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Aprendizaje colaborativo internacional en línea (COIL) en una asignatura de emprendimiento en estudiantes universitarios de Chile y Perú

Collaborative International Online Learning (COIL) in an entrepreneurship course for university students in Chile and Peru

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Abstract

The Collaborative Online International Learning (COIL) experience is an educational approach that strengthens cross-cutting skills in higher education through collaboration between teachers and students from different cultural backgrounds. This study aimed to describe and compare the perception of COIL among 153 engineering students from Chile (93) and Peru (60) enrolled in an entrepreneurship course focused on the development of binational projects. The experience took place over one semester with international teams and constant teacher monitoring. For the evaluation, an instrument was designed and validated comprising five dimensions: learning, technological use, teaching performance, intercultural interaction, and COIL satisfaction. The results showed a high rating for technological use (82%) and a lower perception of intercultural interaction (52%). No significant differences were identified between men and women; however, differences were found according to country, with higher scores among Peruvian students. Likewise, significant differences were observed between the five factors of COIL perception, both in the joint analysis and in five pair comparisons. In conclusion, the study demonstrates the effectiveness of COIL in promoting collaborative learning and intercultural skills and provides preliminary validation of a tool with the potential to be adapted to various educational contexts.

Keywords: Collaborative learning, entrepreneurship, higher education, active methodology, intercultural interaction

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Introduction

Higher education is being transformed by the influence of a globalized context and technological advances, which promote the implementation of strategies and techniques aimed at fostering meaningful learning that encourages creativity, innovation, and collaborative processes (United Nations Educational, Scientific and Cultural Organization, 2005). In this sense, educational institutions assume the challenge of providing students with experiences that facilitate their professional integration into inclusive and flexible spaces within a borderless educational environment.

As part of educational innovation, the Collaborative Online International Learning (COIL) model emerged, developed at the State University of New York, whose impact led to the creation of a specialized center (Rubin, 2017). This methodology proposes teaching within intercultural groups through collaboration among academics and seeks to engage students in project-based collaborative work, whose nature broadens personal development and the acquisition of competencies among participants (San Martín et al., 2022). This model strengthens digital competencies and transversal skills through international interaction and the use of a shared curriculum (Cipagauta, 2022). It differs from virtual exchange (VE) because it incorporates a context of intercultural integration into learning outcomes (Hackett et al., 2023). Furthermore, it expands opportunities for student development and contributes to reducing the socioeconomic gap, at least within the academic sphere (Sharma & Panackