total ash (g)	0.94	0.4
Crude protein (g)	19.32	0.6
Fiber	3.5	3.2

3.3. Selection of recipes and transformation techniques applied:

The selection of recipes was based on the physical aspects of the food, so the application of some transformation techniques would enhance the organoleptic characteristics. The application techniques used are described in (Table 2); a total of 15 products were generated.

For the selected products, which were transformed using the sugar addition technique, the reference for the production of preserves, as described in NTC 285 of 2007-12-1, on the production of jams, sauces, and jellies, was followed, according to the Brix level that corresponds to the production

of the product. The formulation was carried out as shown in (Table 3).

On the other hand, for the preparation of chacha fruit and loquat composite flours (Table 4), the dehydration technique was applied at a temperature of 58 °C for 8 hours for chacha fruit and 15 hours for loquat. The dehydrated food was then processed, and the sample was classified according to ISO 3310-12000 grain size standards, using standard sieves to obtain three samples as follows: sample 1, standard sieve No. 10 with a size of 2.00 mm, sample 2 standard sieve No. 16 with a size of 1.18 mm and sample 3 standard sieve No. 30 with a size of 600µ.

Table 2: List of recipes and transformation techniques applied
Source: Own elaboration.

Applied preservation and processing technology Chachafruit Loquat		
Sugar addition	Fruit sauce	Fruit sauce
	Marmalade	Marmalade
	Arequipe	Sandwich
Dehydration	chacha fruit paste	
	-	Walleye cookies
	chacha fruit and loquat sandwich (Flour)	Buñuelos from Antioquia (fruit flour elaboration)
	Yogurt	Yogurt
Pulping	Wrapped (steaming)	-
	Fritters (Blanching process for mass production)	-
Scalding	Pickle	Chutney

Table 3: Formulation products processing technique sugar addition
Source: Own elaboration.

Preparation	Brix degrees	Formulation
Fruit Sauce (chacha fruit and Loquat)	40°	40% pulp+40%sugar+20%water
Loquat Jams	65°	50% pulp + 50% sugar
Loquat Sandwich	72°	50%pulp + 50%sugar +1%lemon juice+ 1%pectin

Table 4: Formulation of composite flours by dehydration technique
Source: Own elaboration.

Preparation	Percentage of substitution	formulation	Type of sample
chacha fruit paste	50%	50% sour chacha fruit flour +50% semolina	sample 3: standard sieve No. 30 with 600μ measurement
chacha fruit cake with medlar snack	15%	15% fruit sprout flour + %85 wheat flour	Sample 2 standard sieve No. 16 with a measurement of 1.18 mm.
Loquat Cookies	25%	25% Loquat flour + 75% wheat flour	sample 1, standard sieve No.10 with a size of 2.00 mm
Loquat Fritters	25%	25% Loquat Flour + 75% Corn Starch	Sample 2 standard sieve No. 16 with a measurement of 1.18 mm.

Products were also produced using the technique of pulping the two foods, partially substituting the main product, such as the chacha fruit fritters, where 70% of the bean mass was replaced by chacha fruit puree, chacha fruit wraps with 80% substitution of the corn mass by chacha fruit puree, and loquat chutney with 100% substitution of the main product.

Regarding the transformation through thermal treatments, two products were developed: chacha fruit cream (prepared by cooking) from a puree and chacha fruit sponge (prepared by refrigeration) from a chacha fruit milkshake for the elaboration of the pickle, scalding, and pH change were used as transformation methods. The product was then laminated with a thickness

of 3 mm, and subsequently, vinegar and water were added in a proportion of 10% vinegar, 85% water, and 5% salt.

Other products, such as loquat yogurt, chacha fruit yogurt, and loquat and milk rice, used the fruit sauce of the two foods as an additive ingredient after preparing the yogurt base and as an accompaniment in the case of the milk rice.

3.4. Sensory panel

A sensory sampling of salted products: Figure 1 shows the results of the sensory evaluation of the six products in the salted category concerning four attributes that correspond to organoleptic characteristics of the foods to be evaluated, such as aroma, texture, appearance, and aroma, where there is a clear preference for the chacha fruit fritter, whose rating on the mixed hedonic scale exceeded 4. The product least liked by consumers was the Chacha fruit wrap, whose rating, although the lowest, does not indicate a total rejection in terms of taste, appearance, texture, and aroma. The products with the highest scores concerning the evaluation of the four attributes were the chacha fruit Fritter, the chacha fruit Cream, and the chacha fruit Pickle. On the other hand, the chacha fruit wrap and the chacha fruit paste received the lowest scores, with appearance and texture being the determining factors in the qualification of these two foods.

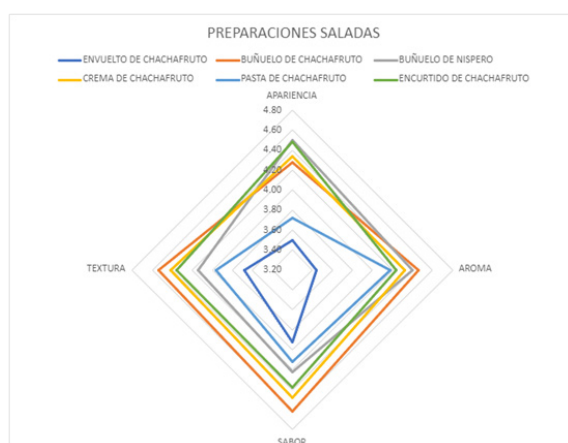


Figure 1: Sensory panel results for savory products
Source: Own elaboration

A sensory sampling of sweet products: Figure 2 shows the results of the sensory panel associated with the nine products of the sweet category evaluated, considering aroma, appearance, flavor, and texture corresponding to the organoleptic characteristics of the foods evaluated; where the most accepted product in terms of flavor was the chacha fruit roscón followed by loquat chancacas and loquat cookies. On the other hand, chacha fruit yogurt obtained the lowest score, followed by loquat yogurt; however, its score was not less than 3.5 on a scale of 1 to 5, indicating that consumers did not entirely reject the product. In terms of appearance, the sponge received the highest rating, while the chutney received the lowest; the aroma of the roscón received the highest rating, and in terms of texture, the loquat jam was the best rated.

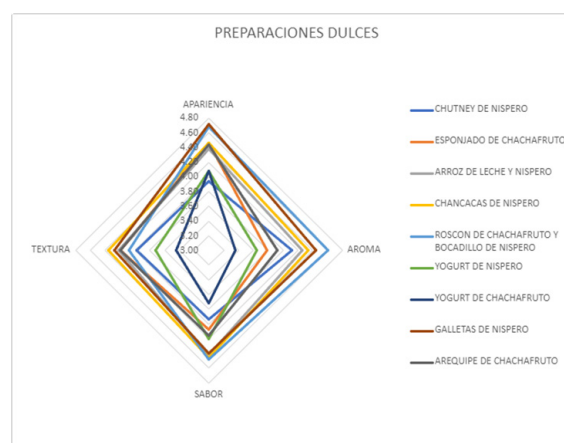


Figure 2: Sensory panel results sweet preparations
Source: Own elaboration

Analysis of Variance by factor (ANOVA)

A 1-way analysis of variance was applied for each attribute with samples grouped in preparations between salty (Table6) and sweet (Table7) compared in their category (Table 5) with the following results.

The Table 6 and the Table 7 show that there are significant differences in the sensory evaluation of both savory and sweet products, respectively.

Table 5: Categories of Sweet and Savory Products

Source: Own elaboration.

Sweet Products	LOQUAT CHUTNEY
	chacha fruit SPONGE
	RICE PUDDING AND LOQUAT
	LOQUAT CHANCACAS
	chacha fruit CAKE AND LOQUAT SNACK
	LOQUAT YOGURT
	chacha fruit YOGURT
	LOQUAT COOKIES
	chacha fruit AREQUIPE
Savory Products	chacha fruit WRAP
	chacha fruit FRITTER
	LOQUAT FRITTER
	chacha fruit CREAM
	chacha fruit PASTE
	chacha fruit PICKLE

Table 6: Analysis of variance: p-value for salted products.

Source: Own elaboration.

Sensory evaluation	p-value	Decision if $\alpha = 5\%$.
Appearance	~ 0 %	Significantly different
Aroma	~ 0 %	Significantly different
Taste	0.28 %	Significantly different
Texture	~ 0 %	Significantly different

Table 7: Analysis of variance: p-value for sweet products.

Source: Own elaboration.

Sensory evaluation	p-value	Decision if $\alpha = 5\%$.
Appearance	0.14 %	Significantly different
Aroma	~ 0 %	Significantly different
Taste	1.93 %	Significantly different
Texture	1.00 %	Significantly different

4. Discussion

Ethnobotanical studies are important because they allow knowing the traditional uses that have been given to the species according to the geographical area where they are conducted; in Bogotá, they have been conducted in popular markets (marketplaces) where a large number

of plants are marketed (Giraldo et al., 2015), in their study they describe the traditional use of medicinal plants from the knowledge and practices in eight marketplaces in the city of Bogotá, in order to identify promising plants for their therapeutic potential and additionally

evidence the possible irrational use that could be generated in the community.

In this research, interviews conducted in Bogotá marketplaces enabled us to determine the number of stalls where these species are commercialized, the quantity of material sold, and the sale price. This exploration allowed us to identify the common names and the most popular uses.

Rubio et al. (2022) emphasize that the plant species used in gastronomy have elements of cultural heritage, community customs, family relationships, ceremonies, myths, legends, emotions, and scents, among others.

The proximate analysis carried out in the case of Chachafruto coincides with that reported by Márquez (2021) in terms of moisture and protein parameters. However, the percentage of fiber differs, as this research reported 3.5%, whereas Márquez (2021) reported 8%. Likewise, the percentage of ash presents a difference.

As for the processing techniques used, the dehydration of the chacha fruit has been carried out in several studies in order to obtain flour, given its nutritional benefits, the methods of adaptation and processing are similar to those carried out by Conda (2021), but for use in dietary supplements in animals, showing promising results in terms of increased bovine milk production.

For loquat, the results of the bromatological analysis coincide with those reported by Navarro and Vega (2023). In addition, several studies have been conducted on the bioactive compounds present, and they have been used to treat various health symptoms, as they have been reported to be analgesic, anti-inflammatory, and antibacterial (Bashir, 2019).

Regarding the loquat transformation processes (Kaunsar & Shinwari, 2020), jam production was also carried out to extend the shelf life of

the raw material and preserve its organoleptic characteristics.

There is a lack of knowledge about the two species under study, both in the local market and among the participants in the sensory panel, which is exacerbated by the limited supply in the market and high prices. The people marketing these foods often lack accurate information about their origins, harvesting seasons, and production areas.

The chacha fruit enjoys greater recognition than loquat among respondents in marketplaces, who report that their consumption level is low. As for the nutritional contribution provided by the consumption of chacha fruit, it complements the daily diet's protein intake, as well as the fiber contribution from loquat consumption. The two species evaluated have high gastronomic potential, given their versatility in preparing both sweet and savory dishes. Their transformation through the application of preservation techniques is feasible; however, the low yield of the two foods during the dehydration process can lead to cost overruns in the production of flour-based products. On the other hand, the flavor of chacha fruit is more suitable for the production of salt products, while loquat is more suitable for sweet preparations.

The sensory panel revealed that both chacha fruit and loquat products received a high level of acceptance from the participants in the two groups that participated in the panel; however, there was a clear preference for loquat products over chachafruit. Of the 15 products submitted to the sensory panel, only three had an average rating below 4: the chacha fruit yogurt, loquat yogurt, and chacha fruit wrap.

Finally, according to the results, the most popular products were Chachafruto roscones with a loquat sandwich, loquat cookies, and Las Chancacas, indicating a preference for sweet foods, especially among children aged 7 to 13 years.

5. Recommendations

It is recommended to continue researching these species, given their potential, by conducting more detailed studies on their nutritional composition and health effects, as well as exploring the benefits

they provide and examining the production costs of the proposals presented. It is necessary to carry out socialization campaigns on how to use and benefit from these species to promote their consumption.

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Media consumption and political orientation. A study on Elections in Spain 2023

Consumo mediático y orientación política.
Un estudio sobre las Elecciones en España 2023

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Media consumption and political orientation. A study on Elections in Spain 2023

Consumo mediático y orientación política.
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Abstract

This study examines the bidirectional relationship between media consumption and ideological orientation in the context of Spain's 2023 General Elections. Using a survey with 1,014 valid responses, the research explores how political preferences influence media selection and, conversely, how media consumption shapes ideological perspectives. It also assesses voters' willingness to diversify their information sources, considering demographic variables such as age and gender.

The findings indicate that while most respondents prefer media aligned with their ideology, younger audiences tend to consult a wider range of sources. Only 17.7% reported having active subscriptions to paid press, with a preference for outlets perceived as neutral. Additionally, 5.9% actively sought media with opposing ideologies. The study concludes that confirmation bias remains dominant, although generational and gender differences influence media consumption patterns.

Keywords: media consumption, ideological positioning, elections, polarization, journalism.

Resumen

El estudio analiza la relación bidireccional entre el consumo de medios y la orientación ideológica en el contexto de las Elecciones Generales de España de 2023. Mediante una encuesta con 1.014 respuestas válidas, se investigó cómo las preferencias políticas influyen en la selección de medios y viceversa. Se evaluó también la predisposición de los votantes a diversificar sus fuentes de información, considerando variables como edad y género.

Los resultados revelaron que, aunque la mayoría prefiere medios alineados con su ideología, los jóvenes muestran una mayor tendencia a consultar fuentes diversas. Solo el 17,7% tiene suscripciones a prensa de pago, con una inclinación hacia medios considerados neutrales. Además, un 5,9% buscó activamente medios con ideologías contrarias.

La investigación concluye que el sesgo de confirmación sigue predominando, pero existen diferencias generacionales y de género en el consumo mediático.

Palabras clave: consumo mediático, posicionamiento ideológico, elecciones, polarización, periodismo.

1. Introduction

The study of media consumption and its influence on ideological positioning has become an essential field of research in the social sciences and communication, being especially relevant in the context of elections, where voting decisions can be significantly influenced by exposure to different types of media. It is precisely for this reason that the present research focuses on the Spanish General Elections of 2023, an event of maximum relevance and crucial to understanding the contemporary dynamics between media, ideology, and electoral behavior.

First, the rationale for the topic lies in the need to understand how the media contributes to political polarization, defined as the process by which public opinions become more extreme and divided, which can have adverse effects on social cohesion and democratic governance. Numerous research studies have demonstrated that the media, particularly those with strong ideological biases, can reinforce individuals' existing beliefs, thereby limiting their exposure to opposing perspectives and exacerbating polarization (Stroud, 2010; Sunstein, 2001; Iyengar & Hahn, 2009; Gentzkow & Shapiro, 2011).

Stroud (2010) analyzed how individuals tend to choose sources of information that align with their own political beliefs, a phenomenon known as partisan selective exposure, which contributes to political polarization by systematically reducing their exposure to information that might challenge their views. For his part, Sunstein (2001) introduced the concept of "echo chambers" in his work to describe how individuals surround themselves with information that reinforces their existing beliefs, which can lead to the radicalization of their opinions and further social polarization. Iyengar and Hahn (2009) examined how preference for ideologically aligned media affected the perception of political reality among voters. They noted that individuals not only prefer media that reinforce their beliefs but also distrust those that present contrary perspectives, thus intensifying political polarization. Finally,

Gentzkow and Shapiro (2011) addressed ideological segregation in both online and traditional media, finding that segmentation of the information market based on consumer ideology is a key factor contributing to polarization.

In line with the latter research, it is worth noting that in an increasingly fragmented media environment characterized by the proliferation of digital platforms and social networks, citizens have an unprecedented ability to select the sources of information they consume. This capacity for personalization enables individuals to create "echo chambers," as referred to by Sunstein (2001), where they only encounter information that confirms their pre-existing beliefs, thereby generating a distorted view of political reality. The study of how this dynamic manifests itself during elections is crucial to understanding its impact on the democratic process. It is one of the main reasons that motivated the present study.

Current media consumption is deeply conditioned by the action of algorithms that select and hierarchize information in social networks, transforming these platforms into editorial actors without precise regulation (Cetina & Martínez Sierra, 2019). This algorithmic logic directly influences the way citizens access political information, favoring ideological bubbles and reducing informational diversity (López-López et al., 2020). Social media have also redefined the communication strategies of parties, promoting a more direct but also more polarized relationship with the electorate (Sierra & Rodríguez-Virgili, 2020). In this environment, large digital platforms act as invisible filters that determine which political discourses achieve visibility (Del Fresno & Daly, 2024).

In turn, political parties integrate automation and micro-segmentation processes that amplify their messages through algorithmic techniques (Campos-Domínguez & García-Orosa, 2018). This set of dynamics presents significant ethical and democratic challenges regarding

transparency, pluralism, and citizen participation in the digital public sphere.

Another key reason for conducting this research is the evolution of media consumption patterns among different demographic groups. Age and gender, in particular, are factors that can significantly influence media preferences and, thus, the formation of political opinions. Young people, for example, tend to consume a wider variety of information sources, including digital platforms and social networks, compared to older generations, who may prefer more traditional media such as television and print newspapers (Mitchell et al., 2016). Understanding these differences is crucial for developing effective political communication strategies that can effectively reach all segments of the population.

On the other hand, the specific context of the 2023 Spanish General Elections provides an ideal setting for this study for several reasons. First, these elections occurred during a period of high political volatility and significant shifts in the media landscape. The emergence of new political parties and increased distrust of traditional media have created an environment in which communication strategies and media consumption play a crucial role in shaping public opinion and voting decisions. Secondly, political polarization in Spain has increased in recent years, with an electorate increasingly divided between opposing ideological options (Camino-Rodríguez, 2021). This phenomenon not only affects social cohesion but also government effectiveness, as it hinders consensus building and the implementation of public policies. Between 2015 and 2023, Spain held four general elections, marked by notable fluctuations in the results and the emergence of new parties, which have significantly transformed the party system traditionally characterized by bipartisanship.

The emergence of these new formations in less than a decade reflects not only the growing ideological fragmentation of the electorate but also its sensitivity to increasingly polarizing and personalized media discourses. Their presence in the political landscape has been interpreted as a response to the crisis of representation, citizen disaffection (Bosch & Durán, 2017),

and the demand for more defined ideological alternatives. This plurality of actors has given rise to more polarized and media-intensive electoral campaigns, in which messages are tailored to specific niches of the electorate, and the media emerge as key channels for consolidating new political identities. In this new context of partisan reconfiguration, the media not only inform the public about the new options but also actively contribute to their legitimization or stigmatization, influencing the way the electorate perceives and evaluates them. Therefore, we believe that understanding how the media contributes to this polarization is fundamental to designing interventions that promote a more inclusive and constructive debate.

The state of the art reflects a rich tradition of research on the interaction between media and politics. From early work in the field of mass communication to more recent research on social networks, scholars have attempted to unravel how the media influences political attitudes and voting behavior. One of the most influential studies in this field is Lazarsfeld, Berelson, and Gaudet's *The People's Choice* (1948), a pioneering work that introduced the idea that the media have a limited impact on changing the political opinions of voters, who tend to select only information that confirms their pre-existing beliefs. This work contradicted the widespread perception that the media could significantly shape public opinions in a unidirectional manner. Wyatt (1998) critically reviewed the enduring influence of Lazarsfeld's work in his article "After 50 Years Political Communication Scholars Still Argue with Lazarsfeld," concluding that although technologies and contexts have changed, the fundamental ideas about the limited effects and influence of opinion leaders remain relevant. Wyatt also highlighted the need to consider the exogenous conditions and campaign events, as referred to by Holbrook (1996), in assessing the relative impact of election debates and other campaign events. Decades later, Lacy and Stamm (2015) reviewed and expanded on the concepts raised in Lazarsfeld's work and, like Wyatt, were able to corroborate the relevance of the original approaches in the modern context, further highlighting the persistence of the limited effects and influence of opinion leaders in the transmission of political information.

In the age of social networks, O'Regan's (2021) work offers a critical update on Katz and Lazarsfeld's personal influence theory. O'Regan argues that the dynamics of interpersonal communication identified by Katz and Lazarsfeld remain valid but are now manifested through social network interactions and the role of influencers. According to O'Regan, communication continues to occur in multiple stages, with opinion leaders and personal networks playing a crucial role in the dissemination and acceptance of political information. The concept of media polarization has also been widely studied, with a notable contribution by Stroud (2010), who explored how individuals tend to selectively expose themselves to information that reinforces their political ideologies, thereby intensifying political divisions by reducing exposure to opposing perspectives. For his part, as discussed above, Sunstein (2001) delved into the phenomenon of "echo chambers" created by the personalization of online information. Sunstein argues that the ability of users to select and filter content on the Internet enables the creation of homogeneous information environments, where individuals interact only with information that reinforces their pre-existing views. This phenomenon, known as "confirmation bias," has significant implications for political polarization and social cohesion.

Finally, the theoretical framework of agenda-setting, introduced by McCombs and Shaw (1972), is also relevant to this study. According to this theory, the media not only reflects reality but also influences public perception of the importance of issues. The authors demonstrated a strong correlation between the issues the media consider important and the issues the public perceives as priorities, suggesting that the media play an active role in shaping the public agenda. Additionally, the work of Zaller (1992) is noteworthy, as it offers a comprehensive understanding of how public opinions are formed and shaped. Zaller introduced the "R-A-S" (Receive-Accept-Sample) model, which describes how people receive, accept, and sample political information, highlighting the influence of ideological predisposition and exposure to media messages.

Nowadays, elections "are perhaps the closest thing to control of government by the people that can be achieved in modern industrialized mass society" (Milbrath, 1972, p. 154). During election periods, the role played by the media assumes special relevance as the flow of information intensifies and strategies of political persuasion are redefined. The media have become especially influential, both because of the aforementioned agenda-setting, which prioritizes specific issues in the public sphere, and because they frame the political debate in ideological terms, thereby configuring frameworks of interpretation that favor or penalize specific political proposals and actors. Media coverage during campaigns can alter the perception of candidates and key issues, affecting both the voting decision and the level of citizen participation. In this sense, contextualizing media consumption within the electoral cycle—in the weeks prior to the Spanish General Elections—allows us not only to understand the intensity of information use but also how electoral behavior is articulated through processes of selective exposure, framing, and polarization.

Subscription to paid media—whether digital or print—has become a significant variable for analyzing the relationship between citizens and the media, given that it implies an active commitment to specific editorial lines, levels of news quality, and journalistic sustainability models. Recent studies suggest that individuals who pay for access to news content tend to exhibit higher levels of political interest, a more critical attitude toward free information, and greater loyalty to media they perceive as credible or ideologically aligned. In this sense, "individuals change their source of information when they detect that the editorial line of the media has been modified," which revalidates "that political predispositions intervene in the loyalty of audience niches" (Humanes, 2014, p. 795).

Therefore, the inclusion of the subscription variable enables the analysis of not only the frequency of media exposure but also the perceived quality of the content and its relationship with the user's ideology, which justifies its incorporation as an analysis variable.

Several studies have highlighted that electoral periods are moments of intensified information, characterized by increased frequency of media consumption, which also becomes more selective and ideologically charged, justifying a more detailed analysis of media consumption under electoral pressure. The joint analysis of variables such as media subscription, content consumption, and ideological orientation aims to provide a comprehensive and nuanced view of the dynamics of information consumption in contemporary electoral processes.

As far as political ideology is concerned, it is one of the most studied concepts in political science. In a changing and polarized sociopolitical scenario such as the current one (McCoy et al., 2018), it is gaining increasing analytical relevance. In this study, political ideology is understood in terms of ideological self-placement on a left-right scale, a criterion widely used in research on polarization, electoral behavior, and selective exposure. Although the binary scheme of ideologies should be qualified due to its simplifying character in an increasingly fragmented and complex political reality, the scale remains a valid tool for capturing general ideological orientations and analyzing how they influence media consumption. In particular, its use allows us to examine the relationship between ideological affinity and media preferences, a key link to understanding the construction of information niches and loyalty to related media.

Based on an analysis of the state of the art, the following research objectives and hypotheses are proposed to comprehensively address the relationship between media consumption and ideological positioning during the 2023 Spanish General Elections. Thus, the primary objective is to examine the impact of media consumption on the ideological orientation of voters during the electoral process. This objective aims to comprehensively understand how media preferences influence ideological positions and how this relationship manifests in a specific electoral context.

The purpose of this study is to identify and describe trends in paid media subscriptions, as

well as general patterns of media consumption during the pre-election period. It also seeks to explore how media preferences relate to voters' political ideologies and to examine demographic differences in these patterns, paying special attention to variables such as age and gender. Another objective is to evaluate the impact of exposure to ideologically biased media on political polarization. Ultimately, the goal is to provide recommendations that foster more balanced and critical media consumption among voters.

The research is based on three main hypotheses:

- H1. The first hypothesis posits a significant relationship between media consumption and the ideological positioning of voters in Spain. This hypothesis is based on previous studies that have shown how media preferences reflect and reinforce individuals' political ideologies. Research, such as Lazarsfeld et al. (1948) and Stroud (2010), has pointed to the tendency of voters to be exposed to media that confirm their pre-existing beliefs, suggesting a significant connection between media consumption and ideological stances.
- H2. The second hypothesis suggests that media consumption patterns vary significantly by demographic factors such as age and gender. This hypothesis stems from observations in recent studies that reveal differences in media preferences among various demographic groups. For example, Mitchell et al. (2016) found that young people tend to diversify their information sources more compared to older generations, while Stroud (2010) identified differences in selective exposure based on gender.
- H3. Finally, the third hypothesis proposes that exposure to media with strong ideological biases contributes to political polarization among voters. This hypothesis is supported by confirmation bias theory and Sunstein's (2001) research on "echo chambers," which suggests that voters who primarily consume media aligned with their ideologies tend to intensify their political beliefs, leading to greater polarization.

2. Materials and methods

The methodology of this study focuses on conducting a representative survey covering various demographic parameters, with special emphasis on gender and age. This survey was conducted in June and July 2023, coinciding with the weeks preceding the Spanish General Elections. The study design included 1014 valid surveys, distributed among six age groups: 18-24, 25-34, 35-44, 45-54, 55-64, and 65+, distributed according to the current percentage distribution:

- 18 to 24 years old: 10.3%.
- 25 to 34 years old: 13.5%.
- From 35 to 44 years old: 19.2%.
- From 45 to 54 years old: 18.9%.
- From 55 to 64 years old: 15.3%.
- Older than 65 years old: 22.8%.

To ensure the representativeness of the sample, a structured questionnaire was used, addressing key issues related to access to information, subscriptions to paid platforms, and the influence of political ideologies on media selection. The questionnaire was divided into two main blocks. The first block focused on general aspects of media consumption, including paid media subscriptions and ideological influence on media choice. The second block focused on the specific context of the July 2023 election campaign, using this juncture as a "laboratory" to examine the information dynamics and test the validity of the research hypotheses.

The data obtained were grouped and analyzed using absolute and relative frequencies, as well as statistical contrast methods, to evaluate the significance of the results. Two main statistical tests were employed: the Student's t-test and the chi-square test (χ^2), both with a 95% confidence level. The Student's t-test is a fundamental statistical tool in this study. Its primary function is to compare the means of one or two samples with known population means or to directly compare the means between two samples (Härdel & Simar, 2019). The choice of this test is justified by its effectiveness in situations where sample sizes

are relatively small, and the variance between groups is not known a priori, which are common conditions in research across various disciplines. The application of the Student's t-test in this study followed a rigorous approach, starting with the verification of the assumptions necessary for its implementation. These assumptions include the normality of the data distribution and the homogeneity of variances between the compared samples.

The results of the Student's t-test provide crucial evidence on the presence or absence of statistically significant differences in the analyzed data. A p-value less than 0.05 (for a 95% confidence level) indicates that the differences between the means are statistically significant, suggesting that these differences are unlikely to be due to chance. Conversely, a p-value greater than 0.05 suggests that there is insufficient evidence to claim a significant difference between the means compared. Careful interpretation of these results is essential to draw valid conclusions from this study. The statistical significance identified through the Student's t-test enables the detection of relevant patterns and trends within the data, significantly contributing to the understanding of the underlying dynamics in the research area.

The chi-square test (χ^2), on the other hand, is a nonparametric statistical test widely used to investigate whether distributions of categorical variables differ from theoretical or expected distributions. In the context of this research, the chi-square test has been employed to evaluate hypotheses regarding the relationship between categorical variables, providing a rigorous method for determining whether observed differences between data segments are statistically significant. The chi-square test procedure begins with the formulation of a contingency table that summarizes the observed frequencies of the events or characteristics studied, distributed in various categories.

The calculated χ^2 value is then compared with a critical value of the chi-square distribution, which depends on the desired confidence level (commonly 95%) and the degrees of freedom of the test (typically the number of categories minus one). If the χ^2 value exceeds the critical value, the null hypothesis is rejected, indicating that there are statistically significant differences between the observed and expected frequencies. This interpretation is crucial for determining the validity of the hypotheses put forward and for better understanding the relationships between the variables studied.

The questionnaire used in this study consisted of two main blocks. The first block was dedicated to the issue of access to information and subscriptions to paid platforms and newspaper paywalls, as well as the influence of political ideologies on media selection. This block also covered local press, radio, and television consumption, allowing for a comprehensive assessment of respondents' media behavior. The second block used the July 2023 election campaign in Spain as a contextual framework to test all questions related to news flows in a particular situation. This approach enables us to examine how informative dynamics impact electoral behavior, utilizing the campaign as a natural laboratory to test the validity of hypotheses and research questions.

In summary, the methodology of this study is based on a representative survey design that encompasses key demographic parameters and uses robust statistical methods to analyze the data. The combination of the Student's t-test and the chi-square test allows for a detailed and rigorous assessment of the significant differences and relationships between the variables studied, providing an in-depth understanding of the dynamics between media consumption and ideological positioning in the context of the 2023 Spanish General Elections. This methodological approach ensures that study findings are valid and reliable, making a significant contribution to academic knowledge on the influence of the media in contemporary politics.

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3. Results

The analysis of the data collected through the survey reveals several significant findings regarding the media consumption and ideological positioning of voters in the 2023 Spanish General Elections. In this section, we will break down these results, presenting both general trends and specific differences according to different demographic parameters, such as age and gender.

Of the total number of respondents, only 17.7% reported having an active subscription to paid newspapers. Figure 1 illustrates the breakdown

of these data by ideological positioning. It shows that nearly half of the respondents (48%) indicated, according to their assessment, that they do not have subscriptions to media with a clear ideological stance. Only 10% admitted to subscribing to publications aligned with their ideology. This finding suggests that a large majority of respondents prefer media that they perceive as neutral or do not identify with a specific ideology, which may indicate a search for objectivity or a distrust of clearly ideologized media.

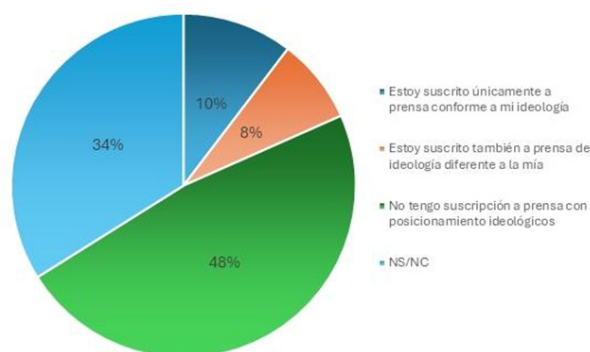


Figure 1: Subscription to press and platforms from the perspective of ideological positioning.

Source: Own elaboration

When analyzing the responses from the perspective of age, we find notable differences. Thus, people between 18 and 24 years of age tend to subscribe more to media with ideologies contrary to their own, contrasting with those in the 55 to 64 age range, who show the least inclination to do so (Table 1). This pattern may reflect a greater openness and desire for exposure to diverse perspectives among young people, possibly influenced by their increased use of the Internet and social networks, where it is more common to encounter a variety of viewpoints. In contrast, older age groups may show a stronger preference for ideological consistency and confirmation of their pre-existing beliefs.

Another important aspect of the study is the total media consumption during the General Elections, which includes paid media as well

as print and free-to-air mass media (MCM). The results indicate that 59% of respondents admitted to having sought out MCM with opposing ideologies to contrast or expand their perspective. In comparison, 12.7% claimed to have consulted sources other than their political ideals specifically to reaffirm their own beliefs. This finding highlights the presence of a substantial group of voters who actively seek to balance their information intake. However, most people still prefer to consume media that aligns with their ideologies.

In terms of gender, there are apparent differences. Women tend to consume more MCMs that align with their ideology compared to men, and in turn, they are less likely to turn to ideologically opposed sources.

Table 1: Total media consumption during the last General Elections (pay wall + press and free-to-air MCM).

Source: Own elaboration based on the survey.

Significance Level: 95%.		Total	Man	Woman
	Total	1014	498	516
I have only consumed information in media close to my ideology.	22,2	18,7-	25,6+	
I have consumed, for the most part, media close to my ideology, but I have also sought some information in neutral media that I had not previously consumed.	22,5	23,3	21,7	
I have consumed, for the most part, media close to my ideology, but I have also sought some information in contrary media that I had not previously consumed.	22,2	26,9+	17,6-	
I discovered new media and found them interesting, without thinking about their ideology.	14,5	14,1	14,9	
I have discovered new media, contrary to my ideology, and I thought it was interesting to contrast.	5,9	5,6	6,2	
I have searched for media contrary to my ideology, just to confirm my opinion.	12,7	11,4	14,0	

This pattern may reflect differences in how men and women process information and seek confirmation of their beliefs. Additionally, it may be influenced by various social expectations and gender roles that impact media exposure and consumption.

Contrary to what might be expected, significant differences by age are minimal, with one notable exception: voters aged 45-54 are more likely to consult sources they perceive as neutral. This trend stands out, especially in comparison to the 35-44 and 55-64 age groups, where interest in these types of sources is lower. This finding suggests that middle-aged individuals may be at a stage in their lives where they seek to balance diverse information and opinions, perhaps due to their work and family responsibilities that require a broader and more nuanced understanding of political issues.

A control question included in the survey was, "Have you followed more media and newspapers

that you usually do not follow during the election campaign?" The result confirms the findings described above, as 77% of voters stated that the election campaign had not affected their usual MCM consumption. This suggests that, although elections generate an increase in news activity, most voters tend to maintain their established consumption patterns, which may reflect the depth of confirmation bias and resistance to change in media preferences.

The results of this survey provide a detailed insight into how Spanish voters consume media about their ideological orientation. Demographic differences in media preferences and the general tendency to seek information that confirms pre-existing beliefs underscore the importance of considering these factors when analyzing the media's impact on politics. These findings not only contribute to academic knowledge about the influence of media but also have practical implications for the formulation of more effective communication strategies and the promotion of more critical and balanced media consumption.

4. Discussion

The results of this research confirm the existence of a significant relationship between media consumption and the ideological orientation of voters in the context of the 2023 General Elections in Spain. The data indicate that, although the majority of respondents prefer to

consume media aligned with their ideology, there is a tendency among young people to diversify their information sources. This finding suggests that new generations may be more willing to be exposed to different political perspectives, which contrasts with the trend observed in

previous studies, such as Valera-Ordaz et al. (2021), Stroud (2010), and Sunstein (2001), who described a reinforcement of confirmation bias and the formation of "echo chambers" in news consumption patterns. The difference observed in this research could be linked to the transformation of the media ecosystem, where digital platforms and social networks have diversified the information options available and have facilitated access to content of different ideological tendencies. However, this apparent informative openness should be interpreted with caution since exposure to diverse media does not necessarily guarantee greater plurality in the construction of political opinions. Studies, such as those by Mitchell et al. (2016), have pointed out that, although young people access a variety of information sources, their consumption may be conditioned by recommendation algorithms that reinforce their previous preferences, thereby limiting the impact of media diversity. In this sense, although the data suggest that young people have a greater predisposition to consult sources with different ideological approaches, it cannot be stated with certainty that this leads to a reduction in political polarization, as suggested by Waisbord (2020).

In terms of methodological comparison, this study aligns with previous research that has employed surveys as a primary tool to assess media consumption and its relationship with political ideology (Gentzkow & Shapiro, 2011; Endersby, 2011). However, a key difference is that this research has specifically explored the dynamics of information consumption during a specific election period, which provides a more contextualized view of how citizens access information at times of high political polarization. Unlike longitudinal studies that analyze long-term trends (Iyengar & Hahn, 2009), this research focuses on a specific event, which allows us to identify consumption patterns in a small but representative time frame. This approach has both strengths and limitations. On the one hand, it provides a detailed snapshot of how voters consume information in an electoral context, enabling us to analyze the immediate effects of media coverage and the influence of political discourse on the construction of public opinion. On the other hand, focusing on a specific

moment does not allow us to assess whether these consumption patterns remain stable over time or whether they are subject to variations depending on the political and media context.

Another relevant methodological difference in previous studies lies in the way generational, and gender differences in the selection of information sources have been addressed. While previous research has analyzed media consumption in general terms, this study has placed particular emphasis on how these demographic factors influence the diversification or restriction of voters' information diet. The identification of trends, such as the greater predisposition of young people to consume diverse sources and the lesser inclination of women to seek out media with opposing ideologies, provides a more nuanced understanding of the phenomenon, complementing the contributions of authors like Pereira-López et al. (2023). These differences suggest that political communication strategies and media literacy should consider not only the ideology of voters but also the sociodemographic characteristics that influence their information habits.

In addition, this research presents a detailed analysis of the role of paid versus free media, an aspect that has been less explicitly addressed in previous studies. The data obtained show that citizens who opt for subscriptions to paid media tend to prefer those considered neutral or without a clear ideological affiliation, which opens new questions about the impact of media funding on the perception of media credibility and the construction of public debate. This finding raises the need for further research on whether media with subscription models exert a different influence on the formation of public opinion compared to those that rely exclusively on advertising or open access.

Regarding the interpretation of the data, the results show that only 17.7% of respondents have active subscriptions to paid press, which raises questions about the sustainability of quality journalism in an information ecosystem where free and open-access sources predominate. This finding is consistent with previous research that has pointed to a decrease in the willingness to

pay for news in digital contexts (Gentzkow & Shapiro, 2011). However, the novelty of this research lies in the differentiation between free and paid media consumption according to voter ideology, which allows inferring that media considered neutral have a higher probability of attracting subscribers than those with a clearly defined political orientation. This data suggests that the perception of impartiality remains a significant factor in trust in the media, an aspect that has been widely debated in studies on journalistic credibility (Tsfati & Cappella, 2003; Masip et al., 2020).

The fact that most voters prefer to consume media without an explicit ideological orientation opens a debate about the concept of objectivity in contemporary journalism. While some authors have argued that the media should assume a clear editorial stance to avoid false equivalence between unequal positions (Bennett, 2016), the results of this study suggest that a significant part of the public seeks information in media they perceive as unbiased. However, this does not necessarily imply less polarization, as the perception of neutrality may be mediated by the recipient's own beliefs. Research, such as that of Gunther (1992), has shown that individuals tend to consider as "objective" those media that align with their ideological framework, which could explain why certain media with a defined editorial line continue to be perceived as neutral by some segments of the audience.

Another point to highlight is the influence of free access on the selection of information media. Access to content without economic restrictions could be affecting voters' willingness to pay for quality information, which represents a challenge to the sustainability of independent journalism. In this sense, studies such as those by Chyi and Yang (2009) have shown that, although citizens value quality information, they are rarely willing to pay for it if they have free access to news through social networks or digital platforms. This has important implications for the future of journalism, as subscription-based business models may not be viable if the public does not perceive significant added value in paid content. In turn, the prevalence of free media with advertising-based funding models may

incentivize the production of content designed to maximize virality rather than informative depth, which could contribute to the spread of biased or decontextualized news.

Ultimately, the low rate of paid media subscriptions reflects not only a preference for free media but also a trend toward information diversification inaccessible platforms. The apparent contradiction between the search for neutral media and the persistence of confirmation bias requires a deeper analysis of how voters construct their perception of impartiality in today's media environment. The increasing influence of algorithms in news distribution and content personalization may significantly shape this perception, suggesting the need for future research that combines quantitative and qualitative methods to assess the relationship between trust in media, willingness to pay for information, and consumption habits in the digital age.

A relevant aspect to consider is the low proportion of citizens who actively seek information in media with opposing ideologies (5.9%). This data reinforces the hypothesis that selective exposure is still predominant in most voters, which coincides with studies such as those of Lazarsfeld et al. (1948), Lacy and Stamm (2017), Valera-Ordaz (2023) and Doménech-Beltrán (2024), who pointed out that voters tend to expose themselves to information that reinforces their pre-existing beliefs. However, the existence of a small percentage of voters who deliberately consume media contrary to their ideology could indicate a possible evolution in information habits that deserves further exploration in future studies.

This finding is relevant in the context of the debate on media polarization and fragmentation of the information ecosystem. Most theoretical models have suggested that information consumption is organized around "echo chambers" (Sunstein, 2001), where citizens primarily interact with content aligned with their values and beliefs, thereby reinforcing their political identity and limiting exposure to divergent perspectives. However, the presence of a sector, albeit a minority, of the population that deliberately

seeks out media with a different ideological orientation, could suggest the existence of a still incipient disposition towards a more pluralistic media consumption. This behavior is especially relevant in the case of young voters, who, as the data in this study indicate, tend to diversify their information sources more than older generations.

The fact that a small percentage of voters actively consume opposing media can be explained from different perspectives. One possible interpretation is that these individuals seek to contrast information to reinforce their position rather than being open to changing their minds. Previous research has shown that exposure to contradictory information does not always lead to a change in attitude. However, in some cases, it may further strengthen pre-existing beliefs, a phenomenon known as the "backfire effect" (Nyhan & Reifler, 2010). Another possibility is that these mostly young voters face a more digitalized and less ideologically structured media environment, where access to diverse information is easier than in traditional formats.

Among the anomalous results is the fact that 77% of the respondents affirm that their media consumption did not vary during the electoral campaign. This finding contrasts with previous literature, suggesting that election periods tend to increase the search for political information (McCombs & Shaw, 1972). One possible explanation lies in the increasing personalization of media consumption, driven by algorithms that filter information based on a user's interests. Alternatively, this could suggest a growing disinterest in traditional media coverage of political campaigns, raising questions about the role of the media in electoral mobilization and shaping public opinion.

In terms of novel contributions, this research highlights the importance of generational differences in media selection and the impact of digitization on exposure to ideologically diverse information. The tendency of young people to seek out more varied sources could be interpreted as an indicator that future generations will be less influenced by confirmation bias and more open to informational diversity. This aspect merits further investigation in future studies.

5. Conclusions

In light of the research results, and based on the proposed objectives and hypotheses, as well as the obtained findings, several conclusions can be drawn that encompass both theoretical and practical aspects.

The first hypothesis, which posited a significant relationship between media consumption and voters' ideological positioning, is confirmed by the data obtained. The results show that a large majority of respondents prefer to consume media that they perceive as neutral, although a considerable percentage choose media aligned with their ideology. This reinforces the theory of confirmation bias, which suggests that individuals tend to seek information that reinforces their pre-

existing beliefs. This finding is consistent with previous studies, such as those by Lazarsfeld et al. (1948) and Stroud (2010), which have demonstrated how voters tend to select information that confirms their existing views. In this context, media consumption not only reflects existing ideologies but can also intensify them, contributing to political polarization. Voters who actively seek out media with opposing ideological biases represent a minority, indicating a general tendency toward consolidation of pre-existing beliefs rather than openness to new perspectives.

The second hypothesis proposed that media consumption patterns vary significantly according to demographic factors such as age and gender.

The results confirm this hypothesis, showing apparent differences in media preferences between different demographic groups. In terms of age, 18-24-year-olds tend to subscribe to media with ideologies contrary to their own more than any other age group. This trend may reflect a greater openness and desire for exposure to diverse perspectives among young people, influenced by their increased use of the Internet and social networks. In contrast, older age groups, especially those between 55 and 64, tend to show a lesser inclination to consume media with opposing ideologies, instead preferring media aligned with their own beliefs.

Gender analysis reveals that women tend to consume more media aligned with their ideology compared to men and are less likely to seek out ideologically opposing sources. This difference may be related to the distinct ways in which men and women process information and seek confirmation of their beliefs, as well as social expectations and gender roles that influence their media consumption.

The third hypothesis suggested that exposure to media with marked ideological biases contributes to political polarization among voters. The results obtained indicate that a significant 66.9% of voters prefer media with related ideologies, although a considerable portion also explores options they consider neutral. The general tendency towards consuming media that aligns with one's ideologies confirms the theory of confirmation bias and "echo chambers" described by Sunstein (2001). This practice can intensify existing political beliefs and contribute to further polarization, as individuals constantly receive information that reinforces their views and is rarely exposed to opposing perspectives.

These findings also enable us to explore the transformations of the information ecosystem about perceptions of media impartiality and the value assigned to paid media. One of the most noteworthy findings is that, despite only 17.7% of those surveyed subscribing to paid press, there is a clear preference for media perceived as neutral, suggesting that the subscription model

could remain viable if it guarantees quality and editorial independence. A key finding from the control question is that 77% of voters reported that the election campaign did not alter their usual media consumption. This suggests that, despite the intensified news activity during elections, voters tend to maintain their established consumption patterns. This finding reflects the depth of confirmation bias and resistance to change in media preferences, indicating that election campaigns have a limited impact on altering voters' information consumption habits.

The findings of this study have several practical implications for political communication and the formulation of media strategies. First, the results suggest the need to promote a more balanced and critical media consumption among voters. Given that most voters tend to seek information that confirms their pre-existing beliefs, it is crucial to develop educational programs and awareness campaigns that encourage critical evaluation of information and exposure to diverse perspectives. Additionally, policymakers and communication professionals should consider demographic differences in media preferences when developing communication strategies. For example, campaigns targeting young people could benefit from a greater presence on digital platforms and social networks. In contrast, campaigns for older age groups should focus more on traditional media and ideological consistency in messaging.

Likewise, this study opens new lines of research focused on the longitudinal analysis of news behavior during different electoral processes, as well as evaluating the effectiveness of media literacy programs in counteracting confirmation bias. In addition, the results prompt us to consider the importance of cultivating a media-critical citizen who can recognize ideological biases in news content and value plurality as a crucial element in democratic societies. Ultimately, it is crucial to address political polarization by fostering dialogue and interaction among individuals with diverse perspectives. The media can play a key role in this effort by providing balanced and diverse coverage, avoiding the creation of "echo chambers" that only reinforce existing divisions.

6. Recommendations

The findings of this research highlight the influence of media consumption in the consolidation of ideological beliefs and its role in political polarization. Based on these results, several recommendations can be made both in the academic field and in the design of communication strategies and public policies. First, it would be advisable to encourage a more balanced media consumption through media literacy programs that promote exposure to diverse sources. Additionally, the development of tools that facilitate the comparison of news from different perspectives could help mitigate confirmation bias. Second, there is a need to investigate other factors that influence media selection, such as educational level, socioeconomic context, and the use of social networks, which could modify these dynamics. Likewise, given that this study focuses on a specific electoral moment, it would be beneficial to conduct longitudinal analyses that enable us to evaluate the evolution of news habits across different political and social contexts. From a methodological perspective, the

inclusion of qualitative approaches, such as in-depth interviews or focus groups, would facilitate a deeper understanding of the decision-making processes involved in selecting information sources. Likewise, it is worth noting that this work has certain limitations, including its quantitative approach and focus on a single electoral context, which invites future research to broaden the time frame and incorporate comparative designs that enhance the external validity of the results. Finally, it is essential to examine the impact of new digital formats, in particular social networks and recommendation algorithms, on the configuration of political orientation. To this end, experimental studies could assess whether exposure to diverse news in these environments has a real impact on reducing polarization. In conclusion, future research should consider mixed methodologies and comparative approaches to broaden the understanding of the link between media and ideology. From an applied perspective, it is essential to design educational and political strategies that encourage more critical and pluralistic media consumption.

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Differences in the use of learning strategies in university education students

Diferencias en el uso de estrategias de aprendizaje en estudiantes universitarios de educación

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Differences in the use of learning strategies in university education students

Diferencias en el uso de estrategias de aprendizaje en estudiantes universitarios de educación

Abstract

Given that university students may have different ways of organizing themselves to learn, the use of learning strategies in students belonging to three education careers at the University of Cuenca was investigated. A quantitative approach was used, the CEVEAPEU questionnaire was applied to evaluate 25 learning strategies to a sample of 305 university students and the differences that may exist in the use of strategies were analyzed among: careers, year of study and gender of the students. It was found that there were significant differences in the use of 14 learning strategies among the three careers investigated; that men used more motivational and affective strategies, while women handled learning skills better; and that in the first year of studies there was a greater use of motivational strategies and those that favor memoristic learning. It is important to know how students use learning strategies, because this facilitates the design of educational strategies according to the context of the groups investigated.

Keywords: learning strategies, education careers, CEVEAPEU, gender, Ecuador.

Resumen

Dado que los estudiantes universitarios pueden tener distintas formas de organizarse para aprender, se investigó el uso de estrategias de aprendizaje en estudiantes pertenecientes a tres carreras de educación en la Universidad de Cuenca. Se usó un enfoque cuantitativo, se aplicó el cuestionario CEVEAPEU para evaluar 25 estrategias de aprendizaje a una muestra de 305 estudiantes universitarios y se analizó las diferencias que pueden existir en el uso de estrategias entre: carreras, el año de estudios que cursan y el género de los estudiantes. Se encontró que habían diferencias significativas en el uso de 14 estrategias de aprendizaje entre las tres carreras investigadas; que los hombres usaron más estrategias motivacionales y afectivas, mientras, las mujeres manejaron mejor las habilidades para aprender; y que, en el primer año de estudios hubo un mayor uso de estrategias motivacionales y de las que favorecen el aprendizaje memorístico. Es importante conocer cómo los estudiantes emplean las estrategias de aprendizaje, porque esto facilita el diseño de estrategias educativas acordes al contexto de los grupos investigados.

Palabras clave: estrategias de aprendizaje, carreras de educación, CEVEAPEU, género, Ecuador.

1. Introduction

High school students often lack compelling reading and study habits, instead relying on memorization and mechanical problem-solving, which hinders their understanding of the tissues. Therefore, they do not develop their critical and reflective capacity (Colonia & Mejía, 2015). Young people often limit themselves to following instructions given by the teacher, and this dependence does not allow them to have control over their study methods. Navarrete and López (2024) explain that there is still a predominance of the active figure of the teacher and the consequent passivity of the student.

Once young people enter the University, they find themselves in a new environment where the teacher no longer gives them instructions or guides them in their studies; they must self-regulate the pace of their preparation and learn independently. Navarrete and López (2024) indicate that teachers often overlook what happens in the classroom and to the students. Colonia and Mejía (2015) explain that these problems can cause students to experience difficulties with their academic performance, leading them to fail or drop out of their university studies.

However, during this transition, they do not know how to organize themselves to study; they are familiar with procedures that are not very efficient in achieving quality learning. In this regard, Huamán et al. (2024) mention that new university students do not have a good understanding of what they read, and soon after, they no longer remember it, nor do they have a good command of technology, which makes it difficult for them to integrate into higher Education. Bravo et al. (2020a) note that some students have low self-esteem, little confidence in their abilities, and do not possess adequate techniques to study and memorize subjects, which hinders their ability to achieve satisfactory academic performance. Therefore, Contreras (2021) says that students must adapt to the new demands of the University, learning more efficient ways of organizing themselves to achieve significant learning.

In college, Bravo et al. (2020b) explain that some careers and subjects are very rigorous and challenging; this forces young people to learn new ways that are more efficient to study, to change their study habits, and to organize themselves to make their efforts, they understand that many factors can affect their studies. They must be strategic to achieve quality learning. Aldana-Rabanales (2022) notes that the use of learning strategies becomes important as individuals gradually learn them through interaction with their peers, acquire new study methods, regulate their efforts, and employ efficient strategies to achieve their academic objectives.

Regarding learning strategies, Acevedo (2016) notes that they are mental processes that students plan to apply to a specific topic, enabling them to understand it, give it meaning, and learn from it. For Masso and Fonseca (2024), learning strategies are deliberate and planned activities that guide the actions to be taken to achieve the set objectives. When students learn to employ learning strategies consciously, they can achieve their academic objectives more efficiently and engage in meaningful learning (Rodriguez et al., 2024).

López del Río and Artuch (2022) explain that there is no single learning strategy that is inherently better than another; instead, these must be adapted to each specific task or activity intended to be performed. Vásquez (2021) suggests that students should plan and monitor their learning process, regulating the appropriate use of strategies to achieve their goals. When rational learning strategies are employed and supported by motivation and cognitive factors, students achieve better academic performance (Gavín-Chocano et al., 2024).

Gargallo et al. (2009) proposed an instrument that integrates various proposals of the time in search of a comprehensive questionnaire, which they called CEVEAPEU. This questionnaire was designed to evaluate learning strategies among

university students and was applied in Spanish universities to validate its effectiveness. Chiner et al. (2020) explain that this proposal overcomes the limitations of previous questionnaires by adapting them specifically to higher Education and integrating motivational, metacognitive, and cognitive strategies.

In its structure, the CEVEAPEU questionnaire proposes three major dimensions related to learning: wanting, deciding, and being able. The first dimension, according to López et al. (2018), is related to the student's motivation, capacity to learn, physical state, mood, and the control they can exert over anxiety and stressful situations. For Rodríguez et al. (2024), these strategies initiate the learning process and sustain the student's effort to learn. Masso and Fonseca (2024) explain that motivation helps students learn and achieve better academic performance.

The second dimension investigated by the questionnaire, deciding to learn, according to Vera et al. (2019), are strategies that are related to the recognition, control, and self-regulation that students have of their ways of learning, i.e., that they manage to monitor their progress and make adaptations to their ways of learning to achieve the academic goals they have set for themselves. Regarding metacognitive strategies, Rodríguez et al. (2024) explain that when students use them, they can monitor and control their cognitive processes. According to López et al. (2018), the use of these strategies enables students to identify their strengths and weaknesses and then decide how to optimize their learning.

The third dimension, being able to learn, implies a series of strategies that enable the student to acquire skills, process information, and better understand it, ultimately having the capacity to generate the required responses (Huamán et al., 2024). These strategies are also referred to as cognitive and involve the student's use of processes such as codification, comprehension, and evocation of knowledge for learning (Masso & Fonseca, 2024). In the CEVEAPEU questionnaire, this dimension is subdivided into two: the strategies that help students obtain quality information and those that enable them to process and use the information (López et al., 2018).

This research aims to investigate whether there are differences in the use of learning strategies among university students concerning three variables: the career to which they belong, the year of study, and the student's gender. López-Aguado (2011) justifies the need for teachers to adapt their teaching methods to the specific characteristics that their students may have, and to demonstrate this, she studied how they used learning strategies and whether there are differences in their use in the variables: career to which they belong, year of study and gender.

López-Aguado (2011) also evaluated the use of learning strategies and autonomous work and found that there are significant differences between the careers he investigated; thus, those in Engineering go deeper into their studies, those in Work Sciences use collaborative strategies, those in Education make an effort to conceptualize and are participative, those in Biology are planners, while those in Law prepare more for their exams. Regarding the career they study, Chiner et al. (2020) explain that there are differences in the use of learning strategies according to the type of studies they pursue. Also, López-Aguado (2011) found these differences in the use of learning strategies between science and education students.

Regarding the use of strategies according to the year in which they study, López-Aguado (2011) found that there is a decreasing use of extension strategies as students advance in their studies; that is, as they progress, there is less effort to delve deeper into the topics. Aldana-Rabanales (2022) explains that students transition from school learning, where they focus on memorizing and mechanically reproducing topics, to the conscious use of learning strategies and the achievement of learning based on the construction of meaning. For their part, Chiner et al. (2020) suggest that university students, as they progress in their studies, employ increasingly effective strategies.

Regarding the gender of students and whether there are differences in the use of learning strategies, Romero et al. (2024) found differences in their use between men and women. Romero (2017), in his doctoral thesis, identified eight publications that revealed differences in the use

of learning strategies based on the gender of the students. Doná et al. (2010) found differences in the use of learning strategies between men and women, especially in those related to information processing.

2. Methods

The purpose of this research was to determine whether there are differences in the use of learning strategies among university students in the following variables: degree program, year of study, and gender. For this purpose, we worked with a quantitative approach, a non-experimental cross-sectional design, and a correlational scope (Hernández et al., 2010).

2.1. Participants

The research was conducted at the University of Cuenca, Ecuador, with students from three education programs: pedagogy of national and foreign languages, basic education, and

pedagogy of mathematics and physics. The three careers totaled a population of 786 students. A random sample of 305 students was taken, which represents a confidence level of 95% and a margin of error of 4.4%. The sampling technique used was stratified, which according to Lind et al. (2008) is intended to ensure that each group of interest is represented in the sample. It was considered to obtain a sample where the three careers investigated, the gender of the students and the different years in which they are studying are represented, those students who are not regular and simultaneously take subjects at different levels are denominated as credits (Table 1).

Table 1: Characteristics of research participants
Source: Own elaboration.

Program	Gender	Año en que cursan sus estudios				Credits	Total
		First Year	Second Year	Third Year	Fourth Year		
Pedagogy of National and Foreign Languages	Men	9	6	6	7	3	31
	Women	17	10	11	10	6	54
Basic Education	Men	6	7	8	5	3	29
	Women	14	13	20	11	9	67
Pedagogía de Matemáticas y Física	Men	11	18	5	9	7	50
	Women	14	27	8	15	10	74
Total		71	81	58	57	38	305

2.2. Instrument

The research proposed the use of a questionnaire called CEVEAPEU to evaluate learning strategies in university students. This questionnaire was proposed, validated, and used by the researchers Gargallo et al. (2009), who developed it in Spanish and have widely applied it in research on this topic. The questionnaire is structured to assess three dimensions: wanting, deciding, and being able. The dimension of wanting, according

to Ortega and Mello (2020), is related to the group of motivational strategies and affective components. The second dimension, power, relates to the metacognitive strategies employed by the student and the control they have over decisions to self-regulate their learning (Beltrán, 2003). The third dimension assessed by the questionnaire, power, is related to the way students select, process, and use information to learn (López et al., 2018).

The CEVEPEAU questionnaire comprises three dimensions, divided into six subscales, which encompass 25 learning strategies and are evaluated using 88 items (Table 2). Each item is answered through a Likert scale with five response options. The questionnaire is available in the article published by Gargallo et al. (2009).

For the analysis of results, the answers given were transformed into scores, as stated in the research by López et al. (2018), as follows: strongly disagree (1 point), disagree (2 points), undecided (3 points), agree (4 points), and strongly agree (5 points).

Table 2: Structure of the CEVEPEAU questionnaire
Source: Gargallo et al. (2009) questionnaire..

Dimension	Subscale	Strategy	Item No.
Willing	Motivational strategies	Intrinsic motivation	1,2,3
		Extrinsic motivation	4,5
		Task value	6,7,8,9
		Internal attributions	10,11,14
		External attributions	12,13
		Self-efficacy and expectations	15,16,17,18
		Intelligence as modifiable	19,20
	Affective components	Physical and emotional state	21,22,23,24,
		Anxiety	25,26,27,28
Deciding	Metacognitive strategies	Awareness of objectives and evaluation criteria	30,31
		Planning	32,33,34,35
		Self-evaluation	29,36,39
		Self-regulation	37,38,40,41,42,43
	Context control, social interaction and resource management	Context control	44,45,46,47
		Social interaction and learning with peers	48,49,50,51,52,53
Being Able	Search and information selection strategies	Knowledge of sources and information search	54,55,56,57
		Information selection	58,59,60,61
	Processing and information use strategies	Information acquisition	66,67,68
		Elaboration	62,63,64,65
		Organization	69,70,71,72,81
		Personalization and creativity, critical thinking	73,74,75,76,77
		Storage. Memorization. Use of mnemonic resources	80,82,83
		Storage. Simple repetition	78,79
		Transfer. Use of information	86,87,88
		Resource management for using acquired information	84,85

2.3. Procedure

The CEVEPEAU questionnaire was transcribed into the Google Forms program, which allows users to answer surveys through digital devices. The questionnaire was administered to the students after informing them of the research's purpose, explaining the use to be made of the data they provided, requesting their voluntary participation, and obtaining their informed consent. The students completed the questionnaire

on their computers or mobile devices and took between 15 and 30 minutes.

The information was processed using the SPSS V27 package. In the analysis, it was determined that the data were not normal, so nonparametric tests were applied. To compare the two groups, the Mann-Whitney U test was applied, which was used to compare the use of learning strategies between men and women. According to Webster (2000), this test is used to contrast the equality

of two populations when the assumption of normality is not met.

To compare three or more groups, the Kruskal-Wallis test was used to compare the use of learning strategies in the three different careers

and also to compare the use of learning strategies in the different years of study. For Levin and Rubin (2004), this nonparametric test establishes whether there is equality or a difference between groups when more than two independent populations are involved.

3. Results

Regarding the use of learning strategies in the three careers investigated, Pedagogy of mathematics and physics, Basic Education, and Pedagogy of national and foreign languages, it was found that there are significant differences in 14 of the 25 learning strategies analyzed by the CEVEAPEU questionnaire, it should be considered that the score can be between a minimum of 1 and a maximum of 5 points. The analysis is presented below.

Concerning the dimension of wanting to learn, the students of the Mathematics and Physics Pedagogy career reached the highest score in three strategies: Value of the task (4.56), this implies that they give much importance to the subjects they learn; also in the strategy Self-efficiency and expectations (4.20) which indicates that they are confident in their abilities to achieve the goals they set for themselves; and, in the strategy Physical and mood state (3.33) where they consider that they are well, that they rest enough and stay encouraged to learn. Regarding the strategy of External Attributions (2.85), it is observed that some students in the Pedagogy of Foreign National Languages program believe that their success depends on chance or third parties.

On the dimension of deciding to learn, which refers to the control they have over their learning process, the students of Mathematics and Physics Pedagogy and Basic Education show a better level of use of the strategy Knowledge of objectives and evaluation criteria (3.99 for both), meaning that the students are aware of the objectives

of the subjects they take and how they will be evaluated; while, in the strategy Self-evaluation (3.86) the students of Basic Education reach the best score, indicating that the students know what their strengths and weaknesses are for studying and learning.

When analyzing the dimension of learning, which refers to the use of techniques and tools to learn, the Mathematics and Physics Pedagogy students achieve the highest score in two strategies: Knowledge of sources and search for information (3.57). This indicates that they know where to find sources of information to study, and the strategy of selecting information (3.75) evaluates the student's ability to focus on relevant information.

In the six remaining strategies, the students of the Basic Education program achieve the best scores, which reflects a higher level of use of these strategies: Acquisition of information (3.79) which indicates that students relate their notes with information obtained from other sources; Elaboration strategy (4.27) means that they read their notes and information until they achieve a good understanding of the topics they study; in the Personalization, creativity and critical thinking strategy (3.88) explains that they reflect on what they are learning in order to reach a deeper understanding of the topics.

Basic Education students also achieved the highest score in the strategy Storage, memorization and use of mnemonic resources (3.80), which indicates that they use specific techniques to

easily remember specific topics; the strategy Transfer and use of information (4.13) explains that they can apply what they have learned in real life situations, and the strategy Management of

resources to use the acquired information (3.98) means that in order to speak or write, they first structure and give form to their ideas. All this can be seen in Table 3.

Table 3: Learning strategies that have significant differences with the other careers.

Source: Own elaboration

Dimension	Learning Strategy	Pedagogy of National and Foreign Languages (Mean)	Basic Education (Mean)	Pedagogy of Mathematics and Physics (Mean)	H Kruskal-Wallis	(p)
Willing	Task value	4,19	4,5	4,56	29,76	<0,001
	External attributions	2,85	2,44	2,6	9,86	<0,010
	Self-efficacy and expectations	3,96	4,07	4,2	6,5	<0,050
	Physical and emotional state	3	3,12	3,33	9,27	<0,010
Deciding	Knowledge of objectives and evaluation criteria	3,54	3,99	3,99	23,22	<0,001
	Self-evaluation	3,61	3,86	3,83	7,04	<0,050
Being Able	Knowledge of sources and information search	3,06	3,4	3,57	22,3	<0,001
	Information selection	3,51	3,71	3,75	6,7	<0,050
	Information acquisition	3,18	3,79	3,57	23,93	<0,001
	Elaboration	3,99	4,27	4,14	9,55	<0,010
	Personalization, creativity, critical thinking	3,57	3,88	3,72	9,53	<0,010
	Storage, memorization, mnemonic resources	3,69	3,8	3,41	11,33	<0,010
	Transfer, use of information	3,79	4,13	3,95	11,63	<0,010
	Resource management to use acquired information	3,82	3,98	3,74	7,33	<0,050

When analyzing the use of learning strategies in the different years of their studies, six were identified that showed significant differences. It stands out that the highest scores for five of them were achieved in the first year.

In the dimension of wanting to learn, the strategy Intrinsic Motivation reaches the maximum value in the first year with 4.56, meaning that they arrive at the University with interest and curiosity to study and learn; the strategy Extrinsic Motivation, with a maximum of 3.59 in the first year, explains that, especially at the beginning of their university studies, they feel supported by those people who support them and are attentive to their studies.

In the dimension of learning, the strategy of information acquisition reaches its maximum value of 3.65 in the first and second years, indicating that students connect their notes with information obtained from other sources to broaden their knowledge of the subject they are studying. In the strategy of Storage, memorization, and use of mnemonic resources, they achieved the highest score of 3.75 in the first two years of their studies, which suggests that, especially at the beginning of their studies, they must memorize certain topics and apply specific techniques to aid them.

The strategy Storage and simple repetition have their highest value in the first year, reaching 3.35, which indicates that they arrive at the University with the habit of learning by heart the topics

without understanding them; with time, the use of this strategy decreases to 3.14 in the second year, 2.87 in the third year, and 2.86 in the fourth year, that is, they stop memorizing and start using strategies that favor critical thinking. The strategy management of resources to use the acquired information has the highest score in the second

year, reaching 4.02. This strategy is related to how the student prepares to use the information previously. No significant differences were found in the dimension of deciding to learn, related to metacognition and self-learning, across the different years of study (Table 4).

Table 4: Learning strategies with significant differences according to the year in which they are studying

Source: Own elaboration

Dimensión	Estrategia de Aprendizaje	Primero (Media)	Segundo (Media)	Tercero (Media)	Cuarto (Media)	H Kruskal Wallis	(p)
Querer	Motivación intrínseca	4,56	4,35	4,45	4,33	10,21	<0,050
	Motivación extrínseca	3,59	3,34	3,33	3,11	10,5	<0,050
Poder	Adquisición de la información	3,65	3,65	3,32	3,6	12,66	<0,050
	Almacenamiento, memorización, rec. mnemotécnicos	3,75	3,75	3,28	3,64	11,62	<0,050
	Almacenamiento, simple repetición	3,35	3,14	2,87	2,86	10,18	<0,050
	Manejo recursos para usar información adquirida	3,89	4,02	3,28	3,75	10,16	<0,050

When the use of learning strategies was analyzed by student gender, it was found that significant differences existed in seven of the 25 analyzed strategies.

In the dimension, wanting to learn, three learning strategies have significant differences in their level of use; in the first two, men achieve the highest score; in the strategy Self-efficiency and expectations, with 4.17, which has to do with the conviction they have of their ability to learn and achieve what they propose; the other strategy, Physical and emotional state, with 3.28, has to do with the level of rest and the feeling of wellbeing they have.

In the remaining five learning strategies, it is women who achieved the highest scores and level of use, as follows: on the Anxiety strategy, which assesses the reaction that students have to situations that cause them stress, women achieved a score of 3.67, indicating that women tend to be more nervous when taking a test or giving a presentation.

In terms of learning, women generally exhibit a higher level of utilization of these strategies than men. In the Elaboration strategy, they achieved a score of 4.21, indicating that students read their notes and other documents to understand the topics. In the Organizational strategy, they achieved a score of 3.79, indicating that they effectively underlined, used summaries, elaborated on graphic organizers, and employed other techniques to understand the topics they studied.

Regarding the strategy of Storage, memorization, and the use of mnemonic resources, women with a score of 3.78 have a higher level of use of this strategy, which means that they organize information more effectively to achieve effective learning. Regarding the strategy for managing resources to utilize the acquired information, they achieved a score of 3.93, which translates to better preparation before using the information. No significant differences were found between men and women in the dimension of Deciding to learn, related to self-learning and metacognition (Table 5).

Table 5: Learning strategies that have significant differences according to gender.

Source: Own elaboration

Dimension	Learning Strategies	Men (Mean)	Women (Mean)	U Mann-Whitney	(p)
Willing	Self-efficacy and expectations	4,17	4,05	9186	<0,050
	Physical and emotional state	3,28	3,11	9043,5	<0,050
	Anxiety	3,46	3,67	8442,5	<0,050
Being Able	Elaboration	4,03	4,21	9083	<0,050
	Organization	3,35	3,79	8076	<0,001
	Storage, memorization, mnemonic resources	3,32	3,78	7764,5	<0,001
	Resource management to use acquired information	3,68	3,93	9278	<0,050

4. Discussion

When analyzing the research findings concerning the career variable, it was found that significant differences existed in 14 of the 25 learning strategies assessed by the CEVEAPEU questionnaire.

The strategies with the highest use in the mathematics and physics course were five: Value of the task (4.56), Physical and mental state (3.33), Knowledge of objectives and evaluation criteria (3.99), Knowledge of sources and search for information (3.57) and the information selection strategy (3.75). Those with the highest use in the Basic Education course were nine: Self-efficacy and expectations (4.07), Knowledge of objectives and evaluation criteria (3.99), Self-evaluation (3.86), Acquisition of information (3.79), Elaboration (4.27), Personalization, creativity and critical thinking (3.88), Storage, memorization and use of mnemonic resources (3.80), Transfer and use of information (4.13), and the strategy of Management of resources to use information (3.98): Pedagogy of national and foreign languages had the highest score in the strategy of External Attributions (2.85).

It is observed that, in the Mathematics and Physics Pedagogy course, as in the Basic Education course, there are five strategies with the highest use in the three dimensions investigated; in the

Basic Education course, there are nine strategies most used in the three dimensions, and in the National and Foreign Languages Pedagogy course there was one with the highest score. In this regard, López-Aguado (2011) explains that many elements of the educational process, including methodologies, approaches to learning, and the way young people study, which are specific to each career, are considered in the career variable. He also found that students in technical careers are not as strategic as those in education careers and that the latter make better use of learning strategies (López-Aguado, 2011). Coincident with these results, Chiner et al. (2020) conducted their research in three careers: early childhood education, primary Education, and architecture, and found significant differences in eight learning strategies, with architecture students having a lower level of use of these strategies.

Concerning the variable, year of study, significant differences were found in six learning strategies, five of them with the highest level of use in the first year of study: Intrinsic motivation (4.56), Extrinsic motivation (3.59), Acquisition of information (3.65), Storage, memorization and use of mnemonic resources (3.75), and Storage, simple repetition (3.35), and the strategy Management of resources to use acquired information (4.02) with a higher level of use in

the second year of studies. For these six learning strategies, there is evidence of higher use in the first years of study, among them two that involve rote learning. No significant differences were found for the remaining 19 strategies.

The results of this research align with those presented by Chiner et al. (2020), which found that first-year students employed memorization strategies more frequently. Meanwhile, it differs from the findings of López et al. (2018), who found that, when comparing students in the first five semesters with those studying in the last five semesters, the latter had a higher level of use in 24 of the 25 strategies. Additionally, they conclude that young people are able to learn strategically throughout their studies. For their part, Romero et al. (2024) found no relationship between the year of study and learning strategies in their research.

When analyzing the students' gender variable, significant differences were found in seven learning strategies out of the 25 investigated; two had a higher level of use among men, and five among women. Thus, the strategies of Self-efficacy and expectations (4.17) and Physical and mood (3.28) were used more by men. In contrast, Anxiety (3.67), Elaboration (4.21), Organization (3.79), Storage, memorization, and use of

mnemonic resources (3.78), and Management of resources to utilize the acquired information (3.93) had the highest levels of use in women. Women scored higher in the Anxiety strategy and the last four strategies related to information processing, indicating that they know how to obtain, process, and utilize information more effectively to learn.

In the research of Lopez et al. (2018), females employed the External Attributions strategy, as well as three strategies related to information processing: planning, Organizing, and Managing resources to utilize the acquired information. In males, the Anxiety strategy scored the highest. López-Aguado (2011) explains that, in her study, women achieved a higher level of use of the strategies of collaboration, conceptualization, planning, exam preparation, and participation than men.

Regarding learning strategies, López et al. (2018) suggest that teachers should promote activities in their students that address individual differences and favor learning and academic achievement. For this, it is essential to understand how they learn and the strategies they employ so teachers can plan activities that maximize their students' learning and academic achievement.

5. Conclusions

From this research on the use of learning strategies by university students, the following conclusions are drawn:

Concerning the career they study, significant differences were found in 14 of the 25 strategies, highlighting that, in the career of Pedagogy of Mathematics and Physics, the strategy, value of the task, reaches the highest score with 4.65/5, which indicates that the students are motivated and give great importance to the topics they have to learn as part of their training. In the Basic Education course, the strategy of Elaboration stands out above the other courses, with a rating of 4.27/5,

indicating that students make an effort to deepen their understanding of the subjects they are learning. In the course of studying the pedagogy of national and foreign languages, the highest score among the other courses investigated is for the strategy of external attributions, with 2.85/5, indicating that students consider their results to depend on chance or third parties and do not trust their abilities.

When analyzing the variable 'year of study, significant differences were found in 6 of the 25 learning strategies investigated. Five strategies have a higher level of use in first-year students:

intrinsic motivation with 4.56/5, which explains the interest they have in pursuing their studies; the extrinsic motivation strategy with 3.59/5, indicates that they have people who support them and are attentive to them; the information acquisition strategy with 3.65/5 means that they study from various sources of information to improve their understanding of the topics. The strategy of Storage, memorization, and use of mnemonic resources received a rating of 3.75/5, indicating that they employ various techniques to memorize specific topics. Similarly, the strategy of Storage and simple repetition, with a rating of 3.35/5, means that they learn through successive repetitions without fully understanding the topic. The strategy of managing resources to utilize the acquired information reached a score of 4.02/5 in the second year of studies; this is related to how the student prepares for an exam or a presentation. No significant differences were found in the use of metacognitive strategies for this variable.

Regarding the gender variable, significant differences were found in 7 of the 25 learning strategies investigated. Men achieved the highest score in two strategies: self-efficiency and expectations, with 4.17/5, which means that they are confident in their abilities to succeed in their studies, and the second strategy, physical and mental state, where they achieved 3.28/5, where they consider that they sleep and rest sufficiently, and are encouraged to study. Women, on the

other hand, achieved the highest score in five strategies: anxiety with 3.67/5 indicates that they become more nervous when they have to take a test or make a presentation; in the elaboration strategy, they reached 4.21/5 this indicates that they carefully read their notes to understand the topics they study; in the organization strategy with 3.79/5 it means that they make graphs, diagrams and summaries which makes it easier for them to understand what they study; the strategy of Storage, memorization and use of mnemonic resources reached 3.78/5, which explains that they use specific techniques to memorize some topics; and, the strategy of resource management to use the information acquired with 3.93/5, which indicates that before answering a question they remember what they have studied and order their ideas.

It is crucial to understand how students organize themselves to study and the learning strategies they employ, as this enables teachers to design educational strategies that cater to the specific characteristics of their students.

This research was conducted in three careers of Education at the University of Cuenca. It is essential to deepen the investigation of learning strategies in order to understand how students learn in different careers that involve other areas of knowledge.

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Prior training and current legislation: impact on the development of didactic units

Formación previa y legislación vigente: incidencia en la elaboración de unidades didácticas

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Prior training and current legislation: impact on the development of didactic units

Formación previa y legislación vigente: incidencia en la elaboración de unidades didácticas

Abstract

The didactic unit manifests the programmatic structure of the teacher for the implementation of the teaching-learning process. Despite its relevance, it is a genre with little research on the difficulties of its production. Thus, through the application of a taxonomic tool of analysis, this study aims to analyze the variation of the difficulties and omissions presented by students of the Master's Degree in Teacher Training in the production of this genre, taking as variables the educational legislation (LOMCE and LOMLOE) and the previous training of the students. For this purpose, 96 didactic units produced by Master's students during three academic years (2020-2021 to 2022-2023) are analyzed. The legislative variable shows variations (lower difficulty index with LOMLOE than with LOMCE) and, likewise, so does the previous training (lower difficulty in Humanities compared to areas such as Psychology, Science or Mathematics). In conclusion, these two variables have implications that must be addressed from the didactic point of view within the teaching-learning process of the programmatic action.

Keywords: curriculum design, educational legislation, learning difficulties, previous training.

Resumen

La unidad didáctica manifiesta la estructura programática para la implementación del proceso de enseñanza-aprendizaje. A pesar de su relevancia, se trata de un género con escasas investigaciones en torno a las dificultades de su producción. A través de la aplicación de una herramienta taxonómica este estudio tiene por objeto analizar la variación de las dificultades y omisiones que presentan los estudiantes del Máster en Formación del Profesorado en la producción de dicho género tomando como variables la legislación educativa (LOMCE y LOMLOE) así como su formación previa. Método: Se analizan 96 unidades didácticas producidas por estudiantes del Máster durante tres cursos académicos (2020-2021 a 2022-2023). Resultados: La variable legislativa evidencia sufrir variaciones (menor índice de dificultad con LOMLOE que con LOMCE) e, igualmente, la formación previa también (menor dificultad en Humanidades frente a áreas como Psicología, Ciencias o Matemáticas). Discusión: Estas dos variables refieren implicaciones que deben ser respondidas desde el punto de vista didáctico dentro del proceso de enseñanza-aprendizaje de la acción programática.

Palabras clave: dificultades de aprendizaje, diseño curricular, formación previa, legislación educativa, unidad didáctica.

1. Introduction

There is a fundamental competence for teachers: the ability to develop classroom programs. It is a technical task that is part of the teacher's daily work. However, curriculum design (CD) extends beyond technical development, with additional implications, as programming integrates scientific and didactic knowledge, transferring the results of research and educational innovations. This process considers adaptation to current legislation and various contextual conditions (Vílchez & Perales, 2018).

From a competency perspective, one of the main challenges faced by teachers is understanding the importance of classroom programming for their professional development. This involves designing and developing it according to the prescriptive curriculum, adapting it to the reality of each educational center, and specifying it in programs. The curricular implementation that programming implies is reflected as a complex task (Rodríguez, 2010), but it is necessary because it is where teachers contextualize the curriculum, enabling informed decision-making.

The competence of developing programs through Didactic Units (DU) requires a set of sub-competences, such as considering the purposes of education, knowledge of the educational community, application of the curriculum, management of the current curricular framework, and the basic knowledge of each subject; knowledge of the psychosocial characteristics of students; integration, according to various pedagogical assumptions, of the disciplinary and didactic field; adequacy of teaching and learning strategies, organization of learning activities and group/class management (Rodríguez, 2010). In addition, the authors of this study incorporate the application of evaluation processes by the curriculum and didactic assumptions.

Indeed, the complexity of implementing CD in classroom programs through DU is determined by the various variables involved in its development

and its qualities: legislative, contextual, curricular, didactic, and formative. In this scenario, this study considers two variables that can offer another perspective on understanding this complexity and, thus, generate teaching-learning processes that address these difficulties: the legislation in force and the student's previous training. On the one hand, the aim is to fill the existing gap in the literature on the Identification of the difficulties that may arise from the programmatic practice of students in training and, on the other hand, to provide an empirical action on the influence of the two variables mentioned in this task, which has not been studied so far. This aims to contribute to didactic actions that can improve teaching-learning practices in these programmatic tasks.

Thus, this research aims to analyze the variation of the difficulties and omissions (D&O) posed by the production of DU of students of the Master's Degree in Teacher Training (MFP), considering the educational legislation as a factor that determines the structure and content of the curriculum, and the previous training of the students. For this purpose, a corpus of 96 DUs produced in the Master's program during three academic years (2020-2021 to 2022-2023) is analyzed.

1.1. Educational legislation and previous training: their influence on the learning process of curriculum design.

The curricular activity in basic education is currently in a transitional phase, as the LOMLOE was implemented in the 2023-2024 academic year following the repeal of the LOMCE. Thus, it is interesting to highlight how both educational legislation and curricular decrees determine specific orientations regarding the meaning and treatment of the elements that constitute the CD and, consequently, the development and production of the DU. These orientations have an impact on the disposition of the basic structure of the curricular elements and their relationships. Regarding the layout of the structure, Figure 1 shows the differences between the two legislations:

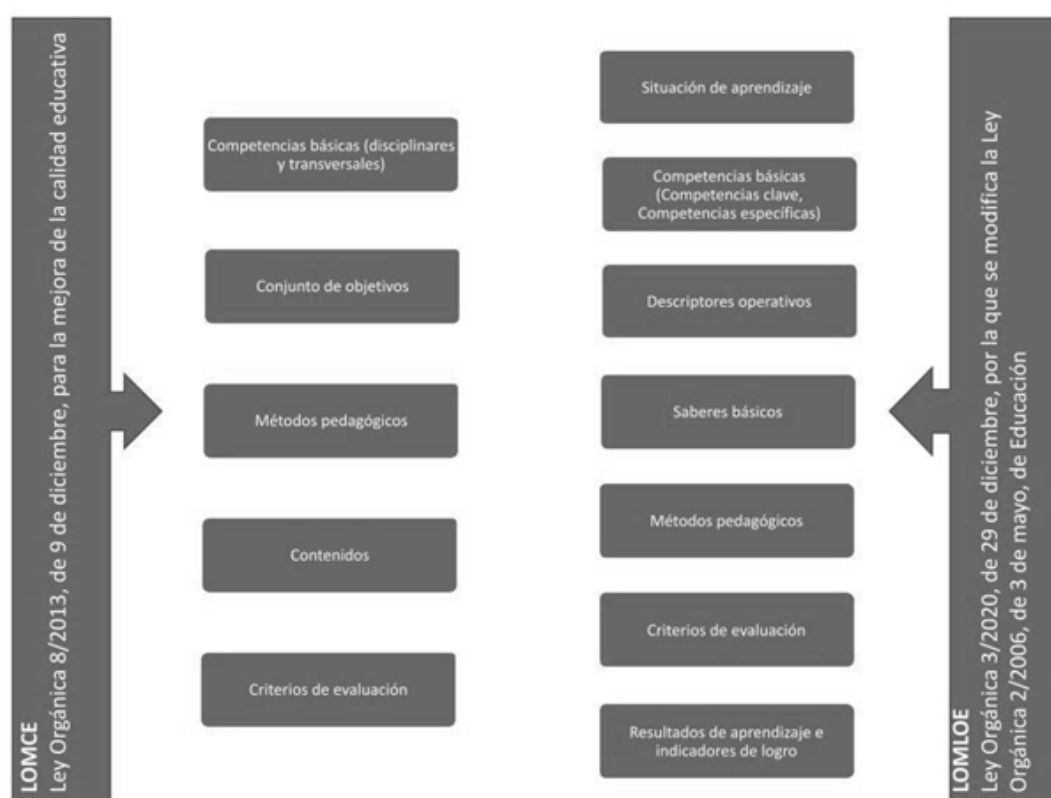


Figure 1: Nuclear elements of LOMCE and LOMLOE.

Source: Own elaboration.

The LOMLOE incorporates a new element that is significant and marks a notable difference: the catalytic effect of the learning situation (SA). While the LOMCE presents the problem situation as a tool for integrating curricular elements, the LOMLOE integrates them in the Context of a specific area (SA) and relation to the meaning and interconnection of competencies (Luengo et al., 2021). While the LOMCE emphasizes objectives and content, the LOMLOE focuses on competencies, including what is to be learned, how it is to be achieved, and how it is to be evaluated (Coll & Martín, 2021).

Figure 2 shows the relationship between all the elements of didactic programming in LOMCE and LOMLOE:

The SA, within the SU, acts as an axis that unites and integrates the rest of the elements, giving rise to a systematic programming based on the development of competencies (LOMLOE)

beyond the mere description and development of each curricular element, whose axis is the contents (LOMCE). This systemic character provided by the ES reflects a conception of integrated learning based on the development of competencies. It begins with the Context in which students live, presenting a problem to be solved and applying the key and specific competencies that correspond to the situation, as specified in learning objectives that, in turn, build upon the basic knowledge. The competencies provide descriptors and evaluation criteria, which enable the Identification of learning, thereby facilitating the evaluation process.

This reorganization of curricular elements is not exclusive to the Spanish Context. In various countries, legislative reforms have presented similar challenges in terms of designing didactic units and implementing programmatic didactic proposals. Studies conducted in Ecuador (Villagómez, 2012), Chile (Castro, 2017; Camus-

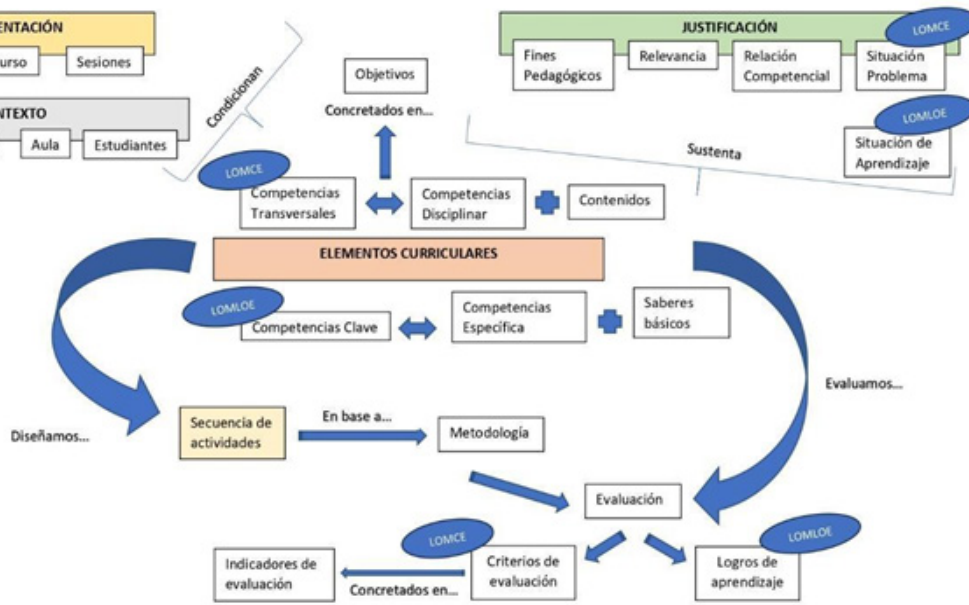


Figure 2: Relationship of DU elements.

Source: Own elaboration.

Camus & Vergara-Núñez, 2023) or Mexico (Cuevas-Cajiga & Moreno-Olivos, 2022) have shown that the transition to new curricular frameworks generates specific difficulties in didactic design, especially among trainee teachers. Thus, the present study is part of a global debate on the challenges faced by future teachers in interpreting and applying renewed curricular frameworks in their programmatic practices, which reinforces the need to analyze the effects of legislative reforms on the development of programmatic competencies in initial teacher education.

On the other hand, and in conjunction with the elements involved in educational legislation, it is essential to start from a fundamental premise: the importance of prior learning for future teachers related to the pedagogy and didactics of each field of knowledge. Previous ideas about how to teach and gaps in disciplinary content can lead to understanding teaching work as a simple sum of the discipline to be taught and how to teach it (Caamaño, 2013) without considering the need to integrate them. In this sense, in the Spanish Context, Toma, Meneses, and Greca (2019) evidenced that students with a background in science but without a solid pedagogical base

presented greater difficulties in designing didactic units based on inquiry. Consistently, international studies (Nilsson, 2008; Friedrichsen et al., 2011; Gess-Newsome et al., 2019) have shown that the level of previous pedagogical and didactic knowledge significantly conditions the quality of the proposals designed by future teachers. Thus, the present study is part of an international debate on the impact of initial training and prior knowledge on the development of programmatic competencies in teacher education.

This circumstance should lead to deepening knowledge of the discipline and reflecting on the didactic implications of teaching it (Sánchez & Valcárcel, 2000), as well as the need to reconstruct pedagogical thinking through flexible schemes and actions that allow for analyzing the Context of the teaching-learning process. According to Sánchez and Pericacho (2022), students who take the MFP come with a clear understanding of what the teaching-learning process entails, having gained this knowledge through their experience, training, and cultural environment. There is no doubt that this background will shape their beliefs about what the teaching profession entails and how they approach their learning in the Master's degree. From this perspective, it can be considered that

the internal structure of a discipline and the type of tasks they performed in their previous training can influence the way they approach learning and its outcomes (Monroy, 2013).

1.2. Teaching units: definition and production difficulties associated with graduate students.

Since the appearance of the Organic Law 1/1990, of October 3, 1990, on the General Organization of the Educational System (LOGSE), and the Organic Law 2/2006, of May 3, 2006, on Education (LOE), the UD's have been established as a fundamental tool for the concretion of the teaching programmatic practice. In this line, the latest legislation, Organic Law 8/2013, of December 9, for the improvement of educational quality (LOMCE), and Organic Law 3/2020, of December 29, amending Organic Law 2/2006, of May 3, on Education (LOMLOE), reflect this importance by consolidating this academic and professional genre (Meza et al., 2021).

The UD is understood as an “ordered set of the elements of the teaching-learning process that are linked to each other in terms of interrelation” (Escamilla, 1993, p.12), which, in addition, require the linking of all the elements that allow generating the didactic practice (Rodríguez, 2010). This provides the DU with a unique value for understanding and designing pedagogical actions. Indeed, the coherence between the elements of the curriculum brings cohesion to the whole process by promoting a practice adapted to a specific group of students, taking into account the learning to be developed and the various didactic elements necessary to make this possible, such as methodological approaches or the timing and organization of spaces (Fernández-Cruz, 2004).

In structural terms, the production approaches of the UD genre, determined by legislation and curricula, have made it possible to observe that, although a continuum is maintained in the structural composition, the relational logic of the design poses more or less significant differences. Thus, according to a review of the existing literature (Gamboa, 2007; Rodríguez, 2010; Toma et al., 2017), it is concluded that the DU

has a relatively stable rhetorical and structural framework (beyond changes in the nomenclature of its elements). Figure 3 shows the components of the genre and its communicative functions:

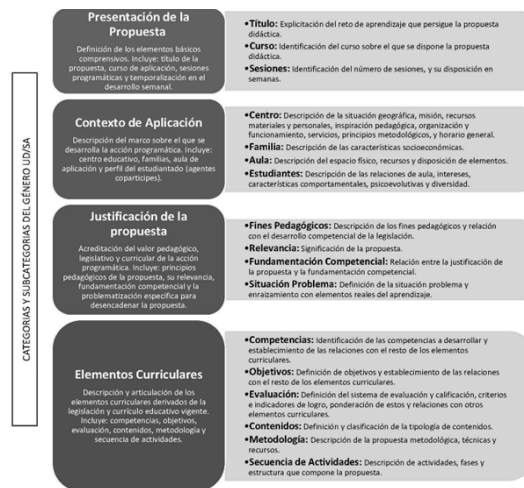


Figure 3: Rhetorical components of DU.

Source: Own elaboration based on Gamboa 2007; Rodríguez, 2010; Toma et al., 2017.

The UD is a fundamental tool that specifies all teaching-learning processes, where teachers must demonstrate more than sufficient competencies (Gamboa, 2007) to design, relate, and develop curricular elements. This leads to the conclusion that the design and development of the curriculum through the DU is not only where the elements are found and described but also where the coherent relationship between them is demonstrated (Cancelo, 1994).

Indeed, it is assumed that UD design is not an immediate process based on simple routines (Cañal et al., 2004). This suggests that the CD poses certain D&O in the students' production, which is evident in the deployment of the different curricular elements and in the arrangement of the framework that comprises the UD genre. This difficulty has been widely acknowledged by previous research, which warns that the absence of specific training or the lack of integration between curricular components can affect the quality of the design (Monroy, 2013; Gess-Newsome et al., 2019). Below (Figure 4), the categories and subcategories of the taxonomy difficulties and omissions in the production of DU analyzed in this study are reflected:

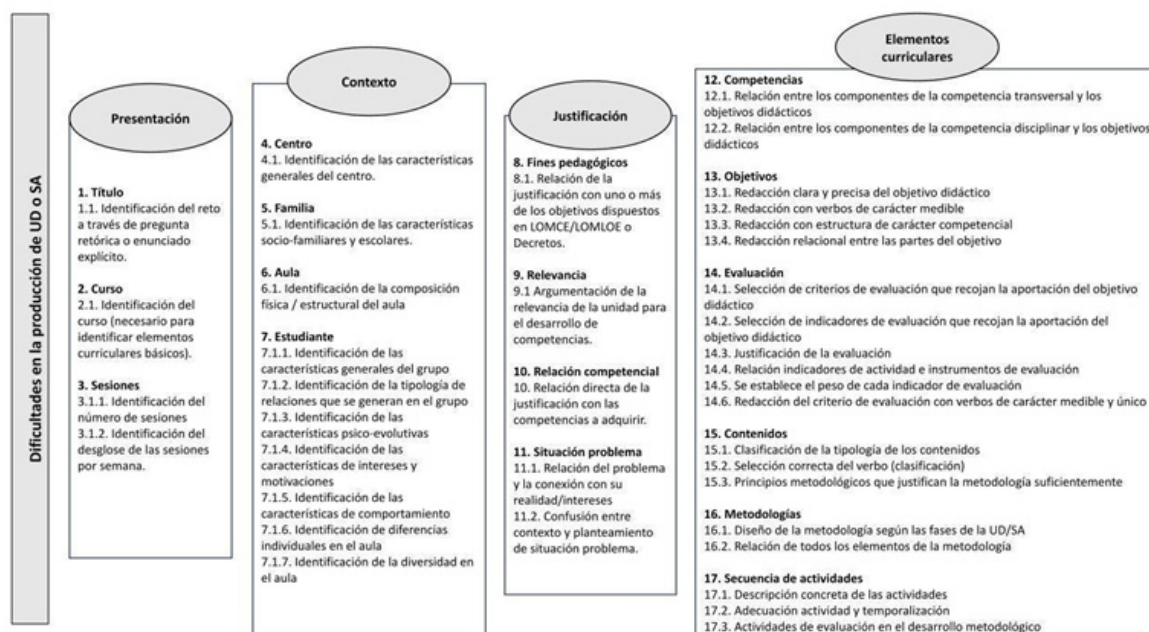


Figure 4: Taxonomy of difficulties and omissions in the production of DU.

Source: Own elaboration.

Considering all the above, the general objective is to compare the variation of D&O in the production of DU among MFP students, taking into account two nominal variables: current legislation and previous training. For the fulfillment of this objective, the following specific objectives are broken down:

1. To compare the degree of recurrence and density per document of D&O in the production of DUs according to the legislation applied (LOMCE and LOMLOE).

2. To compare the degree of recurrence and density per document of the D&O in the production of the DUs, according to the different previous training (Physical Education -PE-, Psychology -Ps., Languages -Id., Humanities -Hum., and Natural Sciences, Mathematics and Statistics CNME-).

2. Materials and Methods

2.1. Methodological design

This research is developed from a quantitative, contrastive approach (Creswell & Creswell, 2018), which provides measures of absolute frequency and ratios. The latter expresses the relationship between the number of D&O and the total number of each analysis segment. This study integrates ready-made variables, specifically legislation, and prior training.

2.2. Corpus

A non-probabilistic purposive sampling method was used, selecting all didactic units submitted by students that met the established inclusion criteria. The research is based on a corpus of texts composed of 96 DUs produced by students of the MFP of a Spanish university. Specifically, 80 DU were produced in the academic years 2020-2021 and 2021-2022, according to the LOMCE, while 16 were developed during the academic year 2022-2023, according to the LOMLOE. The

productions were developed after specific training in CD, lasting 6 weeks in the subject of Subject Learning (4 ECTS). Specifically, it is individual work related to a school subject within their basic disciplinary training. The students carried out this production using a series of fundamental indicators outlined in an activity guide. The work related to a school subject within their basic disciplinary training. The students carried out this production using a series of fundamental indicators outlined in an activity guide. The work was submitted through the university platform (all of them were informed that the task was to

be used for research purposes and gave their consent to that end). Thus, the texts that make up the corpus meet the requirements of provenance (Parodi, 2010), reputation (Nwogu, 1997), and integrity and authenticity (Parodi, 2010).

The characteristics of the corpus and the participants are shown below (Table 1), according to the two variables of analysis (the classification of the areas of previous training is based on the distribution of scientific areas determined by UNESCO):

Table 1: Characteristics of the corpus and participants.
Source: Own elaboration.

Category	Legislation and academic year		
	LOMCE 2020-2021	LOMCE 2021-2022	LOMLOE 2022-2023
Physical Education	7	9	3
Psychology	5	5	3
Languages	6	22	5
Humanities	2	10	4
Natural Sciences, Mathematics and Statistics	7	7	1
Totals	27	53	16

2.3. Instrument

Regarding the instrument of analysis, the taxonomic description (Figure 4) is applied, consisting of four dimensions and a total of 39 D&O. This was designed in consideration of previous research (Monroy, 2013; Gess-Newsome et al., 2019) and the official curricular frameworks. Coding was performed on previously segmented units of analysis, allowing the Identification of common patterns and frequent difficulties in student production. The first dimension refers to the Presentation of the DU, where the definition of the basic elements is established: title, course, sessions, and timing. The second dimension, the Context of the application, refers to the description of the framework within which the programmatic action occurs, specifying educational centers, families, classrooms, and student profiles. The third dimension, Justification of the proposal, establishes the pedagogical, legislative, and curricular value through the Identification of pedagogical principles, relevance, competence foundation, and the specific problematization that triggers the proposal. Finally, the fourth

dimension, Curricular elements, describes and articulates the elements according to current legislation and educational curriculum through competencies, objectives, Evaluation, contents, methodology, and sequence of activities.

2.4. Data collection and analysis procedure

The research was carried out in three phases. The first step consisted of downloading and subsequently uploading the 96 DU to the Atlas—ti software. Once the corpus was formed, an identification code was assigned to each unit of analysis, maintaining the terms of anonymity previously mentioned. The second stage consolidated the data analysis. This process was developed through pre-piloting (5% of the corpus), piloting (28% of the corpus), and, finally, an analysis of the total research corpus (67%). In the third and final stage, the data were systematized and graphically represented, considering the two variables of the study: legislation and previous training.

3. Results

The results of the study are shown below.

3.1. Comparison of recurrence and density of D&O as a function of the legislative variable

Table 2 presents the degree of recurrence and the density of D&O identified in the corpus as

a function of the legislative variable based on absolute data and incidence ratios. First, data are provided for the categories of analysis, then for the subcategories, and, finally, for the D&O with the most significant statistical data:

Table 2: Difficulties according to legislation.

Source: Own elaboration.

Category	TOTAL	LOMCE		LOMLOE	
	NDO	NDO	Ratio	NDO	Ratio
Context	546	452	5,65	94	5,87
Presentation	113	101	1,26	12	0,75
Justification	238	209	2,6	29	1,81
Curricular elements	616	568	7,1	48	3,0
Overall ratio	-	-	16,61	-	11,43

Table 2 refers to a total of 1513 D&O in the corpus, of which 616 are placed in the development of aspects of the Curricular Elements category, 546 in Context, 238 in Justification, and 113 in Presentation. There is evidence of a decrease in the total incidence of the D&O in the application of the LOMLOE compared to the LOMCE (11.43 vs. 16.61, respectively). In this sense, the categories Presentation (from 1.26 to 0.75), Justification (from 2.6 to 1.81), and Curricular elements (from 7.1 to

3.0) show this decrease in the application of the LOMLOE. The Context category is the only one in which the index of difficulties with LOMLOE increases (by 0.22 points). It is interesting to note that the category with the most significant number of errors in absolute terms (616) is the one with the most significant decrease in the difficulty ratio, as indicated, with more than four points.

The 17 subcategories of analysis show the following data (Table 3):

Table 3: Incidence of each subcategory according to legislation.

Source: Own elaboration.

Category	Subcat.	TOTAL	LOMCE		LOMLOE		Global Ratio
		NDO	NDO	Ratio	NDO	Ratio	
Context	Center	77	65	0,81	12	0,75	1,56
	Family	84	69	0,86	15	0,93	1,79
	Classroom	71	59	0,73	12	0,75	1,48
	Student	314	258	3,22	12	0,75	1,48
Presentation	Titles	59	52	0,65	7	0,43	1,08
	Course	2	2	0,02	0	0	0,02
	Sessions	52	47	0,58	5	0,31	0,89
Justification	Pedagogical Purposes	73	60	0,75	13	0,81	1,56
	Relevance	38	35	0,43	3	0,18	0,61
	Competence Relationship	38	30	0,37	8	0,50	0,87
	Situation Problem	89	84	1,05	5	0,31	1,36
Curricular Elements	Competencies	61	57	0,71	4	0,25	0,96
	Objectives	90	87	1,08	3	0,18	1,26
	Evaluation	263	245	3,06	18	1,12	4,18

NDO: Number of difficulties and/or omissions

Table 3 shows that, of the 17 subcategories, 12 show a decrease in the D&O ratio with the application of the LOMLOE. Only five of them show a lower rate with the LOMLOE. There are three categories in the Context category: Family, Classroom, and Student (with differences ranging from 0.02 to 0.33), and two categories in the Presentation category: Pedagogical Purposes and Competency Ratio (with differences ranging from 0.06 to 0.13).

The subcategories of the Curricular Elements category (Competencies decreases from 0.71 to

0.25; Objectives from 1.08 to 0.18; Assessment from 3.06 to 1.12; Content from 0.51 to 0.31; Methodology from 0.75 to 0.31; and Sequence of activities from 0.95 to 0.92) show a greater decrease than the rest. This is significant since, with the implementation of the LOMCE, these are the subcategories with the highest D&O index.

Finally, the focus is on those D&O deployed in the subcategories with the most statistically significant expressions, namely, Student and Evaluation (Table 4):

Table 4: Incidence of D&O of the student category and evaluation according to legislation.

Source: Own elaboration.

Category	D&O	LOMCE		LOMLOE	
		NDO	Ratio	NDO	Ratio
Student	Identification of the general characteristics of the group	19	0,23	1	0,06
	Identification of the type of relationships generated in the group.	59	0,73	7	0,43
	Identification of psycho-evolutionary characteristics	24	0,3	4	0,25
	Identification of the interests and motivations of the group of students.	16	0,2	8	0,5
	Identification of behavioral characteristics	54	0,67	11	0,68
	Identification of individual differences in the classroom	56	0,7	14	0,87
	Identification of diversity in the classroom	39	0,48	14	0,87
Evaluation	Selection of evaluation criteria that reflect the contribution of the didactic objective.	61	0,76	3	0,18
	Selection of evaluation indicators that reflect the contribution of the didactic objective.	55	0,68	4	0,25
	Writing the evaluation criterion with measurable and unique verbs	25	0,31	-	-
	Justification of the evaluation	35	0,43	5	0,31
	Relationship of indicators with activity and evaluation instrument	33	0,41	1	0,06
	The weight of each evaluation indicator is established	36	0,45	1	0,06

NDO: Number of difficulties and/or omissions.

Table 4 shows that four of the seven D&Os in the Student subcategory increase the ratio with LOMLOE, specifically in the areas of identifying student interests and motivations, identifying behavioral characteristics, and identifying individual differences and diversity. On the other hand, in the Evaluation subcategory, the six underlying D&O show a decrease (between 0.10 and 0.58) with the LOMLOE. Thus, it is easier to select evaluation criteria (from 0.76 to 0.18), select indicators (from 0.68 to 0.25), assign qualifying weights to indicators (from 0.45 to 0.06), or write criteria with measurable verbs (from 0.31 to 0). The Justification of the Evaluation and the relationship between indicators (from 0.43 to 0.31) and the relationship with the evaluation

instruments (from 0.41 to 0.31) are at a lower rate of decline.

3.2. Comparison of recurrence and density of D&O as a function of prior training variable

The degree of recurrence and density of D&O identified in the corpus as a function of the prior training variable is shown below. For this purpose, absolute data on the incidence in the corpus, as well as the incidence ratio, will be shown. First, data are given for the categories of analysis; secondly, for the subcategories; and finally, data are given for those D&O that are most significant (Table 5):

Table 5: Incidence of each category according to previous training.

Source: Own elaboration.

Category	TOT.	EF		Id.		Hum.		Ps.		CNME	
	NDO	NDO	R	NDO	R	NDO	R	NDO	R	NDO	R
Context	546	66	3,47	118	3,57	112	7,0	123	8,6	127	8,4
Presentation	113	12	0,63	26	0,78	20	1,25	32	2,46	23	1,5
Justification	238	34	1,78	60	1,88	40	2,5	50	3,84	54	3,6
Curricular Elements	616	74	3,89	116	3,55	138	8,6	152	11,6	136	9,06
Global Ratio	-	-	9,77	-	9,78	-	19,35	-	26,5	-	22,56

NDO: Number of difficulties and/or omissions; R: Ratio.

The analysis assigned to the previous training variable shows a decrease in the incidence of D&O in areas with previous pedagogical training, specifically Physical Education, with an overall ratio of 9.77, and Languages, with a ratio of 9.78. On the other hand, those without such training show a humanities overall ratio of 19.35, while Psychology and Natural Sciences, Mathematics, and Statistics accumulate 22.56 and 26.5, respectively.

It should be noted that, in the case of disciplines with prior training in pedagogy, the D&O ratio is less than half that of other disciplines, with Psychology being the discipline that shows

the highest incidence ratios in all categories of analysis.

On the other hand, it is noteworthy that although Physical Education shows a difficulty index slightly lower than Languages (0.01), in three of the four categories (Context, Presentation, and Justification), it shows a higher D&O index. It is the category of Curricular elements that are the determining factor between the two disciplines (3.89 vs. 3.55). On the other hand, it is the category with the highest D&O in all disciplinary areas.

The following data are provided for the 17 subcategories of analysis (Table 6):

Table 6: Incidence of each subcategory according to previous training.

Source: Own elaboration.

Subcat.	TOT.	EF		Id.		Hum.		Ps.		CMNE		Global Ratio
	NDO	NDO	R	NDO	R	NDO	R	NDO	R	NDO	R	
Center	77	10	0,53	17	0,52	14	0,88	16	1,23	20	1,33	4,48
Family	84	11	0,58	16	0,48	18	1,13	19	1,46	20	1,33	4,98
Classroom	71	7	0,37	14	0,42	16	1,00	19	1,46	15	1,00	4,25
Study.	314	38	2,00	71	2,15	64	4,00	69	5,31	72	4,80	18,26
Title	59	6	0,32	14	0,42	11	0,69	17	1,31	11	0,73	3,47
Course	2	0	0,00	0	0,00	0	0,00	1	0,08	2	0,07	0,14
Sessions	52	6	0,32	12	0,36	9	0,56	14	1,08	11	0,73	3,05
Fines Pedagó.	73	0	0,47	17	0,52	10	0,63	16	1,23	21	1,40	4,24
Relieve.	38	4	0,21	12	0,36	8	0,50	8	0,62	6	0,40	2,09
Relationship Competence.	38	7	0,37	12	0,36	7	0,44	8	0,62	4	0,27	2,05
Situation - Problem.	89	14	0,74	19	0,58	15	0,94	18	1,38	23	1,53	5,17
Competition.	61	6	0,32	11	0,33	13	0,81	17	1,31	14	0,93	3,70
Objective.	90	12	0,63	18	0,55	21	1,31	23	1,77	16	1,07	5,33
Evaluates.	263	25	1,32	49	1,48	62	3,88	63	4,85	64	4,17	15,79
Conten.	46	6	0,32	8	0,24	11	0,69	11	0,85	10	0,67	2,76
Metod.	65	10	0,53	14	0,42	12	0,75	16	1,23	13	0,87	3,80
Sec. of activi.	91	15	0,79	16	0,48	19	1,19	22	1,69	19	1,27	5,42

NNDO: Number of difficulties and/or omissions; R: Ratio.

Table 6 shows that Physical Education and Language Arts, with only 8 and 6 subcategories, respectively, have a ratio higher than 0.5. In this case, it is interesting to note that although the area of Languages shows a higher difficulty ratio in the overall categories and subcategories, the incidence is less localized than in the case of Physical Education. In the case of previous training without contact with pedagogy, in Sciences, Mathematics, and Statistics, 14 out of 17 are situated in a ratio above 0.5 D&O; in Humanities, 15 out of 17, and in the case of Psychology, 17 out of 17.

In addition, it is interesting to note that Physical Education (2 out of 17), Languages (2 out of 17), and Humanities (6 out of 17) show less than half of their subcategories below the D&O ratio point. Meanwhile, Science, Mathematics and Statistics (9 out of 17), and Psychology (13 out of 17) show higher levels.

Finally, in this case, the focus is on those D&O deployed in the subcategories with a higher ratio at one point in all the disciplinary areas analyzed: Students and Evaluation (Table 7):

Table 7: Incidence of the D&O of the categories student and evaluation as a function of previous training.

Source: Own elaboration.

DO	EF		Id.		Hum.		Ps.		CNME	
	NDO	R	NDO	R	NDO	R	NDO	R	NDO	R
Identification of the general characteristics of the group	1	0,05	6	0,18	5	0,31	4	0,31	4	0,27
Identification of the type of relationships generated in the group	6	0,32	14	0,42	14	0,88	17	1,31	15	1,00
Identification of psycho-evolutionary characteristics	3	0,16	5	0,15	6	0,38	8	0,62	6	0,40
Identification of the interests and motivations of the group of students	3	0,16	6	0,18	5	0,31	5	0,38	5	0,33
Identification of behavioral characteristics	8	0,42	11	0,32	12	0,75	14	1,08	16	1,07
Identification of individual differences in the classroom	9	0,47	17	0,52	13	0,81	12	0,92	15	1,00
Identification of diversity in the classroom	8	0,42	12	0,36	9	0,56	9	0,69	11	0,73
Selection of evaluation criteria that reflect the contribution of the didactic objective	8	0,42	13	0,39	10	0,63	16	1,23	17	1,13
Selection of evaluation indicators that reflect the contribution of the didactic objective	7	0,37	9	0,27	13	0,81	15	1,15	15	1,00
Writing the evaluation criterion with measurable and unique verbs	1	0,05	4	0,12	4	0,25	5	0,38	11	0,73
Justification of the evaluation	4	0,21	8	0,24	11	0,69	10	0,77	7	0,47
Relationship of indicators with activity and evaluation instrument	3	0,16	8	0,24	11	0,69	10	0,77	6	0,40
The weight of each evaluation indicator is established	2	0,11	7	0,21	13	0,81	7	0,54	8	0,53

DO: Difficulties and/or omissions; NDO: Number of difficulties and/or omissions; R: Ratio.

As shown in Table 7, in the Student subcategory, the Identification of behavioral characteristics, as well as the Identification of individual differences and diversity, pose the most difficulties for students, with scores remaining close to 0.5 points in the areas of Physical Education and Languages, and exceeding 0.5 in the rest of the areas.

On the other hand, the subcategory 'Evaluation, Selection of Evaluation Criteria and Indicators' is the most difficult for students, exceeding one point in Psychology and Science, Mathematics and Statistics, and 0.5 in Humanities, while maintaining the highest values of the D&O in the cases of Physical Education and Languages.

4. Discussion and Conclusions

The objective of this study was to compare the variation of the D&O presented by MFP students in the production of programs, taking as variables the educational legislation and the previous training of the students, taking into account the complexity of this academic genre (Rodríguez, 2010) due, among other aspects, to the diversity of factors and elements that intervene in its elaboration (Cañal et al., 2008).

In general terms, it can be concluded that there is a significant variation in the recurrence and density of D&O after the application of both the legislation variable (Vílchez & Perales, 2018) and the student's previous training (Caamaño, 2013). Both are elements with significant implications and influence in the development of programming. Thus, these results generate significant interest in identifying ways to improve the development of this genre in postgraduate training.

Regarding the first specific objective, related to the legislation variable, the study draws the following conclusions. First, it is noted that the application of the curriculum with the LOMLOE lowers the overall D&O ratio. It can be thought that the curricular provisions are more closely related and involve less difficulty when interpreting them. Furthermore, this study suggests that the inclusion of ES (a differentiating factor concerning the LOMCE) as an axis may contribute to a better overall understanding of the DU and the relationship between its elements. This assertion is also supported by the results of some of the subcategories correlated with ES, which considerably lower their D&O ratio.

Secondly, it can be seen that most of the D&O are placed in aspects related to the category of curricular elements, regardless of the legislation under which the DU was carried out. This result is relevant to the teaching processes of programmatic action, as it is a first-order element for understanding the teaching action itself (Fernández-Cruz, 2004) and, in turn, for understanding the coherence of the design

(Corrales, 2009). However, the LOMLOE poses a significant decrease in core elements such as the subcategory Competencies or Objectives, which show a greater comprehensive logic. In conclusion, the data allow us to affirm that the LOMLOE establishes a clearer relationship between curricular elements. The understanding of this relationship on the part of teachers in training could lead to an adequate approach to Evaluation.

Thirdly, although the LOMLOE poses a lower overall D&O ratio, it should be noted that the Context category appears to increase its difficulty compared to the LOMCE. This conclusion may be because the guidelines for program development in Educational Administration do not emphasize this element, which would lead to considering it in possible teaching-learning actions from the initial training.

Lastly, we would like to highlight the subcategory with the highest D&O ratio: Evaluation. This should encourage the trainers in the area to give more consideration to this aspect. However, it is once again pointed out that the LOMLOE presents a better resolution when it comes to mobilizing and operationalizing Evaluation, which, as the literature reveals (Más-Torello, 2012), is usually one of the most challenging comprehensive elements.

Regarding the second specific objective, the behavior of the student's previous education variable yields the following conclusions.

Firstly, the analysis reveals that disciplinary areas with prior pedagogical training exhibit a lower incidence of D&O, with an error ratio that is less than half that of the other areas. There is no doubt that previous knowledge related to the DOU genre facilitates the learning of this and its design (Sánchez & Pericacho, 2022; Monroy, 2013). Secondly, it is noteworthy that the highest incidence ratios in each category of analysis are in the discipline of Psychology. This may be

because students' previous training in aspects related to pedagogy and didactics is nonexistent or scarce (García, 2009). Similarly, Humanities and Sciences, Mathematics, and Statistics also present similar (although lower) rates of D&O. Thus, there is a need for greater intervention in these areas and their students in terms of training and learning support. Thirdly, Physical Education and Languages are the areas in which a lower incidence of D&O is observed. In the curricula of these disciplines, areas, subjects, and practices related to education and teaching are deployed. This means that students begin with prior knowledge that enables them to approach the development of the DU with greater confidence in their success.

In conclusion, this study highlights the importance of considering these two variables, legislation and previous training, as key elements that have implications and influence on the training process of future teachers, as they are related to the D&O presented by the students in the elaboration of the UD. Educational legislation establishes guidelines for the curriculum regarding the meaning and treatment of curricular elements and, therefore, in the development and production of the DU. This aspect is especially significant given the limited progress made in recent years in the Spanish Educational System regarding educational laws. This leads to constant changes in the guidelines for the elaboration of curricular designs and programs, which can increase D&O in teachers in training. The results of this study are aligned with international studies conducted, for example, in Ecuador (Villagómez, 2012), Chile (Castro, 2017; Camus-Camus & Vergara-Núñez, 2023) or Mexico (Cuevas-Cajiga & Moreno-Olivos, 2022), which point out that the implementation of curricular reforms brings challenges for teacher training, which reinforces the relevance of considering this phenomenon from a comparative and global perspective. These results are relevant for educational policies in that they underscore the need to review them to emphasize specific training in the development of didactic units. Since the results of this study indicate that students' difficulties are related to the relationship between curricular elements (competencies, criteria, and basic knowledge), it

would be necessary to place special emphasis on the explicit teaching of this aspect.

Regarding previous training, it is evident that a lack of knowledge related to Pedagogy and Didactics increases the incidence of D&O. Students who have worked on these topics in their disciplines perform better and with greater confidence in the elaboration of DUs. Thus, the results obtained in this study align with the international evidence that highlights the impact of prior training on the quality of curriculum design in initial teacher training. International studies (Nilsson, 2008; Friedrichsen et al., 2011; Gess-Newsome et al., 2019) have shown that deficiencies in prior pedagogical and didactic knowledge limit the ability of prospective teachers to integrate competencies, pose inquiry approaches, and design quality curricular proposals. These results are significant in highlighting that it could be interesting for secondary education teacher training to offer specific support for students with less previous pedagogical training. This leads to the conclusion that, in general, there is a significant challenge in developing programs for students in training, which necessitates specific approaches to alleviate this difficulty.

As proposals for the future, we suggest examining how the various regional curricula impact the deployment and development of the DU. Thus, as a limitation of this study, the need is stated to extend the sample to, for example, all state communities in order to establish more concrete elements of where the difficulties in student training are located. This would mean adding the curricular variable to the study of the D&O of production and occupying a completely unexplored territory in both agent training and novice agents. Complementarily, and broadening the quantitative approach of this study, it would be pertinent to incorporate qualitative methods, such as interviews or focus groups with students, which would allow us to delve deeper into their perceptions and experiences of the difficulties they face when designing didactic units. This would allow for a better understanding of the underlying factors—cognitive, attitudinal, or contextual—that contribute to the difficulties detected. Finally, it is suggested that longitudinal studies following prospective teachers during

their professional insertion are advisable, which would enable the observation of the evolution of competencies for designing didactic units in authentic teaching contexts and how initial difficulties are transformed or overcome with

experience. These approaches would not only deepen the understanding of the identified difficulties but also guide the improvement of teacher training programs to strengthen didactic planning skills.

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The sgraffito decorating the baroque chapel of Santa Barbara in the church of San Juan del Hospital in Valencia

Los esgrafiados que decoran la capilla barroca de Santa Bárbara en la iglesia de San Juan del Hospital de Valencia

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Abstract

The didactic unit manifests the programmatic structure of the teacher for the implementation of the teaching-learning process. Despite its relevance, it is a genre with little research on the difficulties of its production. Thus, through the application of a taxonomic tool of analysis, this study aims to analyze the variation of the difficulties and omissions presented by students of the Master's Degree in Teacher Training in the production of this genre, taking as variables the educational legislation (LOMCE and LOMLOE) and the previous training of the students. For this purpose, 96 didactic units produced by Master's students during three academic years (2020-2021 to 2022-2023) are analyzed. The legislative variable shows variations (lower difficulty index with LOMLOE than with LOMCE) and, likewise, so does the previous training (lower difficulty in Humanities compared to areas such as Psychology, Science or Mathematics). In conclusion, these two variables have implications that must be addressed from the didactic point of view within the teaching-learning process of the programmatic action.

Keywords: sgraffito, baroque architecture, decorative techniques and ornamental analysis, religious symbolism, architectural decoration of 17th century.

Resumen

La unidad didáctica manifiesta la estructura programática para la implementación del proceso de enseñanza-aprendizaje. A pesar de su relevancia, se trata de un género con escasas investigaciones en torno a las dificultades de su producción. A través de la aplicación de una herramienta taxonómica este estudio tiene por objeto analizar la variación de las dificultades y omisiones que presentan los estudiantes del Máster en Formación del Profesorado en la producción de dicho género tomando como variables la legislación educativa (LOMCE y LOMLOE) así como su formación previa. Método: Se analizan 96 unidades didácticas producidas por estudiantes del Máster durante tres cursos académicos (2020-2021 a 2022-2023). Resultados: La variable legislativa evidencia sufrir variaciones (menor índice de dificultad con LOMLOE que con LOMCE) e, igualmente, la formación previa también (menor dificultad en Humanidades frente a áreas como Psicología, Ciencias o Matemáticas). Discusión: Estas dos variables refieren implicaciones que deben ser respondidas desde el punto de vista didáctico dentro del proceso de enseñanza-aprendizaje de la acción programática.

Palabras clave: dificultades de aprendizaje, diseño curricular, formación previa, legislación educativa, unidad didáctica.

1. Introduction

The motivation behind the present contribution stems from the desire to provide a preliminary overview of the achievements obtained within the framework of a larger research project. The objective of this project is to conduct a comparative study of the ornamental motifs in the canvases of the religious buildings of the Valencian Baroque and the ornamental motifs found in silk industry fabrics to rediscover how these motifs respond to the cultural and social manifestations of an epoch characterized by a strong sense of identity.

In this contribution, we have chosen a case study with dimensions that allow us to cover the objectives of this first study, which will serve as a reference or model to be applied in other cases, both in architecture and in the silk-weaving craftsmen's trade.

The Chapel of Santa Barbara, situated within the church of San Juan del Hospital in Valencia, is a remarkable example of 17th-century Baroque architecture. According to the study conducted by the doctor and academician Llorca Diez (1930), this chapel was designed by the architect Juan B. Pérez Castiel, and its construction began in 1686. Likewise, the inscription with the date 1689 found on its ornamentation suggests that much of the decorative work was already completed by then. This architect, as detailed by Professor Gonzalez (2010), settled in the capital of Turia, Valencia, from an early age and collaborated in the workshop of Pedro Artigues, originally from Teruel, as recorded in the Patriarca protocol file. Additionally, Juan B. Pérez Castiel, the architect, became the leading master builder of the Cathedral between 1672 and 1707. During this period, he undertook one of his most significant projects, the Baroque cladding of the presbytery of the Cathedral.

He is considered the introducer of the baroque in Valencia. The space of the Cathedral's presbytery, in addition to its historical significance, is distinguished by the decorative richness of its

sgraffito. This ornamental technique finds one of its most elaborate and significant manifestations in the chapel of Santa Barbara.

Sgraffito, an ancient decorative technique that reached its outstanding development thanks to the work of Mudejar artisans (Rodríguez Fraga, 2015), consists of superimposing layers of mortar or plaster and selectively removing the upper ones to create ornamental patterns. This tradition, which primarily spread through southeastern Spain, gained significant prominence in the Valencian Baroque, where it was used to adorn walls with a combination of vegetal, geometric, and anthropomorphic motifs. In the chapel of Santa Barbara, the sgraffito work presents a simple but effective polychromatic palette based on the contrast between the white of the plaster and the black of the smoke, creating a visual effect of great delicacy and dynamism.

Regarding sgraffito in the region, it has been documented in the 17th and early 18th centuries, primarily in the provinces of Valencia and Castellón, with a few examples in Alicante. Additionally, there is a clear preference for using this technique in religious buildings rather than in secular architecture. In the Valencian case, Peñarrocha Altabella (2013) mentions that sgraffito was more commonly applied in interiors than exteriors.

Despite the historical and artistic significance of this chapel, the graffiti adorning its walls has received little academic attention. The main objective of this article is to analyze in depth the formal, technical, and iconographic characteristics of the sgraffito of the Chapel of Santa Barbara, placing them within the context of Valencian Baroque art, Ruiz Alonso (2015) and the Archivo de Protocolos del Colegio de Corpus Christi, (Real Colegio - Seminario de Corpus Christi (n.d.)), and exploring more deeply their connection with the decorative traditions inherited from the Mudejar after.

1.1. Pattern motifs

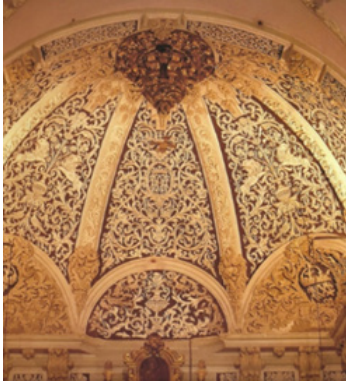
The geometric patterns of the sgraffito of the Baroque period in Valencia are characterized by the simplicity of their elements and their ability to generate visually complex compositions. As Ferrer Orts (2009-2010) describes, these patterns include parallel lines, circles and circumferences, squares, rectangles and rhombuses, six- and eight-pointed stars, Seba nets, interlacing, lobed medallions, four- and six-petaled flowers, wefts of hexagons and imbrications. In addition, their dynamic silhouettes have given rise to curious transformations, such as half moons, hearts, spirals, or fish, always schematic and stylized representations of predominantly Christian chronology, as taught in the book *Dictionary of the Decorative Arts* by Honour (1987). In the Chapel of Santa Barbara, elements that coincide with this description are identified, such as circles, diamonds, flowers, and fish, which confirm their connection with the traditional patterns of the time.

The historical context of these decorative motifs suggests an evolution in their meaning over time. Although in the early seventeenth century, these patterns may have had a symbolic meaning linked to the Counter-Reformation and early Christian architecture, from the second third of the century, they spread in a more standardized and imitative way, in many cases losing their original conceptual content, as Professor Gil Saura (2010) says. In this sense, the vaults decorated with scrolls, grotesques, baskets of fruit, pelicans, or bunches of vines, marked by an evident "horror vacui," were integrated as part of a decorative language typical of the Valencian Baroque. In the dome of the Chapel of Santa Barbara, there are clear examples of this trend, including fruit baskets, pelicans, and vine bouquets that enrich its ornamentation. Suppose one consults Gheerbrant's *Dictionary of Symbols* (1988). In that case, one can learn the meaning of these symbols and their cultural background, thereby gaining a deeper understanding of the meanings conveyed by the decorative motifs of Valencian Baroque architecture.

Another group of recurring motifs in Valencian sgraffito of the period includes anthropomorphic figures that merge with vegetal elements. According to Gil Saura (2010), it is common to find partially transformed human figures, such as bodies that, up to the waist, present human anatomy but end in scrolls or foliage. Also frequent are motifs of hunters with helmets, bows, and arrows, warriors on horseback, musicians with turbans, and wild figures with plumes holding shields. In the dome of the Chapel of Santa Barbara, several of these motifs have been identified, including savages and warriors with bows and arrows among foliage, as well as human figures whose lower bodies are merged into vegetal forms. These representations, typical of the style prevalent in Valencia at the time, reflect both the technical mastery and visual symbolism that characterized Baroque decorative art.

In the Renaissance, proportion, order, symmetry, and modest decoration were used, embodying classical rational aesthetics. Whereas, in the Baroque, which marked the beginning of the 17th century, dynamics, dramatism, contrasts of light and shadow, and more exaggerated and ornate decorations were pursued. As for the materials, on the one hand, the Renaissance used the traditional stone of the place. On the other hand, the more decorative Baroque style employed sculpture, stucco decoration, and gilding. The works of Jarque (1993) and Jarque (1994) contain numerous elements of Valencian Baroque architecture that are relevant to the analysis of the sgraffito of the chapel of Santa Barbara. For example, in Jarque's book (1993), the renovation of the church of San Esteban in Valencia is mentioned, where the arcades and the vault made between 1679 and 1682 are representative examples of Baroque architecture. In the church of San Miguel in Castellón, pilasters and sgraffito dated between 1679 and 1725 are on display, as are the decorative details of the church of Santa Ana in Segorbe. Specifically, as shown in Table 1. Valencian Baroque Architecture.

Table 1: Valencian Baroque Architecture.
Source: Own elaboration.

Number	Scanning photos from the book	Description	Source
1		Details of the renovation of the arches and vault of the church of San Esteban in Valencia.	(Jarque, 1993, pp. 220-221).
2		Detail of pilaster and sgraffito of the Church of San Miguel in Castellón.	(Jarque, 1993, p. 246)
3		Decorative details of the Church of Santa Ana in Segorbe.	(Jarque, 1993, p. 249)

In addition, according to Gil Saura (2010a, 2010b), the technique of decorative sgraffito carving used in Baroque architecture is explored, with a detailed analysis of its application, historical context, diffusion, and influence in Valencia.

This architectural context illustrates how the decorative principles of the Valencian Baroque are also reflected in the sgraffito. Finally, we have chosen the Chapel of Santa Barbara as the main object of our study due to its ornamental richness and its significance as a representative example of this artistic tradition.

1.2. General Objective

To analyze the decorative sgraffito of the Chapel of Santa Barbara through a technical, stylistic, and iconographic approach, understanding its relevance within the Valencian Baroque context and its relationship with the decorative traditions of the time.

1.3. Specific Objectives

Describe the technical and stylistic characteristics of the sgraffito present in the Chapel of Santa Barbara, including the analysis of the materials,

the application techniques, and the ornamental elements used.

Analyze all the decorative patterns present in the architectural elements of the chapel that incorporate sgraffito to identify similarities, variations, and their integration into the overall architectural design of the space.

Inventory and catalog the different sgraffito patterns present in the decorative elements of the chapel, generating cataloging cards for each one and providing detailed information on their visual characteristics, location, and possible variations.

To contextualize the sgraffito of the Chapel of Santa Barbara within the Valencian Baroque

art, this analysis examines its influences, its relationship with the tradition of Baroque decoration, and its symbolism within the religious sphere of the time.

The present work seeks not only to contribute to the knowledge of this ornamental technique in the Valencian Baroque but also to promote its valorization as part of the rich artistic heritage of the church of San Juan del Hospital. This analysis, focused on the sgraffito of the Chapel of Santa Barbara, presents an opportunity to deepen our understanding of the decorative traditions of the time and their evolution within the cultural context of the seventeenth century.

2. Methodology

The study of the sgraffito in the chapel of Santa Barbara has been carried out through a multidisciplinary approach that combines advanced techniques of digital survey, architectural analysis, and cataloging work supported by the discipline of historiography and classical treatise on the crafts of work and decoration, for example, the doctoral thesis of Professor Garcia Valldecabres, and the study of Professor Sanchez Muñoz (2016), entitled: How to catalog works of art and other artistic objects.

2.1. Surveying and Photogrammetry

For the precise documentation of the sgraffito and the architectural structure of the chapel, a 3D laser scanner was used, which enabled the creation of a detailed point cloud model. In the final master's degree work of engineer Mogená Sánchez (2018), 3D modeling and photogrammetry were performed. This technique provides an accurate representation of the chapel's geometry, facilitating the creation of architectural plans and sections. In addition, the laser scanning equipment provides detailed photographs of the sgraffito, which is crucial for analyzing its

patterns and preserving decorative details in high resolution.

2.2. Drawing the Different Patterns

With the data obtained in the first phase, we proceeded to represent the sgraffito graphically using AutoCAD software. Using the architectural plans generated from the survey and the photographs of the sgraffito, the decorative patterns present on the surfaces were drawn. This stage enabled the creation of accurate representations of the ornamental designs and the analysis of their formal characteristics.

2.3. Pattern Cataloging

In this phase, exhaustive cataloging of the sgraffito patterns was carried out, identifying those that are repeated and those that are unique in all the decorated architectural elements of the chapel. For each pattern, a cataloging card was generated that included information about its location, dimensions, visual characteristics, and possible variations. This process enables a detailed inventory of the decorative elements, facilitating comparison and stylistic analysis.

2.4. Analysis of Characteristics and Stylistics

Finally, the technical and stylistic characteristics of the sgraffito were analyzed. In this phase, the design, arrangement, and motifs of the decorative patterns were studied in the architectural context of the chapel. This analysis considers aspects

such as the relationship between the sgraffito and the architectural space, its symbolism, and how it is integrated into the overall aesthetics of the Valencian Baroque. The study also includes an evaluation of the materials and techniques used, which allows for a deeper understanding of the process of developing these strategies.

3. Results

The analysis enabled the identification and cataloging of the various decorative patterns present in the sgraffito of the Chapel of Santa Barbara. The results revealed a remarkable diversity of designs, among which geometric, vegetal, and some anthropomorphic motifs predominate, all characteristic of 17th-century Baroque ornamentation. These patterns include baskets of fruit, bunches of vines, stylized foliage transformed into animal forms, such as fish and pelicans, and anthropomorphic representations, including human figures integrated with vegetal elements. This set of motifs evidences a visual language charged with religious and cultural symbolism rooted in the ideals of the Counter-Reformation.

The distribution of the sgraffito was carried out strategically and systematically, decorating key architectural elements, including arches, pilasters, and vaults. In particular, the dome of the chapel stands out for its complex ornamentation, which reinforces the monumental character of the liturgical space. The harmonious integration between the sgraffito and the architectural structure not only enriches the aesthetic ensemble but also acts as a means of conveying messages linked to Christian values, such as the idea of transcendence and the unity between the earthly and the divine.

In addition, the comparative analysis allowed us to observe how the patterns of the chapel's ornaments share similarities with other manifestations of Valencian baroque, highlighting

recurring elements documented in different churches in the region, as mentioned in Jarque's book (1993), the church of Santa Ana in Segorbe and the church of San Esteban in Valencia. This highlights the influence of local workshops and artisans in the consolidation of a homogeneous and standardized style without compromising the expressive richness of each space.

A summary of the work carried out is presented in Tables 2 to 8 below;

- 2.- Sgraffito - dome-EC1;
- 3.- Sgraffito - dome-EC2;
- 4.- Sgraffito - dome-EC3/EC4;
- 5.- Sgraffito - dome-EB1/EB2;
- 6.- Sgraffito - vault-EB3/EB4;
- 7.- Sgraffito - pilaster-EP1;
- 8.- Sgraffito - mulo-EM1;

From Tables 2-8, the decorative patterns were identified, indicating their precise location, frequency, and main characteristics. This resource is essential for a more detailed understanding of the decorative and symbolic function of sgraffito in the liturgical context, highlighting its role not only as an ornamental element but also as a vehicle of religious and cultural meanings.

Table 2: The sgraffito of the dome sector EC1.
Source: Own elaboration.

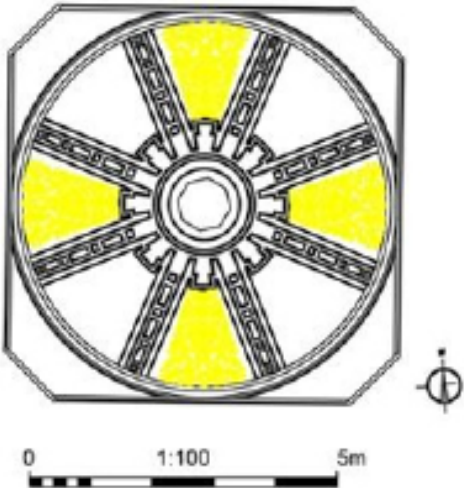
RECORD OF THE SGRAFFITOS IN THE CHAPEL OF SAINT BARBARA CHURCH OF SAN JUAN DEL HOSPITAL	
SGRAFFITO OF THE DOME	SGRAFFITO-DOME-EC1
Drawing	Photo
	
Location	
	Observation Decorative vegetal and foliage motifs, accompanied by stylized human figures, such as warriors wearing helmets and armed with bows and arrows, harmoniously integrated into the ornamental composition. Also visible are human figures whose lower bodies transform into plant-like shapes, enhancing the dynamism and visual richness of the decoration.

Table 3: The sgraffito of the dome sector EC2.
Source: Own elaboration.

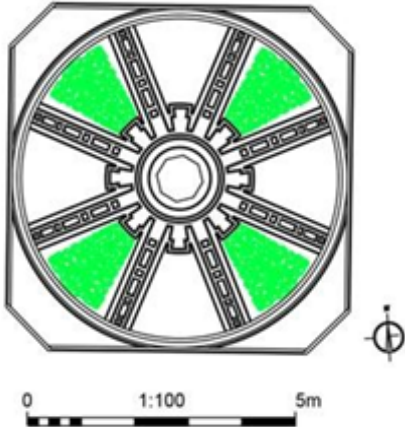
RECORD OF THE SGRAFFITOS IN THE CHAPEL OF SAINT BARBARA CHURCH OF SAN JUAN DEL HOSPITAL	
SGRAFFITO OF THE DOME	SGRAFFITO-DOME-EC2
Drawing	Photo
	
Location	Observation
	Decorative vegetal and foliage motifs, accompanied by stylized human figures, such as wild men, harmoniously integrated into the ornamental composition. Also visible are human figures whose lower bodies transform into plant forms, enhancing the dynamism and visual richness of the decoration.

Table 4: The sgraffito of the dome sector EC3-EC4.
Source: Own elaboration.

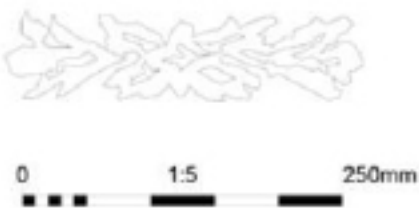
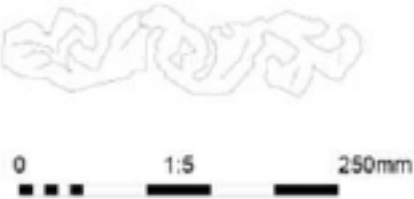
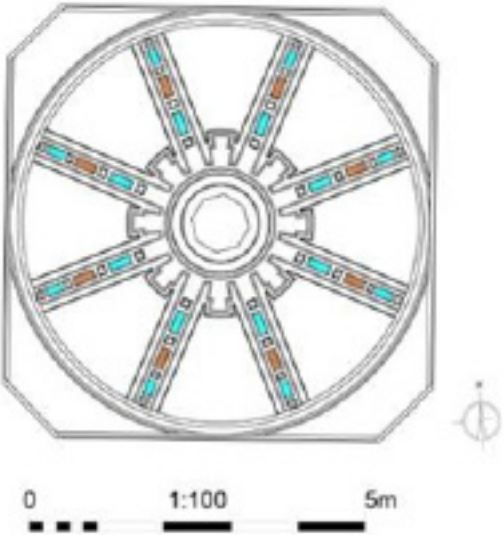
RECORD OF THE SGRAFFITOS IN THE CHAPEL OF SAINT BARBARA CHURCH OF SAN JUAN DEL HOSPITAL	
SGRAFFITO OF THE DOME	
SGRAFFITO-DOME-EC3	 
SGRAFFITO-DOME-EC3	 
Location	 Observation EC-3 Design composed of stylized vegetal elements alternating floral motifs and leaves, forming a continuous linear composition. The harmonious arrangement emphasizes repetition and visual rhythm. EC-4 Intertwined vegetal motifs that exhibit organic fluidity in their design. The curvature of the forms evokes a sense of movement, integrating seamlessly into the overall decorative scheme.

Table 5: The sgraffito of the dome sector EB1-EB2.
Source: Own elaboration.

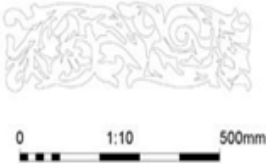
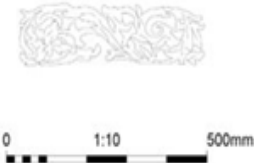
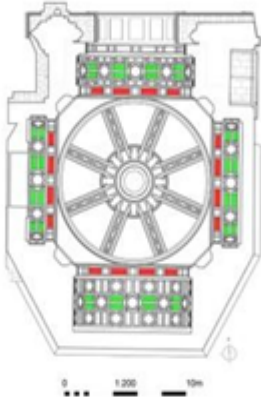
RECORD OF THE SGRAFFITOS IN THE CHAPEL OF SAINT BARBARA CHURCH OF SAN JUAN DEL HOSPITAL	
VAULT SGRAFFITO	
SGRAFFITO-DOME-EB1	Photo
	
SGRAFFITO-DOME-EB2	
	
Location	
	Observation EB-1 Vegetal motifs combining elongated, sinuous leaves with stylized flowers. The design exhibits a balanced and symmetrical composition, highlighting the fluidity and continuity of the forms. EB-2 Design with interlaced vegetal and floral elements, characterized by dynamism and ornamental complexity. Repetition and symmetry reinforce the integration within the overall decorative scheme of the vault.

Table 6: The sgraffito of the dome sector EB3-EB4.
Source: Own elaboration.

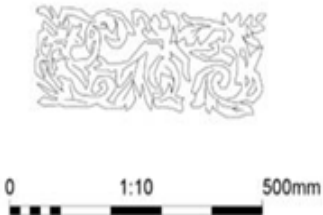
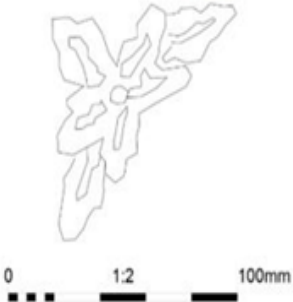
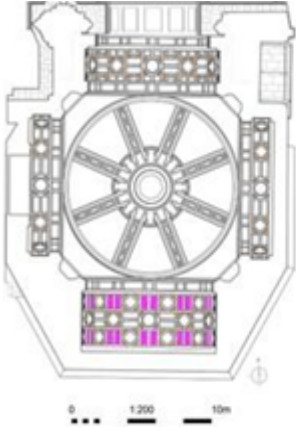
RECORD OF THE SGRAFFITOS IN THE CHAPEL OF SAINT BARBARA CHURCH OF SAN JUAN DEL HOSPITAL	
VAULT SGRAFFITO	
SGRAFFITO-VAULT-EB3	
SGRAFFITO-VAULT-EB4	
Location	 0 1:200 10m Observation EB-3 Design based on foliage with elongated and curved leaves intertwined in a harmonious way. The vegetal elements stand out for their fluidity and symmetry, creating an ornamental pattern rich in dynamism. EB-4 Decorative motif combining stylized flowers and vegetal elements framed in a triangular design. The composition stands out for its balance and the integration of the foliage on the borders, providing continuity to the overall design.

Table 7: The sgraffito of the dome sector EP1.
Source: Own elaboration.

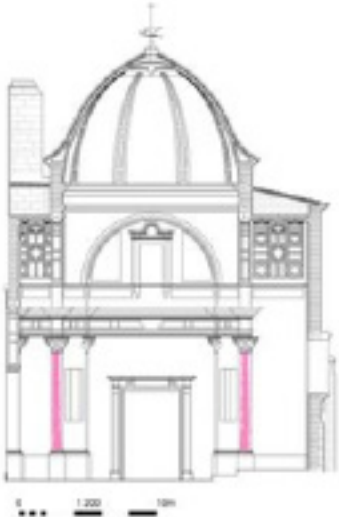
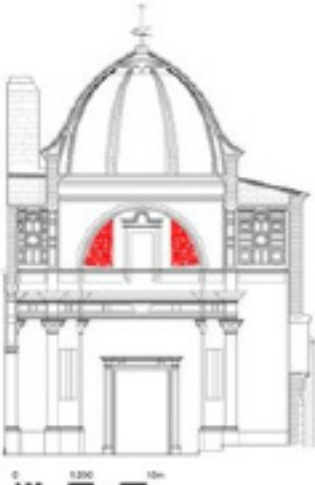
RECORD OF THE SGRAFFITOS IN THE CHAPEL OF SAINT BARBARA CHURCH OF SAN JUAN DEL HOSPITAL		
SGRAFFITO OF THE PILASTER		
SGRAFFITO-PILASTER-EP1	Photo	Location
		
Observation Fruit baskets and vine bouquets are integrated into a stylized foliage that flows and transforms into forms of fish, flowers, and pelicans, located at the center of the decorative patterns.		

Table 8: The sgraffito of the EM1 sector dome.
Source: Own elaboration.

RECORD OF THE SGRAFFITOS IN THE CHAPEL OF SAINT BARBARA CHURCH OF SAN JUAN DEL HOSPITAL	
SGRAFFITO OF THE LUNETTE	
SGRAFFITO-MULO-EM1	Location
	
Observation	
	Vegetal motifs, fruit baskets, and vine bouquets are integrated with stylized foliage that flows and transforms into forms of fish, pelicans, and the figure of a young girl.

4. Discussion and conclusion

4.1. Discussion

According to Ferrer Orts (2017), during the second half of the 17th century, a "progressive theoretical assimilation formulated in the Renaissance" was

consolidated in Baroque architecture, resulting in a more homogeneous and standardized style. This period was characterized by the expansion of architectural elements, including barrel vaults, lunettes, and domes, accompanied by profuse

and meticulous decorative details. In the chapel of Santa Barbara, this stylistic development is evident in the sgraffito that ornament both the walls and the dome, integrating harmoniously with the architectural elements and reinforcing the sacred character of the space.

Likewise, according to Professor Giannotta (2023) and the group of researchers led by Mínguez et al. (2025), the Valencian Baroque decorative project features numerous religious symbols, mythological themes, floral motifs, and animals, among others. The chapel's sgraffitos stand out not only for their vegetal and geometric ornamentation but also for the incorporation of anthropomorphic motifs, such as warriors, hunters, and human figures fused with vegetal forms. These decorative elements reflect the baroque art of the time, which sought to convey a symbolic conception of unity between humanity and nature. The representation of human figures whose lower part is transformed into foliage or scrolls reinforces the idea of a divine order, where the human and the natural coexist as manifestations of divine creation.

In addition, the fruit baskets, pelicans, vine bouquets, and fish present in the chapel's decorative patterns not only serve an aesthetic function but also evoke Christian values associated with abundance, salvation, and spiritual communion. These motifs, integrated into the sgraffito in a dynamic and stylized manner, exemplify how the Baroque decoration of the Santa Barbara chapel served as a visual medium to convey the religious and cultural beliefs of the Counter-Reformation. In this context, the sgraffito technique reveals itself as an artistic language that not only embellishes architectural spaces but also reinforces the symbolic and spiritual narrative of the Valencian Baroque period.

4.2. Conclusion

The present contribution represents an initial advance, presenting partial results from a larger project that will be expanded upon as new findings are achieved and will be reported through subsequent publications. At the same time, the conclusions presented here will be further developed and expanded.

The originality of the present contribution corresponds to the singularity of the chosen case and the multidisciplinary participation, approaches, and techniques employed.

The analysis of the sgraffito of the Chapel of Santa Barbara has shown how baroque ornamentation became an effective means of transmitting the religious and cultural values of its time. The geometric, vegetal, and anthropomorphic patterns that decorate the walls and dome of the chapel are a testament to the symbolic and aesthetic richness that characterized Valencian Baroque art in religious spaces. These compositions, beyond their decorative function, are deeply linked to the beliefs of the Counter-Reformation, as they strengthen Christian ideals through an aesthetic rich in spiritual meanings.

Our study is the first to document, analyze, and catalog the baroque sgraffito in the Chapel of Santa Barbara, located in the church of San Juan del Hospital. This effort has enabled us to gain a deeper understanding of the symbolism and technique of sgraffito, highlighting its relevance in both historical and architectural contexts.

The participation of local artisans who mastered the sgraffito technique demonstrates how, from the second half of the 17th century, Baroque architectural decoration acquired a homogeneous and systematized character. However, it was still anchored in the Renaissance tradition. The ornamental elements present in the chapel, such as fruit baskets, pelicans, flowers, and anthropomorphic motifs, incorporate a visual language rich in Christian symbolism that reinforces the spiritual values of the time.

In conclusion, the sgraffito of the Chapel of Santa Barbara represents a perfect synthesis between art and faith, standing out as an emblematic expression of the power of baroque art to communicate religious ideas while embellishing architectural spaces. This technique, which was initially characterized by its simplicity, achieves in this work an expressive and symbolic dimension of great richness, consolidating itself as a historical and cultural legacy of incalculable value.

5. Recommendations

The following recommendations are the result of a review of the key issues identified, which reveal both opportunities and challenges for future research projects and conservation actions related to architectural heritage motifs or standards.

In the framework of studying patterns in Baroque architectural heritage, it is necessary to adopt more comprehensive approaches that allow us to understand not only the aesthetics but also the historical, technological, cultural, physical, and social contexts of these elements. Research on patterns in Baroque architectural heritage has revealed several interesting and fundamental approaches to understanding how sgraffito patterns are not only decorative elements but also symbolic representations of the culture, contemporary technology, history, and social values of communities over time.

Ferrer Orts (2017) highlights how it has become a significant element of Valencian architecture. Its unique style, the materials used, and the role it played in the decorative arts reveal the historical and artistic context in which it developed in Valencia, as well as how these factors contributed to its subsequent spread to other regions. In addition, Ferrer Orts (2017) demonstrates that the sgraffito technique, adapted during the Baroque period in Valencia, is still in use. Finally, ArchDaily (2022) examines the processes and methods of restoring historic buildings using modern materials.

In another order of procedures and techniques, García Moreno et al. (2024) propose creating a model of a heritage building protected in the twentieth century through HBIM models, which record, among other aspects, the decorative details arranged on the walls. On the other hand, Hou (2024) establishes that the application of carbon fiber composites can be used in the reinforcement engineering of buildings; simultaneously, the technology for restoring sgraffito allows the use of new materials. Furthermore, the results obtained are in line with the provisions of the ICOMOS

annual report (2021), which recommends the use of digital documentation, 3D modeling, and other technological innovations in cultural heritage conservation projects.

First, the main issues addressed in the research center on the analysis of the symbolic and social functions of the patterns. These elements are not merely decorative; they often convey cultural, religious, or ideological messages. For example, specific patterns may be related to spiritual beliefs or representations of power and status within a society. This approach offers a new perspective on architecture, viewing it not only as a functional space but also as a space of cultural communication, not only among the people of the historical moment in which it was created, but above all, as a space of intergenerational communication, encompassing past, present, and future.

Regarding the methodologies proposed, the research has highlighted the need to integrate traditional and modern approaches. Typically, the study of patterns has been based on historical and visual analysis, drawing on ancient sources and comparative studies. However, in recent years, the use of advanced technologies has opened up new possibilities. Tools such as 3D photogrammetry and digital models allow unprecedented accuracy in the documentation and analysis of architectural patterns. These methodologies provide a more accurate and accessible perspective on heritage. This not only facilitates its conservation but also enables a deeper analysis of complex details that were previously inaccessible, allowing not only its academic study but also its preservation for historical and tourist purposes.

Another essential aspect addressed in the research is the diversity of approaches to studying patterns, ranging from purely aesthetic approaches to approaches more focused on historical and cultural contexts. This multidisciplinary approach is fundamental, as it enables a holistic understanding of architectural patterns,

considering both their form and function within a specific social and cultural context.

However, problems and challenges also arise in the application of these approaches. One of the primary challenges lies in the difficulty of interpreting patterns without falling into subjective or overly general interpretations. Patterns can have multiple meanings depending on the context in which they are analyzed, which makes the interpretation process highly complex

and susceptible to variations in researchers' perspectives.

In conclusion, research on patterns in architectural heritage underscores the need for more interdisciplinary approaches and the use of advanced technologies to preserve and analyze these elements. Although there are challenges in interpreting patterns, the symbolic and cultural richness offered by these architectural elements justifies the effort to understand and preserve them for future generations.

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Adolescent suicide risk screening scale: Evidence of content validity

Escala de cribado del riesgo suicida en adolescentes: Evidencias de validez de contenido

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Adolescent suicide risk screening scale: Evidence of content validity

Escala de cribado del riesgo suicida en adolescentes: Evidencias de validez de contenido

Abstract

Suicide is considered a serious and preventable public health problem. Psychometric evaluation using validated suicide risk tools allows for more effective prevention of suicidal behaviors. This study aims to assess the content validity of a set of items measuring key risk factors for self-harming behaviors (both suicidal and non-suicidal) in adolescents. Content validity will be evaluated through clarity, representativeness, and relevance indicators. An instrument was designed by reformulating the content of a selection of 413 items grouped into ten dimensions. The participants were clinical psychology professionals selected by convenience. The Osterlind Index was then used to analyze the representativeness and relevance of the data. Frequency analyses were carried out to assess clarity. The results show adequate values of representativeness, clarity, and relevance for each of the selected items.

Keywords: content validity, suicide, self-harm, adolescents.

Resumen

El suicidio es considerado un grave problema de salud pública entre adolescentes. La evaluación psicométrica mediante herramientas validadas del riesgo al suicidio permite prevenir con mayor eficacia las conductas suicidas. Este estudio pretende obtener evidencias de validez de contenido a través de indicadores de claridad, representatividad y pertinencia sobre un conjunto de ítems correspondiente a los principales factores de riesgo asociados a las conductas autolesivas (suicidas y no suicidas) en adolescentes. Se diseñó un instrumento a partir de la reformulación del contenido de una selección de 413 ítems agrupados en diez dimensiones. Los participantes fueron profesionales de la psicología clínica seleccionados por conveniencia. Para el análisis de los datos de representatividad y relevancia se utilizó el Índice de Osterlind. Se realizan análisis de frecuencia para la valoración de la claridad. Los resultados mostraron valores adecuados de representatividad, claridad y relevancia para cada uno de los ítems seleccionados.

Palabras clave: validez de contenido, suicidio, autolesiones, adolescentes.

1. Introduction

Suicide is currently a serious public health problem worldwide, accounting for about half of all violent deaths and a high emotional and personal cost for the family and economic cost for society as a whole. This problem is even more evident among adolescents, becoming one of the two leading causes of unnatural mortality in the population among young people (Pan American Health Organization, 2023).

Suicidal behavior is understood as any act that intentionally seeks to cause death (DeBastiani & De Santis, 2018). Numerous literature has shown that suicidal behavior is a complex and multicausal phenomenon (Socha-Rodríguez et al., 2020) that can be expressed through various behaviors such as communication of death, desire, ideation, planning, intention, or completed suicide (Huguet-Cuadrado, 2023).

About 800,000 people commit suicide each year, and for every person who does so, at least 20 have attempted it, and many more have at least thought about it, according to data from the Pan American Health Organization (2022). The literature reports that the highest rates of completed suicide have been recorded among older males, while young women have higher rates of attempts; however, in recent years, it has been observed that the rates among adolescents and young people have been increasing, becoming the highest risk group at present. Suicide is the third leading cause of death in people aged 15 to 19 years, and 90% of cases worldwide are contributed by low- and middle-income countries (Pan American Health Organization, 2022). In the Americas, the estimated rate was 9.64 per 100,000 inhabitants for the year 2019, representing a 28% increase since 2000 (Pan American Health Organization, 2021). In this context, the Dominican Republic is among the countries with stable average suicide rates over the last five years (5 to 6 per 100,000), even below the average for the Americas region (8.8 per 100,000). However, there has been an increase in cases reported by adolescents and young people between the ages of 10 and 19 (National Statistics Office, 2024). This makes

this population group one of the most vulnerable groups.

In addition to suicidal behaviors, a significant number of young people and adolescents present non-suicidal self-injurious behaviors. This type of behavior refers to deliberate, voluntary acts of self-inflicted pain, destructive or injurious, without intent to die (Faura-Garcia et al., 2021). The Diagnostic Classification Manual of Mental Disorders, in its fifth revision (American Psychological Association, 2013), places special emphasis on the fact that young people who present self-injury do not have the intention of dying. Therefore, Self-injury without Suicidal Intent (NSSI) is included in a separate section. However, it is reported that there is a significant association between self-injurious behavior and suicidal behavior (Kirchner et al., 2011; Nock et al., 2006; Villa et al., 2016). A person with a previous history of self-injurious behaviors is almost 25 times more likely to die by suicide than the general population (Ayuso-Mateos et al., 2012). Among young people, non-suicidal self-injurious behaviors include cutting different parts of the body (arms or legs), also called "cutting," hitting themselves with blunt objects or against walls, scratching, biting or pinching, hair pulling, ingestion of drugs and other substances, or burns. These behaviors come to affect a range of the adolescent population, comprising between 2% and 4% (Mosquera, 2016). Self-injurious behavior is more prevalent in females, with an average onset age of around 15 years. The most commonly used form of harm is self-mutilation or cutting (De Leo & Heller, 2004; Laukkanen et al., 2009; Nixon et al., 2008; Ross & Heath, 2002). Studies report a lifetime prevalence of self-injurious behavior from 11.5% and up to 46% of adolescents studied; this data varies depending on the characteristics of the population and the instruments used (Brunner et al., 2013; Laukkanen et al., 2009; Nixon et al., 2008; Obando et al., 2019). Despite this wide range, this rate is considered to have remained stable between 2005 and 2011 (Muehlenkamp et al., 2012).

The origin of suicide and self-harm in the adolescent population is multicausal and is associated with numerous risk factors (Park et al., 2020). Meta-analysis studies have highlighted substance abuse (alcohol, drugs), affective disorders (depression, anxiety, low self-esteem), sexual and/or physical abuse, and bullying as the main risk factors, with the risk of attempted suicide being more frequent among females and completed suicidal behavior among males. Similarly, other risk factors associated with increasing the likelihood of committing suicide or self-harm are included, such as having an eating disorder, having previous suicide attempts, having problems in interpersonal relationships, having a psychotic disorder, and having non-normative sexual orientation, among others (Caballero Díaz, 2023; Park et al., 2020). With development and globalization, other unconventional factors also emerge that could increase the risk of suicide and self-injury, such as imitative behavior or social group behaviors. In the current context, there are models of behavior spread in social networks among peer groups that use games in the form of "challenges" whose aim is to encourage and reinforce self-injury, violent behavior, and even suicide in groups of adolescents and young people. In this sense, Kushner and Sterk (2005), regarding the use of social networks and suicidal or self-injurious behavior, point out that the current styles of modern life are capable of altering social cohesion, increasing suicide risk and mortality. Therefore, the dissemination of these practices through the Internet seems to be a promoting factor for suicidal and self-injurious behavior, especially for the most vulnerable groups (Arendt et al., 2020; Pirkis et al., 2018).

The World Health Organization recognizes that it is important for public health to identify promptly the suicidal risk that a person may have, trying to reduce the harm and potential death. This is coupled with the low percentage of adolescents who seek help for suicidal ideation, which hinders the timely detection of those young people at risk of suicide, as well as the possibility of preventing suicidal acts. In this sense, it is necessary to strengthen the ability to detect suicidal risk through psychometric tools that provide valid and reliable information in particular contexts.

The rigorous assessment of suicide risk makes it possible to identify aspects linked to the person's sphere of life in order to anticipate the occurrence of suicidal or self-injurious behavior to reduce the harm and mitigate the impact it could have. Risk assessment is a valuable resource in the field of suicide prevention and timely care. For this purpose, psychological measurement tools have been designed mainly to detect risk factors; however, their scope has been minimal (Kessler et al., 2020). In part, due to the limitations presented by these tools: a) focus exclusively on the specialized clinical setting and psychopathological variables (Rangel-Garzón et al., 2015); b) lack integration of psychosocial factors that combine psychometrically and empirically based decision-making algorithms; c) lack risk management and management proposals for decision-making; d) form part of intervention programs that only allow restricted use; and e) lack of validation in specific populations, such as the Dominican population.

Due to the high percentage of suicidal behavior in young people and adolescents and the low probability that they seek help, it is necessary to have effective, valid, and reliable tools that allow the assessment of suicidal risk in Dominican adolescents to be used in the clinical setting. A risk assessment instrument must possess various psychometric properties, one of which is content validity, which in this case refers to the degree of adequacy of the sampling that ensures the instrument measures the universe of possible behaviors of the object it is intended to measure (Cohen & Swerdlik, 2001). The evidence of content validity of a test is an essential psychometric indicator, which is obtained, above all, through the strategy of expert judgment, especially when the measurement instruments have not yet been validated in specific populations or contexts.

This study aims to obtain evidence of content validity of a set of indicators corresponding to the main risk factors associated with self-injurious behaviors (suicidal and non-suicidal) in adolescents. To obtain this type of evidence, the judgment of experts from the fields of research and clinical practice in the child and adolescent population will be utilized.

2. Materials and methods

2.1. Participants

The sample consisted of a total of 14 professionals, of whom only eight persons completed the evaluation, and one was excluded due to a lack of response to all the items. Therefore, the final sample consisted of a total of 7 people. Of these, six were female, and one was male, with two from Spain and five from the Dominican Republic. The participants were selected incidentally by the objectives of this study. Inclusion criteria were established as follows: a) to be professionals in the field of clinical psychology; b) to have a level of education corresponding to a doctorate or master's degree; c) to have more than 5 years of experience in research and clinical practice with

the child and adolescent population; and d) to participate voluntarily.

2.2. Instruments

Content validity scale for risk factors for suicidal behaviors (ad hoc development). An instrument was designed by grouping a selection of 412 items corresponding to the main risk factors associated with self-injurious behaviors. The content of the items originated from various assessment instruments, from which the original items were reformulated to create the present scale. The following table presents the dimensions explored, along with the instrument from which the content of the items was extracted (Table 1).

Table 1: List of dimensions and instruments
Source: Own elaboration.

Psychopathological factors	Evaluation System for children and adolescents, SENA (Sánchez, et al., 2016).
Cognitive factors	Columbia Scale (Posner et al., 2011) . ISNISS Protocol (Influence of Social Networks and Internet on self-injurious and suicide (Carretero, 2024).
Historical or family background factors	Ad hoc questionnaire
Emotional factors	Beck's Hopelessness Test (Beck et al., 1974).
Adverse or potentially traumatic life events	Life events checklist (Gray et al., 2004). EBIP-Q and from ECIP-Q (Ortega-Ruiz et al., 2016).
Information and communication technology factors	ISNISS Protocol (Influence of Social Networks and Internet on self-injurious and suicide (Carretero, 2024).
Social, interpersonal and family factors	SENA Test (Sanchez, et al., 2016). INQ-Belongeness (Van Orden et al., 201) .0
Personality factors	SENA Test (Sanchez, et al., 2016).
Volitional and motivational factors	Entrapment and defeat scales (Gilbert and Allan, 1998) The Acquired Capability for Suicide Scale (Smith et al., 2010). Discomfort intolerance Scale (Schmidt at al., 2006) Interpersonal Needs Questionnaire (INQ) (Van Orden et al., 201) 0

Considering the cultural and linguistic adaptation of these tests, the Spanish version validated in previous studies was included in the protocol. The tests for adverse or potentially traumatic life factors and motivational volitional factors were adapted from their original English version and translated into Spanish, then reviewed by expert, native Spanish-speaking mental health professionals.

The different items were grouped into a total of nine (9) dimensions, each of which included different items related to certain risk factors mentioned in the literature: 1) Psychopathological Factors (PSF). It groups the indicators of the presence of depression, anxiety, substance use, posttraumatic symptomatology, obsession-compulsion, presence of borderline personality disorder, and somatic complaints; 2) Cognitive and Behavioral Factors (FCC) linked to the indicators of: suicidal ideation, suicidal planning, suicidal attempts and self-injurious behavior; 3) Historical or Family History (AHF), encompasses indicators of history of suicidal behavior in the family; 4) Emotional Factors (FEM), groups indicators of: level of hopelessness and reasons for living; 5) Adverse or Potentially Traumatic Life Factors (FVAT), includes indicators of: physical, psychological or sexual abuse, experiences of separation or rejection, bullying and cyberbullying, exposure to other suicides. 6) Information Technology Factors (FTICs), which include the indicator of consumption of materials promoting and disseminating suicidal behavior through different media (television, radio, Internet); 7) Social, Interpersonal, and Family Factors (FIF), which covers the indicators: family problems, problems with school, problems with peers, social support; 8) Personality Factors (PF), corresponding with the indicators of: level of self-esteem, hyperactivity-impulsivity, anger control problems, rigidity, emotional regulation; 9) Volitional-motivational factors, covering the indicators of: entrapment and defeat (expiration), acquired capacity (perceived efficacy) for suicide, intolerance to discomfort, perception of belonging and overload.

Each of the items was assessed on three criteria (i.e., clarity, representativeness, and relevance), each of which was accompanied by a scale,

respectively: the clarity criterion was assessed on a dichotomous scale (Yes/No), and the representativeness-relevance and relevance criteria were assessed on a scale of three options (high, medium and low). All of them allowed the inclusion of comments or conditions for improvement in an annex section that the expert could add in addition to the scale score. Each of the criteria to be evaluated by the experts is described below:

- Clarity refers to whether the item is correctly formulated and whether you understand its meaning. There are two possible response options: No (Unclear, the item is ambiguous, confusing, or does not clearly express what you are trying to assess) and Yes (Clear, the item is clear).
- Representativeness. This criterion refers to whether the item is representative, i.e., characteristic or typical of the dimension to which it has been assigned. There are three possible response options: 1, "low degree of representativeness," 2, "medium degree of representativeness," and 3, "high degree of representativeness."
- Relevance. Refers to whether the item is relevant or important for measuring the dimension to which it has been assigned. 1 "Not relevant, the item can be eliminated without affecting the measurement of the dimension"; 2 "Not very relevant, the item has some relevance, but assesses very secondary aspects of the dimension or is only indirectly related to it"; 3 "Relevant, the item reflects important aspects of the dimension assessed or directly related to it."

2.3. Procedure

Once the participants had been selected, they were sent an email invitation to participate in the study, along with instructions for completing a double-entry digital template. The template included rows for the components of each dimension to be evaluated and columns for each of the criteria to be scored. At the end of the review document, a space was included for the evaluator to indicate any observations and appreciations they deemed necessary for each item.

Once the form was completed, the participant sent their responses via email to the researcher for analysis.

2.4. Data analysis

The Osterlind index (Osterlind, 1998) was used to analyze the representativeness and relevance data. An Osterlind index is calculated for each item of the dimensions.

The Osterlind index is often used to measure the content validity of items through expert opinions. This tool is helpful in the initial phases of the study, as it aims to ensure that the items accurately reflect the concepts defined theoretically (Sanduvete-Chaves et al., 2014).

Items scoring $p \geq 0.6$ on the Osterlind index could be included in the proposed protocol. For clarity, data analysis, frequencies, and percentages were used.

3. Results

In the psychopathological factors dimension (Table 2), 41 items obtained scores between .67 and .91. Regarding relevance, a total of 25

items were considered relevant or important for measuring this dimension, of which 15 obtained scores between .67 and .83.

Table 2: Index of representativeness, relevance and clarity of psychopathological factors.

Source: Own elaboration.

	Representativeness Index	Relevance Index
Depression		
Enjoying things less than before	1	1
Being sad/sad	1	1
Feelings of loneliness	.833	.667
Thinking that life has no meaning	.833	.667
Death Wishes	.833	.667
Thinking that no one cares	.833	.667
Crying	.833	.667
Thinking you are unlucky	.917	.667
Anxiety		
Ruminating/intrusive preoccupation	.833	.667
Overwhelmed by the problems	.833	.667
Anxiety crisis	.917	.833
Fear of making a mistake	.745	.833
Substance use		
Smoking marijuana or joints with friends	.833	.667
Drinking alcohol with friends	1	1
Post-traumatic symptomatology		
Affected by the events experienced	.833	1
Embarrassment for talking about past events	.917	.833
Intrusive images	1	1
Intrusive and repetitive thoughts and images	.833	.667

Obsession-compulsion		
Compulsions of order	1	1
Anxiety if you avoid compulsions	1	.667
Fear of getting dirty or contaminated	.917	1
Compulsive checking	1	.667
Presence of somatic complaints		
Morning fatigue	1	1
Headache	1	1

In the dimension of cognitive and behavioral factors (Table 3), thirteen items were considered representative, characteristic, or typical of this dimension, of which seven obtained scores

between .6 and .8, and six obtained a score equal to 1. On the other hand, thirteen items were considered relevant, with six scoring between 0.6 and 0.8 and seven scoring 1.

Table 3: Index of representativeness and relevance of cognitive and behavioral factors.

Source: Own elaboration.

	Representativeness index	Relevance index
Suicidal thoughts		
Desire to die or not to wake up	1	1
Suicidal thoughts	1	1
Thoughts on how I would carry out this idea	1	1
Ideas accompanied by the intention to implement them.	1	1
Suicide attempts		
Elaboration of details on how to commit suicide and intentions to carry out the plan.	.833	.833
Prior attempts/planning or prior preparations to end your life	.833	.833
Self-injurious behavior		
Cutting or scratching your skin	1	1
Hitting yourself on purpose	1	1
Pulling out your hair	.667	.667
burning your skin (with a cigarette or other hot object)	.667	1
Inserting objects under the fingernails or skin	.833	.833
Skin scraping	.667	.667

In the dimension corresponding to the historical or family background factors (Table 4), a total of two items were identified as relevant and

representative, both with a relevance index of 0.67 and a representativeness index of 1.

Table 4: Index of representativeness and relevance of historical or family history.

Source: Own elaboration.

	Representativeness index	Relevance index
Family suicidal behavior		
Family member with a history of suicide attempt	1	.667
Family member with a history of suicide	1	.667

When the items contained in the dimension of emotional-motivational factors (Table 5) were examined, referring to the levels of hopelessness and reasons for living, a total of 29 representative

and 30 relevant items were identified. Of these, 18 obtained a representativeness index between 0.67 and 0.83, and another 18 obtained a relevance index within the same range. Twelve items obtained a relativity index equal to 1.

Table 5: Representativeness and relevance index of emotional-motivational factors.

Source: Own elaboration.

	Representativeness index	Relevance index
Level of hopelessness		
Looking forward to the future with hope and enthusiasm	1	1
To expect in the future to achieve what is of interest	.833	.833
Thinking of the future as dark	1	1
See all unpleasant	1	1
Do not expect to get what you want	1	1
Expect to be happier in the future	.667	.667
Have great confidence in the future	.833	.833
To be able to achieve real satisfaction in the future	.833	.833
Waiting for better times	1	1
Hopelessness and pessimism in achieving something	.667	.667
Reasons to live		
Believing you have control over your life	.833	.833
Desire to live	1	1
Fear of death	.667	.667
Not wanting to die	.667	.667
Wanting to see their children grow up	1	1
Have future plans that you want to make	1	1
Loving and enjoying the family	1	1
Courage for life	.667	1
Possibility of finding other solutions to the problem	.667	.667
Esteem and empathy for the family's grief	1	1
Expectations of things to do in the future	1	.833
To be happy and joyful with life	.667	.667

To hope that things will get better	.833	.833
No intention to hasten death	.667	.667
Do not want the family to think you are selfish or cowardly.	.667	.667

The dimension of adverse or potentially traumatic life factors (Table 6) explores indicators of physical, psychological, or sexual abuse, as

well as experiences of separation or rejection, bullying and cyberbullying, and exposure to other suicides. For this dimension, 22 items were considered representative or relevant

Table 6: Representativeness and relevance index of adverse or potentially traumatic life factors.

Source: Own elaboration.

	Representativeness index	Relevance index
Physical, psychological or sexual abuse		
Sexual assault (rape, attempted rape, made to perform any kind of sexual act through force or threat of harm)	1	.667
Other unwanted or uncomfortable sexual experience	1	1
Experiences of separation or rejection		
Bullying and Cyberbullying		
Someone has threatened you	1	.833
Has been excluded or ignored by others	1	1
Someone has spread rumors about him/her	.667	.667
Has hit, kicked or pushed anyone	.667	1
You have insulted and said offensive words to someone.	1	1
Has said offensive words about someone to others	.667	.667
Has threatened someone	1	1
You have spread rumors about someone	1	1
Someone has threatened you through Internet messages or SMS messages.	1	1
Someone hacked into your email account and removed your personal information.	1	.833
Someone has posted private videos or photos of you on the Internet.	.667	.667
You have been excluded or ignored from a social network or chat room.	.833	.833
Threatened someone through SMS or internet messaging	.667	1
You have hacked into someone's email account and stolen their personal information.	.667	1
Hacked into someone's account and impersonated him/her	.667	1
You have posted compromising videos or photos of someone on the Internet.	.667	.667
You have retouched photos or videos of someone that were posted on the Internet.	.667	.667
You have spread rumors about someone on the Internet	.833	.833

When observing the results obtained in the dimension of environmental and circumstantial factors (Table 7), which seeks to assess aspects related to the consumption of materials that promote and disseminate suicidal behavior through different media, it was found that a total of 4 items were considered representative, yielding scores of 0.67.

The social, interpersonal, and family factors (Table 8) obtained results of relevance and representativeness in the dimensions of problems with peers and social support with ranges of .67 and .83.

Table 7: Index of representativeness and relevance of environmental and circumstantial factors.

Source: Own elaboration.

	Representativeness index	Relevance index
Consumption of materials promoting and disseminating suicidal behavior (television, radio, internet).		
Have recently seen images or read about self-injury or suicide in any audiovisual media.	.667	.667
Having been tempted to harm oneself after viewing some type of content on the internet	.667	.667
Have been tempted to hurt yourself and sought help on the internet	.667	.667

Table 8: Index of representativeness and relevance of social, interpersonal and family factors.

Source: Own elaboration.

	Representativeness index	Relevance index
Problems with colleagues		
Others laugh at him/her at school or high school.	1	1
Beaten at school or high school	.667	.667
His classmates ignore him	1	.833
Social support		
His/her friends turn to him/her when they are in trouble	1	1
Is sociable	1	.667
Considers that he has real friends	1	.833

Finally, within the personality factors (Table 9), fourteen obtained accepted values of representativeness and relevance, including indicators related to hyperactivity, impulsivity, and emotional regulation. The factors linked to the motivational volitional theory (Table 10)

obtained 41 accepted indicators in the items of entrapment, defeat, and perceived efficacy for suicide.

In terms of clarity, the items of the nine dimensions obtained scores between 86% and 100% approval by the experts.

Table 9: Representativeness and relevance index of personality factors.

Source: Own elaboration.

	Representativeness index	Relevance index
Hyperactivity-Impulsivity		
They often tell you that you interrupt others and that you do not stop talking.	.667	.667
He is told that he is very impatient	.667	.667
Emotional regulation		
You find it difficult to understand your feelings	.833	.833

Table 10: Representativeness and relevance index of the factors of the volitional-motivational theory.

Source: Own elaboration.

	Representativeness index	Relevance index
Entrapment and Defeat		
Wants to escape from him/herself	.667	.667
You would like to run away from your thoughts and feelings	.667	.833
He feels he is in a pit from which he cannot climb out.	1	1
Feeling trapped	1	1
You want to escape from your life	1	1
Often have the feeling that you would like to run away	.667	.833
Feels unable to change things	1	1
He sees no way out of his current situation	1	1
You feel you have no place in the world	.667	1
He feels that life has treated him very badly	.667	.667
Feels powerless	.667	.667
Feels capable of dealing with any situation that gets in his way	.667	.667
You feel you have hit rock bottom	.667	1
Feeling sunken and lost	1	.667
He feels he has no strength left to fight	.667	.833
Acquired Ability (Perceived Efficacy) for suicide		
He is very afraid of dying	.667	1
He does not mind that death is the end of life as he knows it.	.667	.833
Can tolerate a great deal of physical discomfort	.667	.833

4. Discussion

As a first general result, it was possible to select, according to content validity criteria, a series of items that measure the most relevant facets related to self-injurious behavior, as outlined in the literature. The variables chosen to form part of this protocol were made up of scales or tests with proven evidence of validity and reliability (Table 1) (Al-Halabí et al., 2016; Ordoñez-Carrasco et al., 2021)

The dimensions with the highest number of relevant items were, in descending order, psychopathological factors, cognitive factors, volitional-motivational factors, adverse or potentially traumatic factors, and historical or family factors. Less than fifty percent of the items were emotional and motivational factors, environmental and circumstantial factors, and, finally, personality factors.

The first dimension analyzed refers to psychopathological factors, highlighting the items of depression, anxiety, substance use, posttraumatic symptomatology, obsession and compulsion, and the presence of somatic complaints. All of them obtained scores of significance for both the representativeness and the relevance of the test. Depressive, anxious, and addictive symptomatology is widely studied as factors linked to suicidal risk (Baca García & Aroca, 2014) (Park et al., 2020). In the case of posttraumatic symptomatology, although fewer studies establish this relationship (González and Crespo, 2022), there is evidence showing that the identification and treatment of posttraumatic indicators reduce the risk of suicide. To a lesser extent, studies show the presence of somatic complaints (Lopez-Vega et al., 2020) linked to suicidal risk. Similarly, traits of obsessive-compulsive behaviors significantly increase the risk of showing suicidal behaviors (Albert et al., 2019).

In the cognitive factors dimension, the indicators of attempts, suicidal ideation, and

self-injurious behaviors were accepted, while the suicide planning items were excluded. Thus, the participants found that the wording of the Suicidal Planning items did not fit the intended measure or that their content was not relevant to the dimension in which they were included. This result is not consistent with previous studies on risk factors that include suicidal planning as an aspect to be considered for the estimation of suicidal risk (Hernández-Bello et al., 2020). The relevance of the ideation and intentionality items may have displaced the value of planning, which can also be considered a form of ideation.

In another order, referring to the items linked to the dimension of volitional-motivational factors, it is accepted to focus on the feeling of entrapment and defeat felt by the person, leaving in smaller proportion the items linked to the acquired ability or perceived efficacy of suicide. Previous studies point to the direct relationship between aspects of entrapment and defeat with suicidal ideation in adolescents (O'Connor et al., 2018), unlike the case of acquired capacity for suicide, which has not shown evidence of internal validity (González-Betnazos, et al., 2022). Acquired capacity for suicide is mainly linked to a transition process between suicidal ideation and suicide attempt and may not be an element of initial risk assessment (Joiner, 2005; Van Orden et al., 2010).

The items referring to abuse and experiences of violence corresponding to the dimension of adverse and potentially traumatic factors were considered both representative and relevant. Some studies have highlighted how the experience of adverse or traumatic life events, especially in childhood, such as abuse, are risk factors or even determinants of suicide (García et al., 2006).

The items indicating the existence of previous suicides in the family obtained an adequate score of representativeness and relevance. In line with the existing literature, these items are considered relevant indicators for analyzing suicidal risk

(Hernández-Bello et al., 2020). Items related to identifying the mere kinship relationship with the deceased family member were discarded.

Regarding the dimension grouping of emotional and motivational factors, 43% were considered representative, and 44% were considered relevant for the items related to the contents of hopelessness and reasons for living. Many of the experts who participated in the present study did not rate most of these items positively as important or characteristic of what they were intended to measure. Consistently, similar results were found in other studies where the appropriateness of using these items is weighed for their weakness in estimating suicide risk (Rueda-Jaimes et al., 2016). This may be due to the preference for considering these dimensions for clinical intervention rather than for risk assessment. The same consideration is recommended as good practice for the assessment and treatment of suicidal behavior (Rueda-Jaimes et al., 2016).

The items linked to the dimension of environmental and circumstantial factors were considered representative and relevant, specifically those related to the promotion and dissemination of images, videos, or texts with violent or suicidal material. The judgments of experts who participated in the present study assessed exposure to information with suicidal content as a risk factor. The WHO has explained the role of media influence on suicidal and self-injurious attitudes, beliefs, and behaviors (Herrera et al., 2015) and has highlighted the importance of paying attention to this risk factor. The items related to the social, interpersonal, and family dimensions that were considered suitable for estimating this scale are those involving abuse or bullying content, which is an important risk factor and aligns with the adverse effects dimension.

The literature has highlighted that impulsivity is present in about half of the people with suicidal and self-injurious ideas (Sauceda et al., 2006). Consistent with these results, the items of the personality dimension positively valued by the experts in this study were those related to impulsivity and hyperactivity.

Some limitations of the present study should be mentioned. Firstly, it is related to the low participation of experts, which may be attributed to the extensive nature of the rating sheet, covering multiple dimensions. Some authors have considered this as a threatening aspect of completing a survey (Roco Videla et al., 2021). Secondly, the linguistic differences of the experts derived from their different nationalities and cultural contexts, whose idiomatic expressions can influence the judgment of the items as more or less accurate; thirdly, some of the participants have preferred paradigms or theoretical models, which could bias the assessment of the content of the items by aligning them with the postulates of their theoretical framework of reference. Finally, a fourth limitation was the small number of experts specialized both in the area of suicidal behavior in adolescents and psychometrics, particularly in content analysis. This means that the results of the present study should be interpreted with caution. Future studies should replicate these results with larger samples, utilizing a more parsimonious scale design and incorporating multiple informant sources.

Nevertheless, the set of these results represents a first attempt in the field of psychometric research to construct a scale from the content of previously validated tests and, even more, by obtaining evidence of content validity from the set of all items and variables associated with the main risk factors for suicidal behavior in adolescents and young adults.

It is recognized that this methodology of grouping items from different conceptualizations is unconventional. However, it offers the opportunity to establish more rigorous analyses and comparisons of the different factors associated with suicidal and self-injurious behavior from the perspective of different theoretical models. This type of item organization and structuring has been used in the field of forensic psychology to create protocols to estimate the risk of violence (Pueyo et al., 2008), and applied to the field of suicidal behavior invites further exploration of this methodological possibility.

The results of this study are beneficial for both psychometric research and clinical practice, as

they facilitate a more accurate categorization of the factors associated with the problem and their relationship with therapeutic intervention frameworks.

The associated factors outlined in this instrument can serve as a guide for designing psychoeducation or social intervention programs to be developed in community or school environments for the prevention of problems in the child and adolescent population.

This study can be considered the first content validity study of a suicide risk assessment

protocol for adolescents conducted in the Dominican Republic, which provides a background framework for other studies in the area of psychometrics that may be generalized to other countries with similar psychosocial and cultural characteristics.

Content validity studies should consider the sample size (Roco Videla et al., 2021). In the design of the instrument, a relevant factor to consider is the inclusion of psychological scales for data collection or the use of clinical interviews as alternative and complementary sources of information.

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Inverted Learning and Lifelong Learning: Synergies for 21st Century Education

Formación previa y legislación vigente: incidencia en la elaboración de unidades didácticas

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Inverted Learning and Lifelong Learning: Synergies for 21st Century Education

Formación previa y legislación vigente: incidencia en la elaboración de unidades didácticas

Abstract

This study explored the perceptions of Ecuadorian students about the Flipped Learning (FL) model in Research Methodology, using mixed methods (questionnaire N=18, focus group N=7). The results revealed a positive assessment of FL, highlighting the flexibility and usefulness of videos to reinforce learning. However, challenges such as lack of engagement and difficulty in formulating questions during video viewing were identified. The length and quality of the videos were also critical factors. It was concluded that FL can be effective in this context, but requires careful planning that considers the selection of materials and promotion of interaction. It is suggested to investigate the long-term impact and variables such as gender and digital competence, recognizing the convergence of FL and lifelong learning as a comprehensive educational paradigm.

Keywords: flipped learning, perceptions, lifelong learning, higher education, Ecuador.

Resumen

Este estudio exploró las percepciones de estudiantes ecuatorianos sobre el modelo Flipped Learning (FL) en Metodología de la Investigación, empleando métodos mixtos (cuestionario N=18, grupo focal N=7). Los resultados revelaron una valoración positiva del FL, destacando la flexibilidad y la utilidad de los videos para reforzar el aprendizaje. Sin embargo, se identificaron desafíos como la falta de compromiso y la dificultad para formular preguntas durante la visualización de videos. La duración y calidad de los videos también fueron factores críticos. Se concluyó que el FL puede ser efectivo en este contexto, pero requiere una planificación cuidadosa que considere la selección de materiales y la promoción de la interacción. Se sugiere investigar el impacto a largo plazo y variables como género y competencia digital, reconociendo la convergencia del FL y el aprendizaje a lo largo de la vida como un paradigma educativo integral.

Palabras clave: aprendizaje invertido, percepciones, aprendizaje a lo largo de la vida, educación superior, Ecuador

1. Introduction

In the context of the current digital era, higher Education faces the challenge of preparing students for a dynamic work environment where lifelong learning, adaptability, and autonomy are key competencies. In this scenario, the Flipped Learning (FL) model has emerged as an innovative pedagogical strategy with the potential to foster lifelong learning by promoting active participation, self-regulation, and the development of transversal competencies (Li et al., 2021; Martínez-Clares et al., 2024). Unlike the traditional approach, flipped learning is a pedagogical approach in which direct instruction is moved from the group learning space to the individual learning space. The resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and creatively engage with the subject matter (Flipped Learning Network, 2014). This reorganization of learning time and space not only increases flexibility but also responds more effectively to the individual needs of students, regardless of their age, academic level, or sociocultural context.

Several studies have documented the benefits of FL in Higher Education, highlighting significant improvements in student motivation (Akçayır & Akçayır, 2018), self-regulation of learning (Campos-Martínez & Duran-Llano, 2023), and academic performance (Hew & Lo, 2018; Sola Martínez et al., 2019). Likewise, it has been observed that this methodology favors more effective feedback (Kim, 2017), strengthens student self-efficacy (Sun et al., 2018), and fosters a deeper understanding of content, stimulating critical thinking, collaboration, and the development of higher-order cognitive skills (Blau & Shamir-Inbal, 2017; O'Connor et al., 2016; Pence, 2016).

Although much of the literature originates from European contexts, it is acknowledged that the applicability of FL extends beyond these scenarios, demonstrating a high potential to adapt to diverse educational realities (Sánchez-Soto & García-

Martín, 2022). However, its implementation in contexts marked by structural inequalities, as in many Latin American countries, faces significant challenges. The digital divide and socioeconomic disparities can exacerbate differences in access and academic performance (Malo Álvarez et al., 2020), underscoring the need to critically examine the viability and effectiveness of FL in these environments.

The model is based on student-centered learning theories, where pre-class preparation and active participation during face-to-face sessions are key elements of the learning process (Abeysekera & Dawson, 2015; Lee & Choi, 2019; Li et al., 2021). However, their adoption may be limited by factors such as resistance to change, lack of institutional support (Urgilés et al., 2019), the need for additional pedagogical accompaniment, and poor prior preparation of the student body (Choi et al., 2015; Hung, 2015; Pence, 2016).

The limitations of the model, including gaps in access to technology, the need for well-developed autonomy, limited teacher training, a solid technological infrastructure, and dependence on instructional design, underscore the need for a carefully planned implementation (Lee, 2023). Among the main limitations for students are the high demand for time and effort, the lack of familiarity with collaborative work, and the low perceived value of feedback. On the part of teachers, they highlight the need for a greater investment of time in lesson planning and limited training in the use of digital tools, which can make it challenging to take advantage of the available technological platforms (Quinde-Herrera et al., 2023b).

In this context, the present study aims to investigate students' perceptions of the implementation of the FL model in an Ecuadorian public university. Specifically, this study seeks to answer the following research questions:

How do college students perceive the FL model in terms of their learning experience, including participation, attitudes, and emotional aspects?

What factors influence the effectiveness of the FL model in a university context with inequalities, and what recommendations can be derived to optimize its implementation and promote lifelong learning?

The main objective of this study is to understand how the FL model can be adapted and optimized to promote lifelong learning in unequal educational contexts, thus contributing to equity

and quality in higher Education. It has two specific objectives: 1) to analyze the factors that condition student participation in the FL model and 2) to identify students' qualitative perceptions of the benefits and challenges of the model. This study is distinguished by its focus on a Latin American context with inequalities, which enables the generation of relevant empirical evidence for adapting and optimizing the FL in similar environments. The findings of this research have the potential to inform educational policies and practices that promote equity and quality in higher Education, thus contributing to the development of more just and equitable societies.

2. Materials and methods

A mixed-methods approach was employed, utilizing a sequential explanatory design that began with quantitative data to establish trends and then interpreted the results qualitatively (Creswell, 2009). Table 1 shows the participants in this study and the instruments for data collection.

2.1. Context

The study was applied in two didactic units of the Research Methodology course in the third

year of an undergraduate degree at a public university in Ecuador. The intervention consisted of preparing the instructional design based on the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) between the researchers and the teacher who taught the classes, considering that it is the first experience applying the FL model for all participants. The instructional design phases and recommendations were based on the proposals of Quinde-Herrera et al. (2023a; 2022).

Table 1: Research design, instruments, techniques and participants

Source: Own elaboration.

Explanatory Sequential Design	Data collection instruments and techniques	Number of participants
Phase 1 (quantitative data)	LF Perceptions Questionnaire	18
Phase 2 (qualitative data)	Focus group	7

2.2. Participants

This is a non-probabilistic purposive sampling, following the inclusion criteria: i) public university; ii) teacher with no experience in the use of FL; iii) students who have not received classes under the FL model.

2.2.1. Student profile

In the FL course, 22 students participated (16 female, six male), with an average age of 21.5 years ($SD = 1.34$). All had a computer at home, but 64% used it less than three hours a day. The most commonly used technological tools were

email, instant messaging, and web browsers. Seventy-seven percent of the students studied mainly at home.

2.2.2. Sample

Of the 22 students who attended the class, 18 completed the perception questionnaire (female, $N = 16$; male, $N = 2$) individually immediately after their last FL class session. Qualitative information was obtained through a focus group, in which seven female students participated, selected for their willingness to delve deeper into the questionnaire responses and their active class participation.

2.2.3. Teacher profile

The teacher who participated in the study has taught for more than 10 years in the health area and offers the subject of research methodology. He has not taught using the FL model. To learn more about his profile, an interview was conducted. According to the interview, the primary technological tool she usually uses to communicate with her students is email, as they prefer to resolve their doubts personally. Generally, she uses MS PowerPoint presentations during classes. She does not use more tools due to her limited knowledge and lack of time to prepare for the classes. As for class activities, she usually does group work of up to three people to motivate and maintain student participation. In addition, she uses strategies such as calling them by name and asking direct questions. Finally, she noted that due to time constraints, it is challenging for her to effectively integrate technologies in large classes.

2.3. Data collection instruments

Quantitative and qualitative data were collected through two instruments. In the quantitative phase, a questionnaire was administered to assess students' perceptions of the LF, and in the qualitative phase, a focus group was conducted.

2.3.1. LF perceptions questionnaire

To investigate students' perceptions of FL, a paper-based questionnaire was developed based

on Hung (2015), which presents three sections that included open and closed questions: i) student participation, addresses the time and effort dedicated by students outside the classroom; ii) learning attitudes: evaluates learning engagement and satisfaction with the design of the material; and iii) learning experiences: investigates students' emotional aspects. Additionally, an open-ended question was included at the end, asking students to provide any relevant observations that could improve the teaching and learning process. To adapt the questionnaire to the local context, it was translated into Spanish, maintaining the semantic and conceptual fidelity of the original. Subsequently, a pilot test was conducted with a group of 20 students from another university in the same city, who had characteristics similar to those of the study participants. The objective was to verify the clarity and coherence of the items in the new linguistic and cultural context. Based on the comments and observations of the pilot group, minor adjustments were made to the wording of some items to ensure their comprehension. Although no formal statistical validation was conducted, this process ensured the instrument's adequacy before its final application.

2.3.2. Focus group

This technique was used because it can be applied in any area, context, and population and allows for clarifying the answers to quantitative surveys (Escobar & Bonilla Jimenez, 2009). The focus group was conducted with seven students who participated voluntarily. This group was selected from the 18 students who completed the questionnaire; 7 agreed to collaborate, as they were in the final week of the semester. The selection criterion was the availability and willingness to contribute with their experiences, maintaining variety in terms of levels of participation and perception of the model. The focus group was conducted once the questionnaire data had been processed, approximately one month after the FL was applied. The activity was conducted in a university meeting room; conversations were recorded with prior informed consent and also documented in notes. They were asked to provide their honest opinions about their experience with the FL model in order to improve its application. The duration was approximately 45 minutes, and

a natural conversation was maintained throughout the session.

The focus group guide included semi-structured questions, elaborated based on the quantitative results of the first phase and the gaps identified in the data. For example, questions aimed at exploring the reasons why students did not watch the assigned videos were included, a finding that emerged from the analysis of the questionnaire. However, the focus group development was flexible, allowing most of the questions to emerge naturally during the conversation, enabling a deeper exploration of relevant topics and new ideas. A verbatim transcription of the recording was made for analysis.

2.4. Data analysis

For the quantitative analysis, a descriptive analysis was conducted on the responses to the closed-ended questions of the questionnaire, using frequencies and percentages of the data. In addition, a qualitative analysis was conducted to study the responses to the open-ended questions (Piñuel Raigada, 2002) using Atlas. Ti. 22.1.3.0 program.

To carry out the qualitative analysis, the following coding was implemented: C.A4, where C denotes an open response, and A4. Represents the section

(A) and the question number (4), followed by a number that identifies the Student. For example, code C.A4.1 refers to an answer provided by student 1.

For the focus group response analysis, the responses were coded as follows: GF to indicate that it was a response from the Focus Group, and E, which stands for Student, plus a number indicating the Student's number. For example, GF.E1 indicates that it refers to a response from the focus group, specifically from student 1.

The analysis was conducted through basic thematic coding, where the main ideas were identified and grouped into categories inductively constructed from the responses and then contrasted with previous studies to ensure coherence and interpretative fidelity. The exercise enabled comparison and complementation of the quantitative findings with a more contextual and meaningful perspective from the students themselves.

2.5. Ethical considerations

All participants signed an informed consent form before participating in the study. To ensure confidentiality and anonymity, all personal information was coded in a manner that prevented participants from being identified.

3. Results

3.1. Student perceptions of the FL model

The findings show that students perceive the FL model as a strategy that fosters participation, influences their attitudes toward learning, and has an impact on emotional aspects.

Participation in preparation for learning

Students spent an average of 83 minutes studying the material before each class, with a range

of 10 to 180 minutes ($SD = 61.48$). Regarding video viewing, the average time was 59 minutes, although the maximum duration of the videos provided was 24 minutes. Additionally, students reported that they needed to view the videos on average 2.33 times to thoroughly assimilate the content. Table 2 presents the descriptive statistics on study time

Table 2: Student participation in the LF
Source: Own elaboration.

Study time	N	Min.	Max.	Media	SD
How many minutes do you study outside of class each lesson provided by the teacher?	18	10	180	83,06	61,48
How long does it take you to watch the videos related to each lesson?	18	10	120	59,17	36,95
How many times do you have to watch a video until you assimilate the content?	18	2	3	2,33	0,48

Attitudes towards learning with the FL model

Variables such as commitment to learning and satisfaction with the design of the material were considered as attitudes toward the FL model. A commitment to learning was reflected in the fact that 100% of the students expressed the need to delve deeper into a topic before feeling satisfied

with their understanding. However, only 44.4% attended class with specific questions, while 38.9% limited their study to the material taught in class. In addition, 27.8% prioritized memorizing key points over understanding the content, and a similar percentage considered that the best strategy for passing an exam was to remember answers to possible questions. Table 3 presents the results of learning engagement.

Table 3: Students' perceived commitment to learning
Source: Own elaboration.

Commitment to learning	No.	%
I have to do more work on a topic in order to form my own conclusions before I am satisfied.	18	100
My goal is to pass the course while making as little effort as possible.	2	11,1
I seriously study only what is given in the classroom.	7	38,9
Memorizing key points helps me get a better grade rather than trying to understand them.	5	27,8
I think the best way to pass an exam is to try to remember the answers to possible questions.	5	27,8
I have been spending a lot of my free time trying to find more information on interesting topics that have been discussed in the different classes.	3	16,7
The materials and videos provided by the teacher are not enough, so I have to look for more information about it.	3	16,7
I come to class with questions that I want answered.	8	44,4
I consider that it is not useful for me to study in depth topics that have not been covered in class.	1	5,6

Student satisfaction with the material design

94.4% of the students expressed satisfaction with the course content, while 66.7% rated the learning experience with the FL model positively. Regarding the integration of multimedia

resources, 61.1% showed satisfaction, and 44.4% rated the formats and structure of the material positively. Table 4 shows the percentage of student satisfaction with the design of the material offered in the course.

Table 4: Student satisfaction with the material design

Source: Own elaboration.

Satisfaction with material design	No.	%
I am satisfied with the contents and topics covered in the study material.	17	94,4
I am satisfied with the formats and structure of the study material.	8	44,4
I am satisfied with the integration of the multimedia resources provided.	11	61,1
I am satisfied with this new learning experience	12	66,7

3.2. Learning experience and emotional aspects

This section presents an analysis of responses to three open-ended questions regarding the learning experience, concerns encountered during the process, and changes in attitude following the implementation of the FL model.

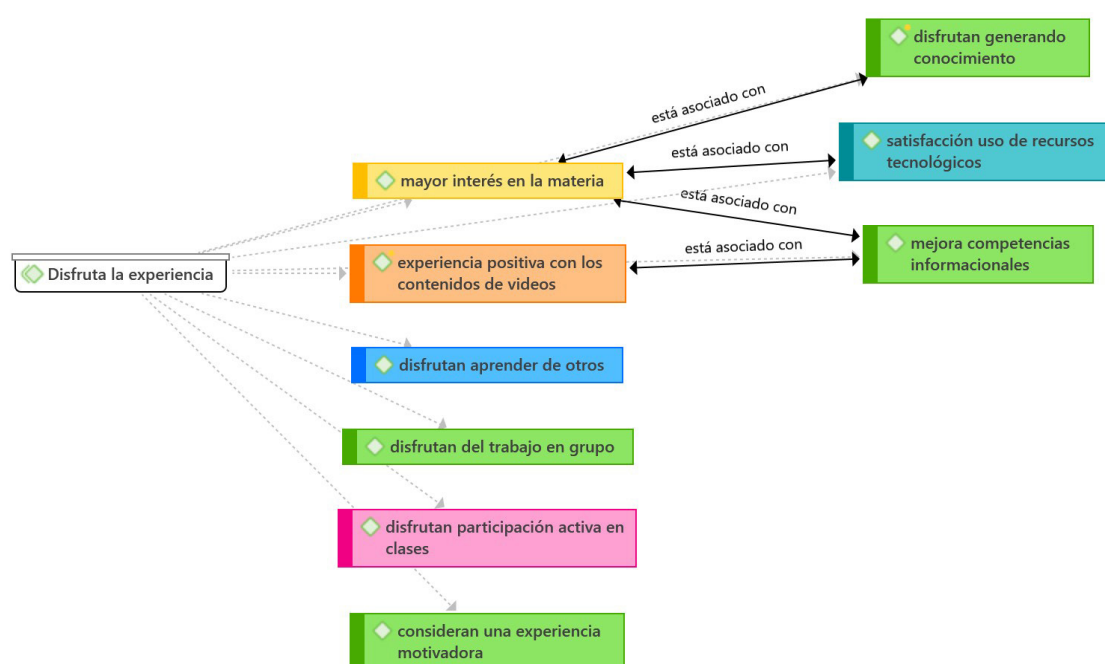
Enjoy the learning experience

Of the 18 participants, three did not respond, and one did not enjoy the experience. Respondents expressed that they enjoyed the learning experience due to the use of technological resources (C.C1.11 Presentation of videos of professors) and that they were able to develop informational skills (C.C1.2 How to research and

how to search for scientific articles correctly). It is interesting to note that they also stated that they enjoyed the process of elaborating the scientific article outline (C.C1.1: Making the article) and formulating research projects (C.C1.6: Research projects). In the focus group, they highlighted the value of active participation, group work, mutual learning, and increased interest in the subject. The experience motivated them to learn autonomously (Figure 1). Additionally, they emphasized the importance of group affinity and the benefits of collaborative work among groups.

GF.E7: I do like to work in a group, but it also depends on the group you have and the affinity.

GF.E2: or if something we were missing and another group had it, then it also helps us to complement each other's knowledge.

**Figure 1:** Enjoyment of the FL Learning Experience

Source: Own elaboration.

Difficulties and concerns of the learning experience.

Of the 18 respondents, 27.78% had no difficulties. The remaining 13 had difficulties with comprehending the content and videos. In the focus group, students expressed frustration with the impossibility of asking questions during the viewing of videos and mainly found difficulties with their duration (GF.E7: maximum about 10 minutes.... [interrupts] GF.E3: yes, or eight... it's a lot, GF.E7: aha! Or saying that they have already abused us, 15!) and they mentioned that sometimes they do not finish visualizing them (GF.E7: I do not see, I did not finish seeing), they lose concentration (GF.E4: one gets distracted

by anything, so I was also watching [makes a bored gesture] and pausing, because I was about to leave, and I would come back, listen again, I think I was waiting, and from there I would go back, I would go to the patio, so... pause, pause, pause, as not to get bored), they make notes while they pause (GF. E3: I take notes [interrupts] GF.E4: Aha! I write down, I listen to what I am already more or less... I write down, I pause and then again, I write down and that's it, to have a reinforcement), and they pause to understand when they consider that the speaker speaks too fast (GF. E2: because he spoke very fast, we also had to stop). They also expressed concern that they could not access the articles because they were behind a paywall (C.C2.5, requiring a fee to find online articles) (Figure 2).

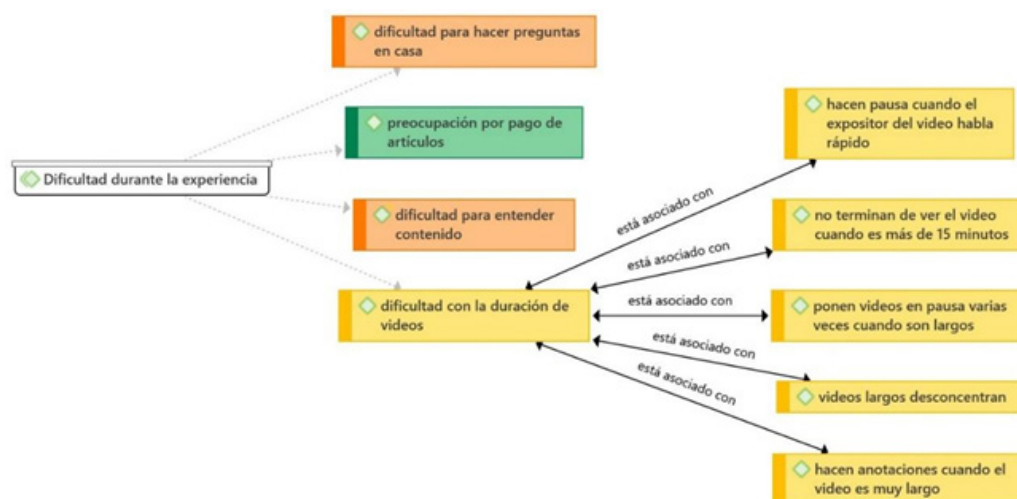


Figure 2: Concerns during the learning experience

Source: Own elaboration.

Four students (22.22%) reported difficulty with the videos. These reported difficulties were probed in the focus group. These discussions led to suggestions for improving FL implementation (Figure 3).

Students mentioned that the videos were handy for learning through tutorials that explain how to do something. For example, bibliographic searches and bibliographic managers (GF.E6: For instance, how to use Zotero, PubMed, etc.). They considered the content of the videos to be adequate. However, they expressed that it would be even better if they were accompanied by examples (GF.E2: I say, the content is acceptable,

but it could be that after the video or during the video, an example is explained [interrupts] GF.E7: a hypothesis, C.G1: More examples from daily practice). They also indicated that the duration of the videos should be between 8 and 10 minutes (GF.E7: maximum about 10 minutes.... [interrupts] GF.E3: yes, or eight... it is a lot). The students relate the duration and quality of the videos to the boredom they feel when watching them (C.G1). Perhaps in terms of the videos, consider making them more didactic, as the ones provided were boring and monotonous; look for dynamic videos. They also prefer videos with concrete content and that are explained through figures or images (GF.E1: that is, that they give

us videos, but those videos where... they make some maps, that is, of this... this, a summary [interrupts] GF.E2: of course the most important thing), preferably that they are professional (GF.E2: there is a page on the YouTube channel, I think it is Education, but it is like that in video, but no person is shown, but only spoken and they make squares).

Change regarding attitudes towards the learning experience with FL

Four students did not respond, and two indicated that there was no change. Of the remaining 12, several categories were identified in the

analysis (Figure 4): greater interest in the subject (C.C3.13: The subject has made me search for information on my own, look for topics of interest and find them), use of technological resources (C.C3.4: Easier to use bibliographic managers), improve information competencies (C.C1.2: Yes, you know how to research and how to search for scientific articles correctly), seek to learn other topics through videos (C.C3.17: I am interested in searching for articles on different websites) and change in the way of learning (C.C3.2: I think that now instead of trying to memorize certain things, I am more concerned about the logic of how they work and thus have more knowledge without forgetting later what I have learned) (Figure 4).



Figure 3: Criteria for video selection

Source: Own elaboration.



Figure 4: Change in attitudes towards the learning experience

Source: Own elaboration.

Student recommendations for implementing the LF

Based on the participant's responses to the open-ended questions in the questionnaire and the focus group, recommendations were generated for two aspects of implementing the LF.

Suggestions for learning preparation

According to the learning experience with FL, participants prefer to select videos of 8 to 10 minutes in length, featuring concise and dynamic examples, preferably tutorials (Figure 4). Long videos can distract students, requiring them to repeat or pause to take notes (GF.E4:

One gets distracted by anything, so I was also watching and pausing...). They expressed that they had a positive experience with the videos, which provided relevant content for the subject (C.A4.3: How important is the literature review in conducting a research project). They also consider that the videos help reinforce and clarify

the topics (C.A4.2: The videos helped me since I was able to reinforce the knowledge given in class and learn better) and support their learning and review process (C.A4.15: You learn more through repetition). Some students mentioned the usefulness of the technological resources used in the course, specifically the programs for quoting (C.A4.5: The programs for quoting) (Figure 5).



Figure 5: Suggestions for preparing for learning

Source: Own elaboration.

Suggestions for learning support

To explore students' perceptions of FL design and the use of digital technologies, the focus group inquired about their interaction with the platform and preferences for digital resources (Figure 6). Participants expressed satisfaction with Moodle, highlighting its ease of use. Some had previous experience with this tool (GF.E4: I think that more than anything when we came to class, it was a problem with the machines, and that is why it did not load or did not come up on some machines, but, in itself, I think that the platform was easy for everyone and something simple to learn...).

Regarding preferred resources before class, students mentioned that they prefer watching videos rather than reading texts (GF.E4: I prefer watching videos to reading a PDF, GF.E6: It is just that PDFs are too long...[laughs]).

The participants indicated that the use of digital technology enables them to integrate the practical aspects of the subject (C.B14.4: The use of technological methods contributes to integrating practice more effectively). However, in the focus group, the students reported difficulty with the video resource, which is mainly due to the lack of time due to the academic workload and university

schedules (GF.E7: ... It is that at home it is more complicated because that is what many of the teachers do not understand that we come home to do homework, work, surveys, then... it is not that we have so much free time, that is the problem, GF.E6: besides, it is not just one subject, the 7 (emphasizes 7) subjects accumulate with the tests, with the work, with the lessons... besides, one also has to sleep, has to eat..., GF.E6: ...if we had classes only in the morning, whatever, but, many times we had classes until seven at night, all day at the university and then do more work and homework..., GF.E7: and on Saturdays we also had electives).

Likewise, in the focus group, students highlighted that it is difficult for them to understand the contents when new material is presented to them only through videos. Students expressed that videos are more useful to reinforce learning since they cannot ask questions while watching them (GF.E4: I know that maybe the next day one goes and asks, this or this, but it is not the same because at that moment, one already talks to the teacher, tells him/her that I did not understand, how can I do? Then you understand that moment, GF.E1: in our case, it could not be applied in all subjects because, for example, in physiopathology, we see disease and it is quiet... and we cannot learn only through a video, we can see the disease and to reinforce the video).



Figure 6: Suggestions for learning support

Source: Own elaboration.

4. Discussion

This study examined students' perceptions of implementing the FL model in a university subject in Ecuador, revealing a generally positive assessment of the approach, albeit accompanied by significant challenges.

Benefits of flipped learning

Participants recognized multiple benefits of FL, such as the flexibility to learn at their own pace and the usefulness of videos in reinforcing and clarifying content, which aligns with previous research (Lee, 2023). Most students agreed that FL constitutes a positive teaching approach and expressed their enjoyment of the learning experience thanks to the use of technological resources, especially the Moodle platform (Díaz Arévalo et al., 2021), as well as the development of research projects, which aligns with findings from Awidi and Paynter, (2019).

Likewise, the perceived usefulness of the FL influenced their adoption and the development of autonomous learning strategies, such as note-taking and group work (Alyoussef, 2023). In this

context, students also recognized the benefits of strengthening autonomous research skills, self-efficacy, and motivation (Martinez-Clares et al., 2024). As Li et al. (2021) point out, active interaction, autonomy, and self-regulation are key elements in the context of FL, essential competencies for lifelong learning, which has become increasingly crucial in a world where technology and job demands are rapidly evolving.

Challenges encountered

Among the challenges identified, the lack of engagement of some students stands out, evidenced by the low proportion who attended classes with prepared questions, suggesting a possible disconnect during the pre-preparation phase. In addition, difficulty in formulating questions during video viewing was noted as a significant barrier, a concern also reported by 67.65% of students in the study by Han et al. (2023).

The implementation of repeatable audiovisual resources in FL environments highlights an

inherent tension between their benefits and risks: while these resources facilitate content assimilation (Choi et al., 2015; Gnaur & Hüttel, 2014), they can also increase the perception of workload among students (Lee et al., 2017; Xiu et al., 2019). Recognizing this tension is crucial for designing strategies that promote comprehension without compromising academic well-being.

Practical recommendations

Video duration and quality emerge as critical factors for effective learning in the FL model.

Students expressed a preference for short-duration videos, between 8 and 10 minutes, which is consistent with previous studies suggesting an optimal duration of 10 to 15 minutes (Choi et al., 2015) or even up to 20 minutes (Bordes et al., 2021). Likewise, the quality of the audiovisual content was determinant in facilitating comprehension, which highlights the need to select or produce high-quality materials, as recommended by Lee (2023) and Pinos-Vélez et al. (2020). The difficulty reported in finding videos that fit specific learning needs underscores the importance of content curation by teachers.

5. Conclusions

- This study provides empirical evidence on the implementation of the FL model in a public university in Ecuador from the Student's perspective. Based on a mixed methodological approach, both benefits and challenges regarding the implementation of FL were identified. The findings allow us to reflect on the potential of FL to innovate educational practices and contribute to the development of competencies for lifelong learning. Based on the objectives set out, the following conclusions stand out:
- Flipped Learning as an Effective Strategy: The study's results show that the FL model is positively valued by students, primarily for its ability to foster autonomy, active participation, and continuous knowledge construction. These elements are considered essential for developing key competencies in lifelong learning.
- Critical factors for its implementation: The effectiveness of the FL depends largely on rigorous planning, which entails selecting high-quality digital materials, designing engaging face-to-face activities, and adapting the model to the Student's educational and sociocultural contexts.
- Convergence with lifelong learning: The FL model aligns with the principles of lifelong learning by promoting flexibility, personalization, and metacognition. These factors enable students to manage their learning and acquire skills relevant to their professional development.
- Future lines of research: It is recommended that the impact of FL on long-term academic performance, knowledge retention, and motivation be explored. It is also necessary to analyze variables such as gender, age, and digital competence in order to design inclusive strategies adapted to diverse student populations.

6. Limitations

This study has certain limitations that should be taken into account when interpreting the results. First, the sample size was relatively small ($n = 18$ for the questionnaire, $n = 7$ for the focus group), which limits the generalizability of the findings to other populations or educational contexts. In addition, the predominantly female composition of the sample could introduce a gender bias that influences the conclusions, as no male students chose to participate in the focus group. Additionally, the study was developed within a

specific context research methodology course at an Ecuadorian public university, which limits the extrapolation of the results to other academic settings. Another relevant consideration is the novelty of the FL model for both students and teachers, a factor that may have influenced their perceptions and experiences. Finally, although the questionnaire used underwent a pilot test, the absence of a more exhaustive validation could affect the robustness of the quantitative data obtained.

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Violence, subjects and education. A study with secondary school actors in Ecuador

Violencias, sujetos y educación. Un estudio con actores del nivel secundario en Ecuador

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Violence, subjects and education. A study with secondary school actors in Ecuador

Violencias, sujetos y educación. Un estudio con
actores del nivel secundario en Ecuador

Abstract

The article aims to describe the characteristics of expressions of violence in and from educational institutions in Quito and Esmeraldas, Ecuador. To do so, a multiple-base methodology was designed that involved the production of data through qualitative techniques, such as participant observation in the development of workshops with teachers and students, semi-structured interviews, as well as the analysis of institutional documents from 2016 to 2021. The results showed that the actors experience situations of violence in various scenarios and levels ranging from normative principles (laws, decrees, norms, political decisions) referring to educational management to the practices of the subjects in daily life inside and outside the institutions. It is concluded that expressions of violence can be characterized at least on three scales that involve visibility-concealment, lesser and greater objectification and speed of transition-lags in this action regime (violence).

Keywords: violence, education, institutions, standardization, action.

Resumen

El artículo tiene como objetivo describir las características que adquieren las expresiones de violencia en y desde instituciones educativas en Quito y Esmeraldas, Ecuador. Para ello se diseñó una metodología de base múltiple que implicó la producción de datos a través de técnicas cualitativas, tales como observación participante en el desarrollo de talleres con docentes y estudiantes, entrevistas semiestructuradas, así como el análisis de documentos institucionales desde 2016 hasta 2021. Los resultados mostraron que los actores vivencian situaciones de violencia en diversos escenarios y niveles que van desde principios normativos (leyes, decretos, normas, decisiones políticas) referidos a la gestión educativa hasta las prácticas de los sujetos en la vida cotidiana dentro y fuera de las instituciones. Se concluyó que las expresiones de violencia pueden caracterizarse al menos en tres escalas que involucran la visibilidad-ocultamiento, menor y mayor objetivación y velocidad de la transición-rezagos de este régimen de acción (violencia).

Palabras clave: violencia, educación, instituciones, estandarización, acción.

1. Introduction

The intensification and diversification of violent expressions in contemporary society have effects on various areas of personal, social, and institutional life while affecting one population group more intensely than another. One of the places where multiple forms of violence converge is educational institutions. At least two forces converge there. An internal force that involves the institutional networks of educational standardization and their effects on teachers. Another, which can be called external, refers to the conditions of vulnerability to which the population attending educational institutions is exposed. That is to say, the expressions of violence unfold from outside the institutions, from the neighborhood, through the daily experiences of the subjects. Between these two forces, tensions, contradictions, continuities, and discontinuities exist. To achieve a comprehensive description, it is necessary to consider violence in a situated, contextualized manner, extending beyond its taxonomies (Semelin, 1983).

From the perspective of international organizations, violence is usually classified as physical, psychological, or sexual (WHO, 2018) or structural or symbolic (Galtung, 2015). Other perspectives propose to understand violence in a double sense. That of the balance that places two issues in parallel (scales) and that of spatial relations that are usually represented at a cartographic level, showing a physical space in different measures (Fraser, 2008). The first of these visions in the case of violence allows us to consider the figure of justice, from which pragmatic sociology theorizes about political orders (Boltanski & Chiapello, 1999; Boltanski & Thévenot, 1991), and the second suggests that a given form of violence is only understandable to the extent that its context is considered.

From pragmatic sociology, the approach we prefer to take in this article, violence is defined as a regime of action, along with routine, love, and justice (Boltanski, 2000), which means that it exists in the world as part of a sequence composed

of situations in which the actors can enter or leave, for small periods or much longer moments.

For Boltanski (2000), the first axiom that defines political orders is the principle of common humanity, which is the main form of equivalence between those who are part of the same city (*cité*). These are based on the idea that we are all human and, therefore, possess the same value and dignity (axiom 3). These principles serve as the central criterion for categorizing a given situation as violent, independently of the other axioms that define political orders: the principle of dissimilarity, orders of grandeur, the investment formula, and the common good (Boltanski & Thévenot, 1991).

Within this framework of debates, this article aims to describe the characteristics acquired by the expressions of violence in and from educational institutions in Quito and Esmeraldas, Ecuador. The hypothesis we propose to develop is that, nowadays, forms of violence are diversifying beyond classic taxonomies, intensifying and deepening. This does not impede actors in educational institutions from deploying strategies to confront the various forms and expressions of violence that appear inside and outside them. From there, we ask ourselves, what are the characteristics of the forms of violence in and from educational institutions in Ecuador?

To develop the objective and hypothesis, the article is organized into four parts. First, we will present the methodological design that enabled us to approach the various forms of violence that occur within and emanate from educational institutions. In the second section, we will describe the research results. This involves how actors think, speak, and act in response to the experiences of violence that affect them at the personal, institutional, and neighborhood levels. Then, in the third section, we will discuss the results to characterize the forms of violence currently present. In the fourth section, we will formulate some conclusions that are condensed from the analysis and discussion of the research results.

2. Materials and Methods

The data presented and analyzed below are part of the results of research conducted in educational organizations in Ecuador that operate in contexts of violence. Two institutions were selected: a Fe y Alegría school (FyA La Tola), located in the city of Esmeraldas, and the Centro del Muchacho Trabajador-Una familia de familias (CMT), in the city of Quito. The FyA La Tola school is based on the assumptions of popular education, which is very accentuated in Latin America and integrates critical pedagogy (Apple & Beane, 1997; Giroux, 1983; McLaren, 1998), with the construction of a didactics that overcomes the existing logics of domination (Freire, 1978; 2002). Likewise, CMT, in addition to the Popular Education perspective, has as its axis the vision of the family as a social nucleus that requires transformation, both spiritually and in terms of work, as a reality that needs to be dignified (CMT, 2008, 2014).

To examine the characteristics acquired by forms of violence in educational institutions, a multi-methodology was designed, involving the collection of data through qualitative techniques, such as participant observation during workshop development and semi-structured interviews with teachers, as well as the analysis of institutional documents from 2016 to 2021. These techniques, as a whole, enabled the obtaining of better results and a comprehensive description of the characteristics that violence currently exhibits.

Participant observation refers to a series of field activities (Espinosa, 2017; Hirai, 2012), which is located in a central place in this process since it favored an ethnographic exercise that took place between 2017 and 2021 and which was radicalized with the training and accompaniment of teachers in the development of contextual tools to address violence (Fe y Alegría, 2016), and the work as a consultant to renew the model of attention to families (CMT). Specifically, the observation work was conducted during the development of 18 workshops at two institutions.

This involved conducting training sessions and various meetings in which teachers from secondary-level educational institutions participated, as detailed in Table 1.

The periodic visits to the institutions, as well as the data generated through the workshops, served as the basis for identifying key actors to conduct semi-structured interviews, which aimed to deepen certain aspects and/or dimensions of the analysis. In this sense, 18 interviews were conducted with teachers from the CMT (Quito), 6 of which were held virtually; 12 interviews were conducted with teachers from the FyA La Tola school (Esmeraldas), 2 of which were held virtually. In total, we conducted 32 interviews in the two institutions.

We also worked on analyzing institutional documents. The purpose of this was to triangulate the data, as well as to understand and describe the progress, stagnation, and setbacks in the mechanisms and strategies through which institutions regulate situations of violence. The focus was on the following documents:

- Proposal for Comprehensive Care for Families at the Working Child Center - A Family of Families. 2018.
- Transforming with Love. Methodology of the Centro del Muchacho Trabajador - A Family of Families. 2008.
- Working Boy Center Strategic Plan 2019-2023.
- Working Boy's Center Values Guide." 17. n/d
- Strategic Planning. Draft Report. Center for the Working Boy. 2015.
- Context Analysis Report. Fiscomisional School "Padre Aurelio Elías Mera." 2016.

All data was processed using the AtlasTi software. This program provides tools for the combined analysis of information recorded in various formats, including text, audio, video, and images. The results were analyzed using the constant

Table 1: Activities and dimensions of observation in the field work.**Source:** Own elaboration based on fieldwork records (2017-2021).

Date	Location	Research activity and technique	Axis and/or dimension of observation and analysis
Between June and September 2017	Fe y Alegría School (FyA La Tola), Esmeraldas.	Observation in the framework of workshops conducted with teachers.	-Situation of the families that make up the CMT organization. -Context of influence of the educational center in La Tola.
Between February and September 2018	Centro del Muchacho Trabajador-A Family of Families (CMT), Quito.	6 workshops at FyA La Tola	-Elements of interest inside the space corresponding to the CMT and FyA La Tola.
January and May 2021		12 workshops at CMT	-Network of actors that make up the CMT, their different relationships, and the mechanisms by which they support the work. -Projects developed at FyA La Tola that directly or indirectly affect the school. -Collective interpretation of the information produced through the workshops with teachers.

comparison method (Glaser & Strauss, 1967) to identify similarities, differences, and regularities until saturation was achieved. This resulted in the emergence of primary and/or central categories. In this way, we developed a theory based

on the data (Glaser & Strauss, 1967) through the constant comparison of categories related to the characteristics of the forms of violence currently observed, as described in the next section.

3. Results and discussion

The actors in educational institutions experience situations of violence in various scenarios and at different levels, ranging from normative principles (laws, decrees, norms, and political decisions) related to educational management to the practices of subjects in daily life, both inside and outside the institutions. The particularities of each case are described throughout the analysis, with a focus on situations in the daily lives of the subjects and organizations.

In Case 1 (CMT), it is essential to distinguish between two distinct ways of perceiving violence. The first is linked to how standardized processes have caused the crisis that the organization is currently going through - an effect of the changes in public policies on labor and education in the country - and which affects institutions and subjects in multiple ways, as expressed by a teacher:

That part was difficult, wasn't it? The fact that my colleagues lost their jobs, and that part is obviously tough, because we saw how they turned out, very good colleagues, very professional (...). It was ugly, getting used to the other colleagues, it was also ugly. The part of the children was horrible because I saw them from the youngest to the oldest, we tried to place them in schools so that they would not lose... we were very close to them, to their families (Interview with teacher, November 5, 2019).

Some of the services offered by the organization were eliminated or modified, causing workers to feel that their job stability was at risk. Several of them were separated from the work when the central headquarters where it was founded was closed. For those who continued in the CMT and are part of it today, this represented a form of violence to the extent that the management of this process "was not handled in the most appropriate way" (Worker interview, January 16, 2020). Some workers feel that the process should have been more informed, and many of them recall the work at the old headquarters with nostalgia, expressing how painful it was for them and their families.

The second form of violence is observed in the group of CMT beneficiaries, i.e., families. These refer to vulnerabilities, such as poverty, family abandonment, domestic violence, unemployment, and the risk of consumption that exists among students (CMT, 2018). Others mention early pregnancy or some suicide attempts, although the same actors consider them as isolated cases.

When discussing these issues, which could be considered violent, the actors reflect on how they are made visible within families. This is because one of their interests in the transition process is to classify them in order to better target their services to "those families that need it most" (CMT, 2018, 2019). The strategy consists of placing the family groups following the logic of the traffic light (CMT Meeting, February 12, 2019), placing red for the families most in need of support, yellow for those who can sustain themselves, albeit limitedly, and green to those who have better

possibilities and to whom, therefore, the services offered by the organization should be limited.

This logic is transferred to the situations that the actors consider problematic, given that what makes one family vulnerable may not be experienced in the same way by another. Thus, for example, in the case of domestic violence, which appears as a constant in several of the CMT families, a point is made regarding the level that it can reach, being that in some cases, it does not go beyond a firm scolding. In contrast, in others, it can reach extreme situations that put a person's life at risk.

In case 2 (FyA La Tola), situations of violence are reflected in the school, continuing the pattern that occurs outside the institution. In this case, violence is made visible or invisible to the extent that it is more or less complex. Thus, it is much easier to talk about domestic violence, which teachers consider the most significant problem of the school (Escuela P. Aurelio Mera, 2016), than about other problems that, from an external view, could seem much more violent, such as the micro-trafficking that takes place right behind the school, in the La Olla neighborhood, or the gas and gasoline trafficking that represents a problem for the entire community. However, it has become normalized over time despite the serious consequences it brings not only to the school but also to the parish.

After gasoline became more profitable, the people began to use intermediaries to try to make the fishermen fall in love (...). People also started to do business, and the gasoline business also brought serious consequences here, where the groups, groups arrived here, tried to monopolize, because they also tried to demand that you as a fisherman had to negotiate gasoline in exchange for (gesture of money with hands) (Interview with inhabitant, May 6, 2021).

The problem of fuel trafficking on the Ecuadorian border, as well as domestic violence, are some of the concerns of the teachers. Taking stock of the contextual situations that affect school life, it is evident that trafficking brings many complex issues to the school because, in addition to putting

the lives of the students' families at risk, it places the students themselves in a mirage situation that makes them think that the only way out of poverty is in this type of illegal actions, and not in education.

There have been drownings because the boat is sinking, boys who leave at two in the morning and on the way the sea is rough, the sea is rough, it is strong, and they have drowned; there are engines, entire boats with two engines have gone, the bald ones have been saved by a miracle, but that does not stop them either because the need is great, that is poverty (Interview with worker, May 6, 2021).

Although many of the families in La Tola are dedicated to fishing, trafficking is something that attracts the attention of more than a few. The students at school discuss it because they experience it every day and grow up with it. However, the teachers avoid the subject, speaking slowly and in very low tones when the subject is brought up or showing nervousness because they understand that, in addition to being something illegal, it can put them at risk.

Thus, the view of violence in the case of M&A is oriented more towards its consequences, how it affects school life, and how it places them in a situation of asphyxiation, given that they can do little or nothing to change this reality. On the other hand, the M&A mission constantly reminds them that they are there precisely to promote the transformation of their context, which leads them to want to act, even if they do so with fear.

In short, the various situations and/or expressions are not presented under a specific classification, nor do they involve all existing forms of violence. Instead, based on the discussion of how the actors think, say, act, and perceive violence, which does not occur linearly, they can be characterized on at least three scales: visibility-concealment, lesser and greater objectification, and speed of transition-lagging of the action regime, as we will discuss and deepen below.

3.1. Visible and invisible violence

The first scale corresponds to the degree of visibility that one form of violence has in relation to the others. In the case of the instrumental use of children for micro-trafficking or fuel trafficking in the border area of La Tola, it is a highly complex form of violence that only becomes visible after a long period of interaction with the actors in the community itself. It is a form of violence of which much is known (because it is part of everyday life) but of which little is said.

The same does not happen with other forms of violence manifested by the actors, such as aggression by students in the playground, abandonment, or domestic violence that are visible from the first moment and explicit even in official documents such as the Context Analysis of the school of La Tola (Escuela P. Aurelio Mera 2016). What places them in another space on the scale is precisely this visibility they have, as they can be discussed openly and, therefore, are, to some extent, more feasible for change. Actors devote time and effort to devising strategies that allow them to confront these visible forms, which means that their visibility makes them much more manageable but no less complex for that reason. In other words, a visible form of violence is not necessarily the simplest, nor is a hidden form the most complex.

At the same time, it becomes clear that the greater the visibility of a situation, the better the treatment of a problem in terms of seeking alternative solutions and confronting it. On the other hand, the question of visibility is not a matter that can be settled only between two options since, being a scale, there are multiple alternatives, which makes it possible to understand that in between, there are forms of violence that are not entirely visible, but of which there are certain traces, or that are visible, but of which it is preferred not to speak.

Other forms of violence, such as the humiliations suffered by some workers in organizations because of their professional status or for other reasons, or the fact that students may fall into delinquency, are part of these other forms of violence, which become visible over time.

3.2. Degrees of objectification

Two specific terms have been used to describe forms of violence beyond those related to their visibility: complex and straightforward. Regarding these terms, it has been mentioned that there is no inverse relationship linking them to the visibility of a situation, which raises the question: When is it possible to describe violence as simple or complex?

A first response is found in the seriousness of a situation. Thus, if two students yell at each other, it could be said that this is simple violence because it does not entail greater risks and, therefore, seriousness, but if they begin to fight or hurt each other, concerns begin to grow. The level of conflict will place the actors in front of a much more serious situation.

Unfortunately, the sole criterion of the seriousness of a situation is not enough to define the complexity of violence, as this may depend on the subjectivity of individuals. Therefore, it is necessary to add another criterion to measure the seriousness of an issue in order to consider its level of complexity. Following the line of argument that we have been working on, this is the degree of objectification of a human being, as opposed to the principle of common humanity, or, if you will, the fact that equivalences can be deactivated from the most minimal to the most excessive. It is in this way that the passage from a regime of action (justice, routine, love) to one of violence could be read not only horizontally but vertically (Thévenot, 2016), adding gradualness to the deactivation of equivalences.

The concept of objectification is significant in this explanation, as it refers to the objects that are part of the world and that each of the regimes of action favors a different relationship with them.

Nevertheless, while *agape* is free from equivalence - that is, from the existence of a stabilized relationship between things and persons - and instead assigns to itself persons considered as such, the regime of violent dispute, while also freeing itself from the tutelage of equivalence, ignores persons and - a fact of

ten pointed out - by concentrating on things, opens the possibility of treating human beings as if they were things (Boltanski, 2000).

In this way, what could be called a scale of complexity of violence is marked by the degree of objectivity of the world in which people are objects, and these are subtracted from any form of relation, limited, therefore, in their capacity to stabilize the world. It is clear that to speak of a scale is to maintain that a greater or lesser objectification is possible, which can be determined by the time a person lasts in such a state or by the magnitude of the same. That is to say, an act of disrespect could be considered a matter of lesser objectification, given that it is brief, or it could even be the result of a moment of impulsivity, as opposed to an attempted murder in which objectification reaches such an extreme that it is capable of considering the human life of another person as something of no value.

This provides clues as to what the meter of this objectification might be, namely, the risk that a human life is placed in. Greater dehumanization would be equivalent to greater risk and vice versa. In ascending order, it could be considered that the forms of violence manifested by actors in the organizations would be disrespect, aggression, humiliation, drug use, suicide attempts, and murder, to give an example. Furthermore, by considering this scale, the internal-external classification disappears, as it would not matter the space from which a form of violence is produced, but rather how it isolates common humanity.

At this point, it is important to state that words such as scale, measurement, degrees, and equivalence, among others, have been used when speaking of how violence and the passage to a regime of violent dispute comprise a vertical dimension and do not occur flatly. Addressing the question of scales adduces a form of measurement that cannot be detached from the regimes of action. Boltanski (2000) himself speaks of the time in which a person can be installed in a regime, thereby manifesting a type of measurement without this, meaning that the equivalences in the two regimes that do so have not been deactivated. This is a scale of measurement and

calculation that exceeds the presupposition of equivalence that has been placed here at the center of the analysis, namely that of the common humanity and dignity of persons.

3.3. The speed of transition and lags

Finally, it is important to consider the speed of transition from one regime to another, in this case to that of violence, as well as the lags that accompany a given situation. Not only how long it lasts but also how it is reached and how it remains afterward, as these can be indicators of its intensity. In the constant dialogues held with the actors, both from the CMT and M&A, the time factor was a determining factor in the way they understood the violent dispute regime.

This encompasses a before and an after. On the one hand, prior to the violent situation, there was a period during the change from one regime to another, as, for example, when CMT workers felt that they were humiliated in a process that included the different stages of transition of the organization and that began, in this particular case, with the closure of the headquarters. On the other hand, it can be considered a time after the violent situation as a lag. For example, in La Tola, when discussing how students arrived exhausted to their classes because they had been working all night on the gas filming, the routine that preceded the very fact of falling asleep at their desks or showing tiredness during the day was highlighted.

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Tola, when discussing how students arrived exhausted to their classes because they had been working all night on the gas filming, the routine that preceded the very fact of falling asleep at their desks or showing tiredness during the day was highlighted.

Speaking of action regimes, Boltanski (2000) states that one can remain in them, as if they were states, for short or long periods. That is to say, in the case of violence, one can maintain a quarrel with another person, which could last only one day until its resolution places the actors in a new state of affairs. At the same time, different countries can engage in a war of years' duration. In these cases, we would have a short-lived and a long-lived regime of violence, and as can be seen in the example, these already show the intensity of the violence. We could then speak of a before (transition), a during (regime), and an after (lag) about violence as indicators of its magnitude.

The question of the time in which the transition to the regime of violence takes place and the lags that this brings with it allow us to think of a scale that makes visible the dimension of a situation of violence or its intensity based on the lapse of time it lasts, an issue that psychology treats as a prolongation of traumatic situations and that can extend even for generations (Faúndez et al., 2014).

Adding the three scales presented here, we would have three different criteria for understanding violence beyond the linear or horizontal passage from one regime to another. These are visibility-concealment, lesser and greater objectification, and speed of transition-regime lags. Thus, violence acquires a new set of dimensions that allow it to be understood as a regime of action, maintaining the deactivation of the equivalences of common humanity as a central criterion for defining a given situation that is perceived as violent.

4. Conclusions

The description of the characteristics acquired by expressions of violence in and from educational institutions allowed us to place the discussion within a framework where diverse forces, including educational standardization regulations, institutions, and actors, converge. From there, violence is viewed as a complex issue, and its intensity varies according to the particularities of the institutional, personal, and neighborhood contexts of the two organizations we addressed in the research.

The results show that the actors of both institutions talk about violence in very different ways, although they share some points, such as the fact that it affects their inner self in some way. This situation, which could be called "asphyxia," causes them to stop considering the violence that is exercised on them in order to attend to the violence that the structures impose on others, or else, it makes some violent situations invisible. However, their consequences have a significant impact on the spaces in which they operate.

The complexity involved in situations of violence, as well as the "suffocation" effect, does not prevent actors from deploying strategies to change this reality. From this perspective, we believe that solutions to violence will be more effective when they foster new relationships and networks.

When the actors stop talking about how they experience violence and start thinking about how to confront it, they again reveal the dimensions previously described and the complexity that each situation represents for them. In the case of La Tola, it would not be possible to understand why teachers consider the noise coming from the La Olla neighborhood as violence without analyzing the neighborhood itself, the people who frequent it, and the actions that take place there. Only the sum of all these factors explains the violence observed in this situation, which worries educators, causing their potential solutions to shift from focusing solely on the school problem to considering the broader context, thereby opening up new networks.

The mechanisms implemented by both the CMT and FyA to reduce violence in their organizations and contexts is an example of the mobilizing character of violence, analyzed on the scale of a regime of action, which allows the actors to make use of their critical operations and resist how this regime manifests itself in their daily spaces.

In this sense, the strategies implemented for this purpose appear as forms of resistance to violence. The actions and practices of teachers demonstrate that, in the face of current forms of violence, educational institutions are places where people consider ways of life without violence in more livable, just, inclusive, and equitable societies.

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Life Cycle Analysis of materials used in social housing in Ecuador

Análisis de Ciclo de Vida de materiales usados en viviendas sociales en Ecuador

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Life Cycle Analysis of materials used in social housing in Ecuador

Análisis de Ciclo de Vida de materiales usados en viviendas sociales en Ecuador

Abstract

This article aims to evaluate the sustainability of construction materials in Ecuador, whose use accounts for 41.1% of the country's environmental impact, focusing on social housing projects in the provinces of Azuay and Cañar. The Life Cycle Assessment (LCA) methodology was applied to quantify the environmental impacts of concrete and steel from raw material extraction to end-of-life, using the OpenLCA software. Two scenarios were compared: one based on conventional practices and another incorporating sustainable strategies, such as the use of recycled materials and steel reuse. The results show that the extraction and production stages are the most impactful, with cement and steel being the main contributors due to their high energy consumption. It is concluded that the incorporation of recycled materials and the implementation of circular economy strategies can significantly reduce environmental impacts, especially in the categories of climate change and resource depletion, reinforcing the need for sustainable approaches in social housing construction.

Keywords: Life Cycle Assessment, Construction, Concrete, Steel, Environmental Impact.

Resumen

El artículo presenta el resultado de evaluar la sostenibilidad de los materiales de construcción en Ecuador, cuyo uso representa el 41,1% del impacto ambiental del país, enfocándose en proyectos de vivienda social en las capitales de las provincias Azuay y Cañar. Se emplea el Análisis de Ciclo de Vida (ACV) como metodología para cuantificar los efectos ambientales del concreto y el acero desde la extracción de materias primas hasta su disposición final, con el uso del software Open LCA. Se comparan dos escenarios: uno con prácticas convencionales y otro con estrategias sostenibles, como el uso de materiales reciclados y la reutilización del acero. Los resultados indican que las etapas de extracción y producción son las más impactantes, destacando el alto consumo energético del cemento y el acero. Se concluye que la implementación de materiales reciclados y estrategias circulares puede reducir significativamente el impacto ambiental, especialmente en cambio climático y agotamiento de recursos, reforzando la necesidad de enfoques sostenibles en la construcción de vivienda social.

Palabras clave: Análisis de Ciclo de Vida, construcción, concreto, acero, impacto ambiental.

1. Introduction

Construction-related activities have been identified as one of the primary sources of adverse environmental impacts globally. Current construction processes are often not environmentally sustainable, omitting the social responsibility and assertive practices necessary for sustainable building. It is estimated that approximately 40% of global energy consumption comes from the construction sector (Enshassi et al., 2018). In Ecuador, the construction industry accounts for 41.1% of the total national environmental impact, ranking third in CO₂ emissions and contributing significantly to the country's Gross Domestic Product (GDP) (INEC, 2020).

Ecuador has actively participated in various environmental protection treaties, recognizing the significant ecological diversity within its territory. Currently, this commitment is reflected in the implementation of the 2030 Agenda, which aligns with the National Development Plan 2021-2025 and the United Nations' Sustainable Development Goals (SDGs). The country has established a platform for monitoring the progress of the 2030 Agenda, developed with the support of the United Nations System (UNS). In July 2017, the National Assembly adopted a resolution establishing the SDGs as a mandatory framework for its work (UN Ecuador, 2022).

Various public and private institutions in Ecuador have incorporated the Sustainable Development Goals (SDGs) as a basis for decision-making, innovation, and development in their respective sectors. However, current legislation still does not provide sufficient regulatory guarantees for the effective implementation of the environmental rights of both individuals and nature (Almeida, 2021). Consequently, the strategies proposed for industrial development have remained, to a large extent, aspirational without rigorous implementation or significant impact.

In the construction sector, the Ministry of Urban Development and Housing (MIDUVI) has issued

the National Habitat and Housing Plan 2021-2025, which has a strategic objective of creating sustainable, inclusive, resilient, and safe habitats. This objective is intended to be achieved through a comprehensive portfolio of urban development and regeneration projects with a focus on climate change adaptation (MIDUVI, 2021). However, while this plan aligns with the SDGs, it lacks a comprehensive regulatory framework for housing design and construction that effectively contributes to achieving this strategic objective. Additionally, the Ecuadorian Technical Standard (NTE) and the Ecuadorian Construction Code (NEC) remain outdated, which limits the ability to implement these goals.

To move towards sustainable construction practices, it is essential to recognize that the selection of materials plays a crucial role in the sustainability of buildings (Acosta, 2009; Enshassi et al., 2018; Tamayo and Rocha-Tamayo, 2011; Vélez and Contreras, 2020; Hernández-Zamora et al., 2021). In Ecuador, 75% of the total construction cost corresponds to the cost of materials; however, the selection of materials is not usually based on environmental responsibility criteria. In addition, most of the materials used in the provinces of Azuay and Cañar, both domestic and imported, lack environmental certifications. Currently, there are no regulations requiring the exclusive use of ecological materials, which aggravates the environmental impacts generated by the construction industry.

Between 2017 and 2020, the construction sector in Ecuador experienced sustained growth, driven by favorable economic conditions, including oil sales and the global economic recovery following the recession. However, as of May 2020, the sector recorded a 16.35% decline in its contribution to GDP due to the COVID-19 pandemic (Lozano Torres, 2022). This drop was further intensified by the conflict between Russia and Ukraine, as well as the global economic slowdown, which significantly affected developing economies. Domestically, the number of construction

companies declined by 10.56% between 2015 and 2019, primarily due to the imposition of tariffs and reduced demand for construction materials during the pandemic (Lozano Torres, 2022).

This study takes 2020 as a reference year to examine the materials used in the construction of social housing projects located in the capitals of the provinces of Azuay and Cañar, strategic regions in the context of planned urban development in Ecuador. These projects, prioritized by the State in the framework of the 2030 Agenda and the Sustainable Development Goals, constitute a representative case study to assess the environmental implications of the building sector at the national level. Given the significant weight that construction materials carry in both economic and environmental terms, and in the absence of specific regulatory guidelines that require the use of inputs with lower environmental impact, the need to generate technical evidence to support decisions aimed at transitioning to more sustainable construction models is recognized.

Unlike other regional studies that are limited to specific phases of the life cycle, such as the production or transportation of materials, this work encompasses the entire cycle, from extraction to final disposal (cradle to grave).

This approach is crucial in the Ecuadorian context, where there are no regulations for the final disposal or environmental traceability of construction waste. Therefore, this study fills a gap in the Latin American literature, providing local evidence based on data representative of the country.

Within this framework, the objective of this research was to evaluate the environmental impacts associated with the materials most commonly used in the construction of social housing in the capital cities of the provinces of Azuay and Cañar through the application of Life Cycle Assessment (LCA). The evaluation was conducted according to the guidelines established by ISO 14040:2006 (ISO ORG, 2006), utilizing the specialized software OpenLCA. The analysis considered the most relevant environmental performance indicators, with a particular emphasis on global warming potential, energy consumption, and emissions associated with material production. Based on the results obtained, it identified opportunities for improvement in the selection of materials. It contrasted them with international state-of-the-art references, contributing scientific evidence to the design of public policies, the updating of sector regulations, and the formulation of technical strategies aimed at sustainability in the construction of social housing in Ecuador.

2. Materials and methods

The analysis focused on two representative social housing projects developed in the cities of Cuenca and Azogues, promoted respectively by the Municipal Public Company of Urbanization and Housing (EMUVI EP) and the Ministry of Urban Development and Housing (MIDUVI). According to the databases of materials used in housing construction, those with the highest percentage of use were discriminated against. As a result, concrete represented 70% of use and Steel 17%, on average, being the materials chosen for the study.

The functional unit selected was 1 kg of construction material (concrete or Steel) used on site. This unit enables the standardization of results and their comparison with international literature. The scope of the study was defined under a cradle-to-grave approach, considering all relevant stages of the materials' life cycle: extraction and processing of raw materials, manufacturing, transportation to the construction site, use during the building's useful life, and final disposal.

For concrete, two scenarios were evaluated. The conventional scenario corresponded to the ready-mix concrete specified in the construction documents, consisting of 0.24 m³ of water, 0.65 m³ of sand, 0.95 m³ of gravel, 360.50 kg of cement, and 0.30 kg of plasticizing admixture per cubic meter. The alternative scenario consisted of ecological concrete with a 30% replacement of cement content by calcined pozzolana and the use of recycled aggregates from construction waste. This formulation is based on scientific evidence indicating that partial cement substitution is one of the most effective strategies for reducing greenhouse gas emissions associated with concrete without significantly compromising its mechanical performance (Guo et al., 2021; Marinković et al., 2024). The transport of materials was estimated at 13.5 km from the concrete plant to the construction site, using 20-ton Euro 4-type heavy-duty trucks, according to Ecoinvent v3.7 datasets. The final disposal of the concrete did not include reuse due to the lack of national regulations governing post-demolition recycling.

Two scenarios were also established for Steel. The first one reflected the current conditions in the country, where structural Steel is not reused at the end of its life cycle, being destined as waste or scrap without processing. The second scenario, of a sustainable nature, envisioned a 100% reuse rate by the circular economy principle. This alternative is based on international studies that have documented the technical feasibility and the environmental benefits of reusing structural steel components after minimal reconditioning processes. The average transport distance was estimated at 13 km from the local supplier to the construction site. The energy associated with the recycling process was included in the reuse scenario.

The life cycle inventory (LCI) was developed with OpenLCA 1.10.3 software using the Ecoinvent v3.7 database. The processes were selected based on their geographical and technological alignment

with the Ecuadorian context. In the absence of specific local data, regional (Latin America) or global averages were used. An average transport performance of 2.5 km/l for heavy vehicles and a load factor of 80% was assumed. Energy consumption and emissions were modeled directly from the Ecoinvent production modules.

The environmental impact assessment was conducted using the CML 2001 method, which allows for a detailed characterization of multiple impact categories. In this study, five key categories were selected: Global Warming Potential (GWP, kg CO₂-eq), Acidification (AP, kg SO₂-eq), Eutrophication (EP, kg PO₄³⁻-eq), Photochemical Ozone Formation (POCP, kg C₂H₄-eq) and Abiotic Depletion (AD, kg Sb-eq). These categories were chosen for their relevance in the environmental assessment of building materials and their frequency of use in comparable studies.

Additionally, an external validation component was integrated through a systematic review of scientific literature. This review was conducted in the Scopus and Web of Science databases, utilizing the keywords: Life Cycle Assessment, sustainable concrete, steel recycling, housing, developing countries, and environmental impact. Only studies published between 2019 and 2024, in English or Spanish language, with quantitative data on at least one of the following metrics were included: GWP, primary energy consumption, or recycling rates. The results of these studies were extracted, normalized to the selected functional unit, and organized in a comparative table with the data obtained in the present study.

This methodology enables not only the estimation of the current environmental impacts of materials used in social housing in Ecuador but also the evaluation of the potential Reduction that could be achieved through substitution and reuse strategies. In this way, quantitative evidence is provided that can support the formulation of public policies aimed at sustainable construction.

3. Results

The LCA results revealed that the raw material extraction and material production stages have the most significant environmental impact on social housing construction. In the extraction stage, cement emerged as the material with the most significant environmental footprint due to its high energy consumption and CO₂ emissions. During materials production, Steel showed the most substantial environmental impact, mainly due to energy consumption and greenhouse gas emissions associated with its manufacturing process.

3.1. Life Cycle Analysis: Steel

The LCA results for steel are presented in Table 1, where two scenarios are compared:

- *Scenario 1:* No reuse of steel at the end of its life cycle.
- *Scenario 2:* With a 100% reuse rate at the end of its life cycle.

Table 1: LCA for Steel
Source: Own elaboration.

Impact Category	Scenario 1 (kg/kg steel)	Scenario 2 (kg/kg steel)	Reduction (%)
Climate Change (GWP)	3.2400	0.9500	71%
Acidification (AP)	0.0069	0.0022	68%
Eutrophication (EP)	0.0019	0.0006	67%
Photochemical ozone formation (POCP)	0.0003	0.0001	67%
Depletion of Abiotic Resources	0.11	0.033	70%

The analysis of the life cycle of Steel reveals that reuse at the end of its cycle allows a substantial reduction of environmental impacts in all the categories evaluated. In particular, the mitigation of global warming potential (GWP) stands out, which decreases by more than 70% compared to the scenario without reuse. This improvement is consistent with that reported by Hossain et

al. (2020), who observed similar reductions in Latin American contexts. In addition, the benefits extend to other categories, such as acidification and eutrophication, reflecting that the reuse strategy not only reduces greenhouse gas emissions but also other atmospheric and water pollutants.

3.1.1. Steel Resource Consumption

Table 2: Resource consumption for Steel
Source: Own elaboration.

Resource	Scenario 1 (per kg of steel)	Scenario 2 (per kg of steel)	Reduction (%)
Water	2.20 m ³	0.66 m ³	70%
Non-Renewable Primary Energy	14.82 MJ	4.44 MJ	70%
Wood	0.0002 m ³	0.0002 m ³	0%

The analysis shows that steel recycling reduces water and non-renewable primary energy consumption by 70%. However, wood consumption remains constant across all scenarios

3.2. Life Cycle Analysis: Concrete

The LCA results for concrete are presented in Table 3, comparing conventional ready-mix concrete and concrete made with recycled materials.

Table 3: LCA for Concrete

Source: Own elaboration.

Impact Category	Ready-mix concrete (kg/kg)	Concrete made with Recycled Materials (kg/kg)	Reduction (%)
Climate Change (GWP)	0.930	0.650	30%
Acidification (AP)	0.065	0.048	26%
Eutrophication (EP)	0.024	0.018	25%
Photochemical Ozone Formation (POCP)	0.002	0.001	50%
Depletion of Abiotic Resources	0.550	0.300	55%

3.2.1. Resource Consumption for Concrete

Table 4: Resource consumption for concrete

Source: Own elaboration.

Resource	Ready-mix concrete (m³)	Concrete made with Recycled Materials (m³)	Reduction (%)
Water	0.18 m³	0.14 m³	22%
Non-Renewable Primary Energy	2,775 MJ	2,400 MJ	14%
Cement	300 kg	170 kg	43%

The results indicate a significant reduction in resource consumption when recycled materials are used in the concrete mix. Specifically, as shown in Table 4, water use is reduced by 22%, representing a significant contribution in contexts of water scarcity. Likewise, there is a 14% decrease in non-renewable primary energy consumption, suggesting a lower environmental impact associated with the life cycle of concrete. The most significant Reduction corresponds to cement use, with a 43% decrease, which is particularly relevant considering that cement production is one of the main contributors to global carbon dioxide emissions.

Finally, the comparison presented in Table 5 provides quantitative evidence of the effectiveness of sustainable strategies for constructing social housing projects. In the case of Steel, a 71% reduction in global warming

potential (GWP) is observed when comparing the production of virgin Steel (3.24 kg CO₂-eq/kg) with that of recycled Steel (0.95 kg CO₂-eq/kg), which is consistent with the values reported in recent studies (Hossain et al., 2020). Similarly, in the concrete sector, a 30% decrease in GWP is recorded, going from 0.930 kg CO₂-eq/m³ in conventional ready-mix concrete to 0.650 kg CO₂-eq/m³ in concrete made with recycled materials. In addition, the Reduction in cement consumption, with a 43% decrease (from 300 kg/m³ to 170 kg/m³), supports the optimization of the mix through the use of recycled components. These results demonstrate that the application of circular economy practices in the construction materials supply chain can significantly reduce environmental impacts, which justifies the need to incorporate regulations and policies that encourage the recycling and reuse of these materials in the construction sector.

Table 5: Comparison of results with state of the art
Source: Own elaboration.

Base Study	Material	Indicator	Value (Base Study)	Value (Comparative Studies)	% Reduction (Base Study)	% Reduction (Compared)
Petroche et al. (2021)	Steel	GWP (kg CO ₂ -eq/kg)	3.24 (virgin) / 0.95 (recycled)	~3.0 (virgin) / ~1.0 (recycled)	71%	67-71%
Hossain et al. (2020)	Steel	Primary Energy (MJ/kg)	14.82 (virgin) / 4.44 (recycled)	~15.0 (virgin) / ~5.0 (recycled)	70%	~67%
World Steel Association (2023)	Steel	GWP (kg CO ₂ -eq/kg)	3.24 (virgin) / 0.95 (recycled)	~3.1 (virgin) / ~0.9 (recycled)	71%	70-71%
Sansom and Meijer (2002)	Steel	Energy Consumption (MJ/kg)	14.82 (virgin) / 4.44 (recycled)	16.2 (virgin) / 5.1 (recycled)	70%	68%
Petroche et al. (2021)	Concrete	GWP (kg CO ₂ -eq/m ³)	0.930 (conventional) / 0.650 (recycled)	~0.950 (conventional) / ~0.570 (recycled)	30%	40%
Labaran et al. (2021)	Concrete	GWP (kg CO ₂ -eq/m ³)	0.950 (conventional) / 0.600 (optimized)*.	Range: 0.05-0.18 (depending on blend and additives)	~37% (average)	N/A
Guo et al. (2021)	Concrete	GWP (kg CO ₂ -eq/m ³)	0.930 / 0.650	1.01 (conventional) / 0.61 (with substitutes)	30%	~40%
Marinković et al. (2024).	Concrete	GWP (kg CO ₂ -eq/m ³)	0.930 / 0.650	0.89 (natural) / 0.54 (recycled)	30%	39%
Mendoza and Oswaldo (2021)	Concrete	Cement Consumption (kg/m ³)	300 (conventional) / 170 (recycled)	310 (conventional) / 180 (recycled)	43%	~42%
Vázquez-Rowe et al. (2019).	Concrete	POCP (kg NMVOC/m ³)	0.002 (conventional) / 0.001 (recycled)	Similar values in studies of recycled materials	50%	50%
Marey et al. (2024)	Concrete	Energy Consumption (MJ/m ³)	2.775 / 2.400	2.88 (conventional) / 2.15 (recycled with ash)	14%	~25%
Hernández-Zamora et al. (2021).	Concrete	GWP (kg CO ₂ -eq/m ³)	0.930 / 0.650	1.00 (conventional) / 0.63 (alternative materials)	30%	~37%

Note: The value of Labaran et al. (2021) is expressed in a range depending on the variability in the mixture and the use of additives, so an average is used for comparative purposes.

4. Discussion

The results of the Life Cycle Assessment (LCA) conducted in this study confirm that the extraction of raw materials and production of materials is

responsible for the most significant proportion of the environmental impact in the construction of social housing in Ecuador. These findings align

with multiple international studies that emphasize the importance of these stages, particularly in cement and steel production, due to their high energy consumption and significant contribution to greenhouse gas (GHG) emissions (Guo et al., 2021; Marinković et al., 2024; Sansom & Meijer, 2002).

Regarding Steel, the present study revealed a 71% reduction in global warming potential (GWP), going from 3.24 kg CO₂-eq/kg in the scenario without reuse to 0.95 kg CO₂-eq/kg when 100% reused at the end of its life cycle. This result is highly consistent with previous studies, such as Hossain et al. (2020), who reported GWP reductions of 67-71% in similar contexts when applying steel reuse and recycling strategies. Also, non-renewable primary energy consumption was reduced by 70% (from 14.82 MJ to 4.44 MJ), in line with values presented by the World Steel Association (2023), which indicates an energy reduction of 70-75% by employing electric arc furnaces (EAF) instead of blast furnaces (BOF).

The reductions observed in other impact categories for steel - such as acidification (68%), eutrophication (67%) and photochemical ozone formation (67%) - reinforce the environmental benefits of structured recycling, and are consistent with those reported by Petroche et al. (2021), who observed similar reductions in studies applied to Latin American contexts.

Regarding concrete, the study demonstrated that the use of recycled materials results in a 30% reduction in GWP (from 0.930 to 0.650 kg CO₂-eq/m³). This improvement is within the range reported by other authors, such as Marey et al. (2024), who documented average reductions of up to 40% by incorporating partial cement substitutions with blast furnace slag or fly ash. This behavior has also been validated by Labaran et al. (2021), who observed GWP values as low as 0.570 kg CO₂-eq/m³ in optimized mixtures. These results position recycled concrete as an environmentally efficient alternative, particularly in regions where cementitious admixture sources are readily available.

Furthermore, in terms of resource consumption, concrete with recycled materials showed a 43% reduction in cement use (from 300 to 170 kg/m³), which is consistent with the results obtained by Mendoza and Oswaldo (2021), who reported a 42% decrease in similar mixes. This change not only reduces the direct environmental impact associated with clinker production but also promotes a more rational use of non-renewable mineral resources. In other categories, reductions of 22% in water use and 14% in non-renewable energy consumption were also evident, comparable to data from Marinković et al. (2024).

Notably, the Reduction in photochemical ozone formation in recycled concrete was 50%, a result that reflects substantial improvements in volatile organic compound (NMVOC) emissions. This result is identical to that observed by Vázquez-Rowe et al. (2019), who evaluated concretes with recycled aggregates in urban contexts and reported the same percentage decrease in this impact category.

The quantitative comparison summarized in Table 5 enables us to confirm that the results of the present study are not only methodologically consistent with international LCA standards but also reflect comparable or even higher environmental efficiencies in some instances. For example, while Hossain et al. (2020) report a GWP reduction in recycled Steel of 67%, this study reached a value of 71%, which can be attributed to the Ecuadorian energy context, which is highly dependent on hydroelectric sources (more than 80%), which reduces the indirect environmental load associated with industrial processes.

In this sense, it is recognized that the local context can significantly influence the magnitude of environmental impacts. As Labarán et al. (2021) point out, the environmental performance of recycled concrete improves in regions with clean energy matrices, such as those in Ecuador. This aspect should be considered when transferring technical conclusions or recommendations from one context to another.

However, despite the encouraging results, there are still regulatory and technical barriers that

limit the implementation of circular strategies in social housing construction in Ecuador. The absence of mandatory regulations for the use of recycled materials and the limited infrastructure for processing construction and demolition waste (CDW) hinder their widespread adoption. This

contrast with the European environment, where standards such as EN 12620:2002 permit the use of recycled aggregates in structural concrete, reinforces the need to adopt a regulatory framework that facilitates the widespread use of these materials.

5. Conclusions

The life cycle analysis (LCA) of the materials used in the construction of social housing in the provinces of Azuay and Cañar has revealed that the materials used in this sector generate significant environmental impacts, especially in the extraction of raw materials and production phases. In particular, cement was found to be one of the most significant contributors to global warming potential (GWP), followed by Steel, which also has a high environmental footprint in terms of greenhouse gas (GHG) emissions and consumption of non-renewable resources. These results underscore the urgent need to transform construction practices towards the use of materials with lower environmental impacts, thereby mitigating the adverse environmental effects of construction.

The study has also demonstrated that incorporating recycled materials into construction can lead to significant reductions in environmental impacts. For example, partial substitution of conventional cement with recycled materials such as blast furnace slag and fly ash resulted in a decrease in GWP, water consumption, and non-renewable primary energy. This practice not only reduces CO₂ emissions but also contributes

to the conservation of natural resources, which is crucial for promoting sustainability in the construction sector.

A relevant finding is that the use of recycled materials in combination with low-energy technologies, such as the incorporation of renewable energies in material production, can result in a significantly smaller environmental footprint compared to conventional methods. This is mainly because the recycling of materials and the production of low-energy materials have a significantly reduced environmental impact compared to the extraction and manufacturing processes of new materials.

On the other hand, the study's results show that, despite the obvious environmental benefits, the adoption of recycled materials in the construction of social housing in Ecuador is hindered by the lack of clear regulations and policies to encourage their use. Although there has been some progress in terms of awareness of the environmental benefits of these materials, the infrastructure for collecting and processing construction and demolition waste (CDW) remains insufficient, which limits the use of recycled materials in construction.

6. Recommendations

A key recommendation is the creation of a national certification and environmental labeling program for building materials that establishes

minimum criteria for energy efficiency and recycled content adapted to local conditions. This program could facilitate the adoption of more

sustainable materials by providing incentives for both manufacturers and developers who use materials with low environmental impact. In addition, the implementation of regulations requiring the incorporation of recycled materials in construction projects could accelerate the transition to more sustainable practices.

In addition to public policies, it is essential to continue researching the environmental and economic performance of recycled materials, particularly in the context of construction in Ecuador. It is essential to develop life cycle cost (LCC) studies to evaluate the costs associated with the processing, transportation, and use of recycled materials, as well as the economic benefits derived from reducing environmental impacts. This would enable the economic justification of using recycled materials and contribute to more informed decision-making decision-making in the construction sector.

To achieve the effective integration of recycled and energy-efficient materials in the construction of social housing, it is also necessary to create local databases containing life cycle inventories tailored to the country's specific conditions, taking into account aspects such as the energy matrix and the country's climatic characteristics. These tools will allow professionals in the sector to make more informed decisions regarding the selection of materials and construction methods with lower environmental impacts.

Awareness of the importance of sustainable materials should also be raised among both

industry professionals and consumers. This will help change consumer preferences and increase demand for more environmentally responsible building practices. The inclusion of these topics in educational and continuing education programs for architects, engineers, and builders will be crucial in promoting a culture of sustainability within the construction industry.

A greater focus is needed on research on the acceptance and performance of recycled materials in real construction conditions in Ecuador. Studies on the durability and performance of these materials in the local context are crucial for assessing their viability in large-scale social housing construction projects. Furthermore, fostering collaboration among researchers, industry professionals, and government authorities will be crucial to achieving a comprehensive approach to sustainable construction.

The results of this study underscore the importance of adopting a sustainable construction model in Ecuador that prioritizes the use of recycled and energy-efficient materials. The adoption of these materials would not only contribute to reducing the environmental footprint of social housing construction. However, it would also drive the development of a more responsible industry aligned with the principles of the circular economy. It is crucial that both the public and private sectors collaborate to overcome existing barriers and promote the use of sustainable materials through policy, research, and education, ensuring a more sustainable future for generations to come.

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Secondary education and creativity in industrial design: reflections of inequality

Educación secundaria y creatividad en Diseño industrial: reflejos de inequidad

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Secondary education and creativity in industrial design: reflections of inequality

Educación secundaria y creatividad en Diseño industrial: reflejos de inequidad

Abstract

This article examines the relationship between secondary education and design creativity in Industrial Design students in Chile. From a hypothesis of inequality, it was analyzed whether school trajectories influence the development of the creative personality when entering university. The Torrance test (TTCT) and a sociodemographic survey were applied to 71 students (51 design students, 20 from other careers), using ANOVA and Chi-square to explore links between creativity and variables such as type of school, parents' educational level, cultural experiences and academic difficulties. The results revealed significant correlations between creativity and prior structural factors, especially type of school and family educational capital. Discrepancies were also identified between creative self-perception and workshop performance. The need for an inclusive curricular design that considers formative diversity is raised. It is concluded that creativity should be understood as a situated and socially conditioned expression.

Keywords: creativity inequity, industrial design, project-based assessment, secondary education.

Resumen

Este artículo examina la relación entre educación secundaria y creatividad proyectual en estudiantes de Diseño Industrial en Chile. Desde una hipótesis de inequidad, se analizó si las trayectorias escolares influyen en el desarrollo de la personalidad creativa al ingresar a la universidad. Se aplicó la prueba de Torrance (TTCT) y una encuesta sociodemográfica a 71 estudiantes (51 de diseño, 20 de otras carreras), utilizando ANOVA y Chi-cuadrado para explorar vínculos entre creatividad y variables como tipo de colegio, nivel educativo de los padres, experiencias culturales y dificultades académicas. Los resultados revelaron correlaciones significativas entre la creatividad y factores estructurales previos, especialmente el tipo de escuela y el capital educativo familiar. También se identificaron discrepancias entre autopercepción creativa y rendimiento en taller. Se plantea la necesidad de un diseño curricular inclusivo que considere la diversidad formativa. Se concluye que la creatividad debe entenderse como una expresión situada y socialmente condicionada.

Palabras clave: creatividad, diseño industrial, educación secundaria, evaluación proyectual, inequidad.

1. Introduction

Academic performance in Design is closely tied to the nature of its demands, where creative responses are integral to the expected outcomes (Kreitler & Casakin, 2009).

In its most extended definition, according to the WDO 1, it is stated that Design harnesses creativity to solve problems, i.e., it is imagination-oriented towards a utilitarian end. However, an important part of the creative capacity is influenced by social factors (Sözbilir, 2018), territorial aspects (Cabra & Guerrero, 2022), nurturing environments (Si et al., 2018), and not only intellectual factors (Chávez et al., 2024). Indeed, in this process, the family structure also plays a significant role, as it can either promote or inhibit creativity in students with a procreative, non-conformist, and/or impulsive personality (Si et al., 2018).

However, in the teaching of Design, there is usually no distinction between the different biographies, but rather a focus on the achievement of creative results, applying creative methods in more or less creative environments, but leaving aside the creative personality, the different sociocultural backgrounds of the students (Donoso & Vielma, 2024) and the process (G. Li et al., 2024).

The quality of scholastic education, as well as inherited capital, significantly influences the creative personality (Hendrie et al., 2024). A correlation exists, indicating that the better the quality or density of education, the more complex and abstract ideas people can elaborate (Escobar & Escobar, 2016). This occurs not only because of having received an education in theoretical content but also because of the stimuli and experiences that influence the further development of social, verbal, empathetic, and communicational skills (G. Li et al., 2024).

In Chile, schools are classified as private paid (PA), private subsidized (SB), and municipalized (MU), the last two being those that receive state funding. The schools that obtain lower scores

in the university selection tests (PSU) are the municipalized schools, which are attended by the most socially vulnerable students. In contrast, the other schools obtain better results (Eyzaguirre et al., 2022), provided that the socioeconomic level of the student is high (Moya & Hernández, 2014).

The implementation of inclusive policies, such as the Higher Education Access Program, allows students from vulnerable sectors to enter universities; however, their experiences are marked by challenges derived from the lack of institutional support and the clash with a different cultural environment (Vivero et al., 2020). Therefore, the quality of education directly influences the early development of creativity that impacts decision-making with a high symbolic and functional load (Eyzaguirre et al., 2022).

1.1. Creativity

Creativity is a psychological dimension of the human condition that has shaped its cultural and technological evolution (Corbalán & Limiñana, 2010). There are many operational definitions for creativity, which account for its complexity. However, we have focused on that conscious process that allows the generation of original and valuable ideas (X. Li et al., 2024). This process requires both executive control capabilities and cognitive flexibility since the ultimate purpose is to solve a Design problem creatively (Huang et al., 2024).

On the other hand, learning creative methods alone is insufficient to facilitate the conception of creative ideas if a well-developed creative personality has not yet been achieved (Krumm, 2004). Moreover, creativity is situated because it depends on the culture and its rules (Cabra & Guerrero, 2022), in which the person who brings ideas and solutions to a field that gives them meaning is immersed. Creativity is not only a personal matter but also a contextual one (Csikszentmihalyi, 2013).

Creative processes also involve both intuition (Desmet & Schifferstein, 2012) and abductive observations to conceive feasible and original ideas (Cross, 2014). Intuition, which is instantaneous and tacit knowledge that arises in response to a stimulus, is a rational process that relies on both a person's knowledge and experience (Guerra, 2018). However, if both are limited, intuitions will be more predictable because the answer is usually contained in some way within the problem, unlike how it occurs with abductions based on analogies (Martín, 2015). These are original and can be explained and considered plausible, even if they are not necessarily true. Then, creative observation, a characteristic of Design, is a type of abduction that causes semantic changes in ideas, promoting paradigmatic shifts (Pinheiro et al., 2022).

On the other hand, creativity also requires other characteristics, such as curiosity, persistence, and focus, as one must have more developed emotional control (Csikszentmihalyi, 2013).

1.2. Executive functions

They are a set of essential cognitive skills that enable self-regulation, attention control, cognitive flexibility, and strategic planning for problem-solving, as well as promoting creativity by facilitating the ability to combine information, regulate impulses, and adopt new perspectives (Stolte et al., 2024). These functions allow adapting to new contexts. However, low development of these functions causes the encounter of students with the particularities of the Design career in many cases to be frustrating, being, among other factors, causes of desertion mainly in the field of arts and humanities (Peña et al., 2023).

The epistemic characteristics of the discipline have a strong qualitative and interpretative approach, both for the user and the designer, which leads to a high degree of uncertainty (Lawson, 2005), especially for young people with less developed executive and metacognitive abilities. They tend to put aside self-criticism, making it difficult for them to face the uncertainty posed by a creative project, which causes them great emotional stress that ultimately affects their

academic performance (Pardos and González, 2018). This makes it difficult for them to learn complex rules intuitively to generate anticipatory actions (Alarcón et al., 2017) in decision-making.

It is here that the quality of education proves decisive, starting in basic education, in the formation of skills that will give them future autonomy (Muchiut et al., 2018) and strengthen their ability to relate to real people in real contexts (Design Council, 2020).

1.3. Phenomenological field observation

The epistemology of Design, a project discipline (Simón Sol et al., 2012), recognizes the user as the central motive that gives rise to the object of study for whose research resorts to various techniques that have evolved (Dorst, 2016).

During the 1980s, a third generation of design methods emerged, marking a shift in design methodology by challenging the positivist research methods promoted by the Ulm School of Design (Taranto, 2013). In these methods, the importance of intuition and subjectivity as creative promoters is valued (Breña, 2019). In that decade, the method known as Design Thinking emerged, which recognizes the way of thinking from Design as a method in itself and incorporates new approaches, including phenomenology, from which we have derived Emotional Design, Interaction Design, and User-Centered Design, among others.

The knowledge originated through the application of the phenomenological method is based on the personal and unprejudiced experience of the observer in a particular context, where they sharpen their perception and finally "realize" a state of reality to build their account (Puentes, 2013). From the phenomenological experience, Design observation could be understood as the result of "seeing and describing" experiences in their essence, as they manifest themselves in consciousness, by observing without prejudice (Navarro et al., 2022).

Then, "realizing" implies that the phenomenological experience ultimately results in concrete yet creative observation because it

originates in the subject's own experience, distinct from that of the other observers, which facilitates the establishment of creative associations (Smart, 2019).

The phenomenological approach, due to its inherent subjectivity, is to some extent questionable, as the source of knowledge is based on experience rather than evidence (Bunge, 2010). Despite everything, this same speculative property allows us to break the structures of rigid thoughts and "perceptual automatisms" (Vasquez, 2024).

The quality of the phenomenological observation depends on the quality of the experience (Donoso, 2019). Therefore, the virtual experience that reduces the sensory experience to only audiovisual representations of reality produces incomplete and fragmented experiences (Pizzaleo & Morcellini, 2003). Many of these are preconceived images where pre-produced

representations mediate communication and do not originate in face-to-face communication or physical experience in the context where they occur (Gardner, 2005).

At this point, the gap in students' social vulnerability reappears and widens again, as those who have had the opportunity for high-quality, memorable experiences find phenomenological observation more natural. In contrast, those with metacognitive difficulties, such as self-criticism, find it more challenging (Aguirre, 2020).

Thus, those who travel regularly tend to be more creative. Those who master another language are even more so (Cabra & Guerrero, 2022), while adverse social conditions limit exposure to enriching experiences, thereby reducing the stimulation of executive processes, such as exploration. In contrast, more favorable contexts facilitate a more comprehensive and adaptive development (Faúndez et al., 2023).

2. Materials and Methods

The question that guided the research was: How does the quality of education affect the creative capacity and academic performance of design students?

2.1. Research question

How does the quality of education affect the creative capacity and academic performance of Design students?

2.2. The general objective

To identify the social variables that affect the creative performance of design students in order to propose actions to improve didactics.

2.3. Study design

A quantitative, non-experimental, and correlational approach was used to analyze the relationship between demographic variables with performance and creative ability in students entering the first year of the Design career.

2.4. Sample

To answer the research question, two samples of students were asked about their creative profiles and their relationship with the socioeconomic origin of those who enter the Design field.

The universe of the research consisted of a cohort of 106 first-year students in the Design career, from whom the final sample, referred to as the "Design Group," was selected. The inclusion criterion was that the selected students were newly admitted to the career and were not repeaters. The sample consisted of 51 students chosen at random, which is representative of a 95% confidence level, with a margin of sampling error of 10%. It was considered that these ranges of certainty were sufficiently relevant to find trends and develop hypotheses for future work. In parallel, another sample was organized as a "control group," consisting of 20 students of the same age, randomly selected but from different career paths, to provide a reference point for comparing results.

The identities of both the participating universities and the selected students, who also signed an informed consent form, have been kept confidential.

Since the students in the control group did not take the WORKSHOP course, they were asked to indicate their first-year GPA, which was homologated to that of the WORKSHOP and was referred to as WORKSHOP2 for calculation purposes and to represent the degree of curricular advancement.

2.5. Object of study

The subject "Design Workshop" (WORKSHOP) was selected as the object of observation because it marks the curricular progress of the students and requires all their creative abilities to solve a problem.

2.6. Instruments and tests

A two-part socio-demographic characterization survey was applied, and the well-known and widely validated Torrance test was used to assess creative personality, which measures four creative variables: fluency, originality, elaboration, and flexibility (Grimaldo & Chavez, 2023).

Despite the existence of other tests, such as the CREA, Wechsler, or Guilford, we chose the Torrance test because we are interested in measuring "creative personality" rather than "creative ability" as measured by these tests (Laime, 2005). This subtlety arises because we have selected the creative personality as a career entry competency rather than as a result of the graduation competencies, as the creative personality at entry can be formed or improved in the first years, which is consistent with the hypothesis that social factors influence creativity.

The Torrance test consists of three work forms that subjects must complete, drawing lines presented to them and simultaneously writing down what the drawing represents.

For practical reasons, we worked with forms 2 and 3 of this test, as they measure the four variables of the creative personality. We adjusted

the scale to compensate for the score provided by Form 1, which was not considered because it only measures three variables.

2.7. Survey application

The evaluation was conducted using an interpretative guide for the drawings, where scores are assigned according to specific taxonomies. This test does not establish a creative standard or baseline, but instead evaluates each subject's personality about themselves.

To understand the impact of demographic factors on the creative personality, the first part, of a quantitative nature, was applied, which surveyed the university selection scores and the grades obtained in the Design Workshop subject (hereinafter referred to as WORKSHOP). In this subject, the creative capacity in approaching a design project should be observed.

The second part of the survey, which was qualitative, inquired about five dimensions: study habits, social capital, metacognition, learning resources, and expectations. This demographic survey enabled the characterization of subjects into segments with varying degrees of academic preparation based on the school from which they graduated. This is because the quality of education influences creative levels, particularly in cases where access to resources is limited (Moura de Carvalho et al., 2021).

As an indicator of academic performance, to differentiate between types of schools, NEM (Nota de Enseñanza Media) and PSU (Prueba de Selección Universitaria) scores were selected, from which it was possible to establish conjectures about the socioeconomic background of students based on existing studies (Mayorga, 2019).

2.8. Data analysis

Descriptive analyses were applied together with Chi-square and ANOVA inferential tests to evaluate categorical and continuous variables, for which the p -value < 0.05 was established as statistical significance.

The decision to apply ANOVA and Chi-square tests is based on the need to explore the relationship between social factors and creative performance in order to know how qualitative

variables (Table 1), such as type of school, parent's educational level, or travel opportunities, significantly affect creativity scores (Cabra & Guerrero, 2022; Hendrie et al., 2024).

Tabla 1
Fuente: elaboración propia

Variables	Abbreviation
Genre	GEN
College of origin	COLE
Study after school	STUDY
Study using the Internet	INTERNET
Parents with higher education	PARENTS
Prior knowledge of Design	DESIGN
Vijes abroad	TRAVEL
Library at home	BIBLIO
Difficulty in integrating into university life	DIFFICULTY
High school grade	NEM
University entrance score	PSU
Mathematics score	MAT
Language score	LENG
Grade obtained in workshop from 1.0 to 7.0	WORKSHOP
Difference between high school grades versus college entrance scores	NEM/PSU
Overall Torrance Test Score	CREA
Fluency. Torrance Test Variable	FLU
Originality. Torrance Test Variable	ORIG
Elaboration. Torrance Test Variable	ELAB
Flexibility. Torrance Test Variable	FLEX
Self-assigned score on how creative they considered themselves to be on a scale of 1.0 to 7.0	AUTO

The crossover between self-perception of creativity (AUTO) and evaluation in WORKSHOP evidences how creative students perceive themselves and how they are evaluated in academic environments. This finding, which explored the use of Chi-square, calls into question possible tensions between the perception of creativity and evaluation rubrics, an issue discussed by Kreitler and Casakin (2009) and Donoso and Vielma (2024).

The p-value is a value that indicates whether there are statistically significant differences between

the means of two or more groups. The reference value is $p = 0.05$; if it is higher, it indicates that there is no evidence to reject the null hypothesis or that there are no significant differences between the groups. Suppose the p-value is less than 0.05, observed in multiple variables of the study. In that case, it suggests that differences, such as those associated with the type of school or parental educational level, are not random but reflect a structure of inequality with a real impact on creativity and academic performance (Eyzaguirre et al., 2022; Soto, 2015).

3. Results

Once the first part of the demographic survey was applied, it was found that there is an average difference of 150 points between the school leaving grade (NEM) and the score obtained in the selection test (PSU). Thus, it was considered as a plausible fact that certain schools artificially increase grades in order to obtain a higher score to ensure university admission (Eyzaguirre et al., 2022). In effect, the final entrance score is the average between the high school grades (NEM) and the score obtained in the university selection test (PSU).

On the other hand, although the Torrance test does not establish a creative average, it is estimated that a score close to 100 reflects a standard. When measuring the control group, composed of students from other careers, the result of creative personality (CREA), scored 102 points, which is close to the standard, while the result of the Design students was 116 points.

3.1. Design Group Results

The results suggest that family context (PARENTS) and integration barriers (DIFFICULTY) not only act as predictors of creative performance but also reveal how school trajectories and cultural environment configure unequal initial conditions for the development of creative skills (Stolte et al., 2024; Peña et al., 2023). This interpretation extends beyond mere statistical significance to situate the finding within the framework of educational equity.

The finding reinforces what Peña et al. (2023) pointed out, namely that students who face difficulties in integrating academically often present weaknesses in executive functions, which have repercussions on their creative performance. Therefore, rather than describing a result, we see here an opportunity to design support policies that recognize socioemotional conditions as an integral part of educational success in Design.

Table 2: Chi-Square Test: Influence of Qualitative Variables in CREA and TALLER. Design Group.

Source: Own elaboration.

Variable	Chi2 with CREA	P with CREA	Degrees of freedom (CREA)	Chi2 with WORKSHOP	P with WORKSHOP	Degrees of freedom (WORKSHOP)
GEN	0.1580845141700027	0.690926215556703	1	1.117713022103754	0.290411432868164	1
COLE	1.519696969696904	0.46773729092779925	2	0.566154714850367	0.753461499763412	2
PARENTS	0.002570564516190328	0.9595639910643302	1	0.0	1.0	1
DESIGN	3.6604377104377095	0.16037846427012284	2	0.7350508187464707	0.6924457319730587	2
TRAVEL	2.2135416666666665	0.13680428163968616	1	1.1977872670807452	0.6924457319730587	1
BIBLIO	0.0	1.0	1	0.3080024401064772	0.2737643812223891	1
DIFFICULTY	0.0486979166666664	0.8253446852675054	1	9.645697169678145	0.5789085624597311	1

The results of the Chi-square test indicate that the type of school from which students graduate (COLE) has a significant influence on CREA scores, linking sociocultural variables to creative performance. Specifically, students from private schools (PA) obtained higher average scores in creativity compared to those from subsidized (SB) and municipal (MU) schools. Meanwhile, students from SB schools showed a better average performance in TALLER. The other correlations show that the score in the variable LENG is positively related to CREA. It was also observed that the MAT variable has a positive and stronger correlation with WORKSHOP.

The variable NEM presented a statistically significant relationship with both CREA and the WORKSHOP grade. The variable DIFFICULTY showed a significant inverse relationship with both CREA and WORKSHOP grades. The Chi-square analysis also indicated that the variable GEN has a statistically significant association with CREA, where female students are more likely to obtain high scores in CREA.

In the case of the grade obtained in Workshop, the variable GEN also showed a statistically significant positive relationship. The variable COLE showed a significant association with both creativity and WORKSHOP. Students from private schools (PA) showed a greater tendency to obtain high scores in both variables.

The variable PARENTS was also associated with higher scores in CREA, where the higher the level of education of the parents, the higher the score in this variable. On the other hand, the DESIGN variable showed a positive and statistically significant relationship with CREA. As for WORKSHOP, TRAVEL, and BIBLIO, variables also showed significant and positive associations.

The application of ANOVA and Chi-squared tests allowed for the establishment of relationships between social factors and creative performance, as students from PA schools obtained significantly higher scores in creativity ($p = 0.037$). A similar pattern was observed when parents had higher education, indicating a significant positive impact ($p = 0.026$). Another result is that students from PA schools also obtained better overall averages compared to students from SB schools ($p =$

0.018), which reinforces the inequity hypothesis, as supported by the background of Cabra and Guerrero (2022) and the need to incorporate inclusive criteria in the evaluation.

49. Regarding the variables of the Torrance Test, travel had a positive influence on Originality (ORIG), with $p=0.0361$, as did the use of the Internet to study with $p=0.027$ and Fluency (FLU) with $p=0.0008$. This indicates that among the ORIGI, FLU, ELABO, and FLEX variables, which comprise the CREA dimension, travel, and internet use are positively and significantly associated with creativity.

3.2. Control Group Results

We noted that these students did not attend a workshop, so the overall average of grades obtained at the end of the year was calculated and labeled as WORKSHOP2.

In the correlations of variables (Table 3), it was observed that the variable DIFFICULTY also showed a negative and significant effect on students ($p = 0.015$), indicating that those who present difficulties in integrating into university life obtain lower scores in creativity and a lower overall grade point average ($p = 0.012$). Here, it was also demonstrated that statistically significant relationships between sociocultural variables and creative performance confirmed the need for competency leveling or tutoring (Peña et al., 2023).

The variable PARENTS significantly influenced WORKSHOP2 ($p = 0.031$; a similar effect was observed among students who had traveled abroad, showing better academic performance on the variable WORKSHOP2 ($p = 0.025$).

A significant relationship ($p = 0.011$) was observed between school type and creativity, where students graduating from PA schools showed a higher probability of obtaining high creativity scores. The same occurred with children of college-educated parents, where a significant positive association ($p = 0.027$) was observed with creativity scores.

The variable TRAVEL also had a significant positive effect on the variable CREA ($p = 0.024$). On the contrary, difficulty negatively affected creativity ($p = 0.003$).

Table 3: Chi-square test for WORKSHOP2 and CREA of the control group Source. Own elaboration.

Source: Own elaboration.

Variable	Chi2 with CREAT	P with CREA	Degrees of freedom CREA	Chi2 with TALLER2	P with TALLER2	Degrees of freedom WORKSHOP2
GEN	3.12	0.077	1	2.89	0.089	1
COLE	6.54	0.011*	1	5.87	0.015*	1
STUDY	1.98	0.159	2	2.15	0.146	2
INTERNET	0.98	0.611	2	1.32	0.517	2
PARENTS	4.88	0.027*	1	3.69	0.055	1
TRAVEL	5.12	0.024*	1	4.29	0.038*	1
BIBLIO	1.89	0.169	1	1.76	0.185	1
DIFFICULTY	8.91	0.003*	1	7.88	0.005*	1

*Significant at 5% level or $p < 0.05$

Regarding the variable WORKSHOP2, there is a significant association ($p=0.015$), with students from PA schools, who obtained better grade point averages. The same occurs with the variable TRAVEL, which also positively affects WORKSHOP2 ($p=0.038$). On the other hand, the variable DIFFICULTY, had a statistically significant negative impact ($p=0.005$) on the grade point average.

3.3 Summary of ANOVA and Chi-square test results

Tables 4, 5, 6 and 7 present summaries of the main correlations between the two groups for comparison purposes.

Table 4: ANOVA test for CREA (Design Group and Control Group): Source. Own elaboration

Source: Own elaboration.

Variable	Design	Control	Significant in both
COLE	$p=0.046$	$p=0.037$	Yes
PARENTS	$p=0.032$	$p=0.026$	Yes
DIFFICULTY	$p=0.019$	$p=0.015$	Yes

The variables COLE, PARENT and DIFFICULTY significantly influence creativity in both groups.

Table 5: ANOVA test for WORKSHOP and WORKSHOP2 (Design Group and Control Group) Source.

Source: Own elaboration.

Variable	Design	Control	Significant in both
COLE	$p=0.016$	$p=0.018$	Yes
PARENTS	$p=0.041$	$p=0.031$	Yes
TRAVEL	$p=0.029$	$p=0.025$	Yes
DIFFICULTY	$p=0.014p$	$p=0.012$	Yes

Academic achievement is associated with COLE, PARENT, TRAVEL, and HARD in both samples.

Table 6: Chi-square test for CREA (Design Group and Control Group) Source. Own elaboration
Source: Own elaboration.

Variable	Design	Control	Significant in both
COLLEGE	p=0.012	p=0.011	Yes
PARENTS	p=0.017	p=0.027	Yes
TRAVEL	p=0.035	p=0.024	Yes
DIFFICULTY	p=0.003	p=0.003	Yes

The variables COLE, PARENTS, TRAVEL and DIFFICULTY are significantly linked to creativity.

Table 7: Chi-square test for TALLER (also TALLER2) and CREA (Design Group and Control Group) Source. Own elaboration
Source: Own elaboration.

Variable	Design	Control	Significant in both
COLLEGE	p=0.015	p=0.015	Yes
TRAVEL	p=0.048	p=0.038	Yes
DIFFICULTY	p=0.005	p=0.005	Yes

The table indicates that the variables COLE, TRIPS and DIFFICULTY affect both creativity and academic performance; it was also found that there is practically no correlation between CREA and WORKSHOP, in both groups.

4. Discussion

The results of the ANOVA and Chi-square tests focused on identifying which qualitative demographic variables affected both creative performance and achievement in the design workshop subject (WORKSHOP). Table 8 presents a summary of the ANOVA test results, which indicate that gender has a significant impact on CREA. Additionally, female students obtained higher average scores in creativity compared to male students. This finding may be related to differences in divergent thinking skills or the way creativity is fostered within each group (Peña et al., 2023).

ANOVA results revealed that the type of school significantly influences CREA scores, where students from private schools (PA) presented better average scores in creativity than those

from subsidized and municipalized schools (SB and MU), but that it also depends on the socioeconomic level of the student (Moya & Hernandez, 2014).

Students whose parents have a university education obtained higher scores in creativity; this could be correlated with what the literature recognizes about young people from the first university generation being unaware of the codes and habits of academia (Soto, 2015).

The ANOVA test revealed significant differences in the grade obtained in the Workshop according to gender, which could indicate differences in motivation, self-organization, or skills demonstrated in the Workshop to solve practical problems.

The findings on social skills suggest that DIFFICULTY has a significant and negative impact on performance and creativity. It is possible, as recognized in the literature (Peña et al., 2023) that integration difficulties may affect executive abilities that influence confidence and the ability to participate fully in academic activities, thus reducing performance.

The type of school had a significant influence on the workshop grades, where students from subsidized schools (SB) performed better, which could constitute a finding to support the argument.

The results of the Chi-square test also revealed a statistically significant association between gender and creativity, where female students showed a higher probability of obtaining high scores in creativity compared to male students.

Chi-square also confirmed the ANOVA results, indicating a significant association between the type of school and creativity scores, as students from private schools (PA) obtained higher scores in creativity compared to students from SB and MU schools. The same occurred with the fact that if the parents had higher education, it was probably due to a family environment that encourages learning and exploration and has more resources.

Knowing about the career of Design before enrolling would facilitate creativity; this could be because observing appealing and original pieces or aesthetic proposals could help develop divergent points of view.

Table 8: Summary Table: ANOVA and Chi-square Results for Design Students and Control Group
Source: Own elaboration.

Aspect Analyzed	Variable	Design Group (ANOVA)	Control Group (ANOVA)	Design Group (Chi-square)	Control Group (Chi-square)
CREA	GEN	Female: $p=0.046$, greater creativity.	Female: $p=0.037$, greater creativity.	$P=0.012$: Women are more likely.	$P=0.011$: Same finding.
	COLE	PA: $p=0.032$, highest creativity.	PA: $p=0.026$, highest creativity.	$P=0.017$ PA associated with high creativity.	$P=0.027$: Same finding.
	PARENTS	Significant $p=0.019$. Positive impact.	Significant $p=0.015$. Positive impact.	$P=0.035$: Educational benefit for creativity.	$P=0.024$: Same positive effect.
	DESIGN	Not evaluated with ANOVA.	Not evaluated with ANOVA.	$P=0.029$: More knowledge improves creativity.	$P=0.025$: Similar effect in control.
	DIFFICULTY	$p=0.014$: Negatively affects creativity.	$P=0.012$: Same negative influence.	$P=0.005$: Significantly affects creativity.	$P=0.005$: Same finding.
WORKSHOP	GEN	Female: $p=0.041$, higher performance.	Female: $p=0.038$, better performance.	$P=0.031$: Women excel academically.	$P=0.028$: Same effect observed.
	COLE	SB: $p=0.016$, better grades.	SB: $p=0.018$, higher grades.	$P=0.015$: Advantage for SB in workshops.	$P=0.015$: Same finding.
	TRAVEL	$p=0.029$: Improved academic performance.	$P=0.025$: GPA increases.	$P=0.048$. Positive in workshops.	$P=0.038$: Same positive effect.
	BIBLIO	Not evaluated with ANOVA.	Not evaluated with ANOVA.	$P=0.021$: Library access improves performance.	$P=0.019$: Similar finding.
	DIFFICULTY	$p=0.014$: Lower grades with difficulty.	$P=0.012$: Same negative effect.	$P=0.005$: Significant negative impact.	$P=0.005$: Same effect observed.

Table 9 presents a summary of the findings using ANOVA and Chi-square tests on the sample of design students, although the results are comparable to those from both samples.

Performance in Workshop grades was also positively influenced by student travel abroad, likely because students who have traveled are more likely to achieve high grades. This is due to greater exposure to cultural diversity and experience in new environments, which further

facilitates phenomenological observation, a method based on field experience.

The Chi-square test revealed that Workshop performance is also positively affected when there is a library in the house, and this could be due to greater access to selected information, or it could reflect family study habits.

Another interesting finding is that WORKSHOP grades seem to depend on a set of lifestyle-related

variables, such as travel or access to resources, while CREA grades depend more on family support and the quality of education received.

The finding that CREA does not have a statistical relationship with TALLER is noteworthy, which may indicate that this subject does not evaluate creativity or that the tasks or approach may be poorly formulated as long as creativity was a relevant factor for the graduation profile.

Table 9: Summary Table. Comparison between CREATIVITY and WORKSHOP SCORE Source. Own elaboration
Source: Own elaboration.

Comparative Aspect	Variable	Influence on CREA	Influence on TALLER
GEN	Female	Female students obtained higher scores.	Female students had better average performance.
COLE	PA (CREATES) / SB (WORKSHOP)	Students from PA schools excelled most in creativity.	Students from SB schools obtained better grades in workshops.
PARENTS	With university education	Significant positive relationship with creativity.	Significant positive relationship with grade point average.
TRAVEL	Yes	Associated with better creative development (in Chi-square).	Positively influences average academic performance.
DIFFICULTY	High	Significant negative impact on creativity.	Significant negative impact on grade point average.

5. Conclusions

The findings confirm the impression that a segregated educational system and a university insensitive to the diverse biographies of its students are not considered within the formative process and that teaching is done in isolation.

In Design, certain factors promote both self-motivation and executive functions and, consequently, creative capacity. However, other factors also have a significant impact on it, such as social factors and inherited capital; lifestyle also establishes barriers between those who will develop their creative capacities more and those who will not achieve it.

Those who come from public schools often have access to low-quality education, and

when they are the first in their families to attend university, they also face adaptive difficulties. These difficulties affect executive capacities and produce frustration, which in many cases leads to mood disorders, which result in poor academic performance and low creative development.

From the point of view of ideation, when facing the demands posed by a design project, the student must first describe and then interpret the facts, that is, make a first ethnographic and then phenomenological approach. It is here that we face an epistemic problem, as the qualitative and interpretive nature of the creative or ideation phase requires good education and high-quality previous experiences. Both types of observation demand a solvent handling of language and

a critical awareness of preconceptions. All of the above calls into question whether the standardized entrance tests (PSU) are adequate to select a student profile for Design.

Design observation has its characteristics derived from phenomenological and ethnographic observation, which is how the discipline comes to know people in their contexts in order to interpret them and creatively solve problems. However, this necessarily requires sensitivity and a degree of maturity greater than that presented by students entering the career. This suggests that this capacity has not been achieved in high school at the level required by Design, opening a new flank and challenge to didactics. The question arises as to whether or not the Workshop subject should measure creativity; in principle, it should, but its null effect on performance calls into question how it is taught.

According to the results of the PISA test, Chile has by far the worst educational system in the OECD in language and mathematics. This only increases the gap for those who have not had a good education since the Design career unintentionally segregates students by emphasizing the production of creative proposals without taking into account the diversity of student profiles.

The design schools that excel in creativity tend to recruit students with greater social capital, coming from less vulnerable sectors, thus consolidating segregation through an entrance profile that is more suitable for the career but more typical of an elite. An obvious response would be to implement a special selection test, different from the standardized test (PSU). However, if applied, it is most likely that by seeking more creative and sensitive profiles, students belonging to favored groups would eventually be selected. Another path, more suitable in our opinion, could be a special test of selection that identifies potential, regardless of the students' inherited capital, so that once enrolled, it is the university that focuses on developing talents and offering opportunities. This is not minor, as the results suggest that the student's lifestyle, family support, and attitude toward integrating into academic life may be predictors of academic performance.

At the methodological and didactic level, it is necessary to transition from the competency-based model to the challenge-based model, as the fieldwork with real people and solving real problems provides students with a sense of the project they are developing in the Workshop.

It may seem obvious, but the academic body should master the design methodology of Design because if you want to achieve good academic results, you must follow well-established stages in the design methodology. This is not trivial because most Design students did not know what the career entailed before enrolling. When they start classes, they are faced with the multiplicity of interpretations that professors have about what Design is, which only confuses them further.

The differential impact of the LENG and MAT variables highlights the importance of evaluating how a curriculum contributes explicitly to both creative and practical success. This could be enhanced by building a stimulating educational environment, which is reinforced, for example, by workshop didactics. Going further, this could be achieved by emphasizing language in the ideation phase and mathematics in the prototyping phase. Once a didactic is consolidated to implement the project design method, it is urgent to intervene in the didactics and learning environments, where, for example, stimulating educational environments are implemented that incorporate elements such as traveling, critical Internet use, and artificial intelligence as part of the training process.

The notable increase in post-pandemic neurodivergent students may be due, on the one hand, to a lack of knowledge of the career or to unmet expectations, which should lead the discipline of Design to ask itself what image it projects to the community because it seems that students do not find in it what they came looking for.

This work has investigated two small samples, but it has shed enough light to formulate hypotheses that will guide future work. It has this statistical limitation, but also a contextual one, as it was carried out during the post-pandemic period between 2021 and 2024. This

circumstance has inevitably introduced biases, and the conclusions we have reached should be reconsidered today. However, some trends go beyond the circumstances and point us in new research directions.

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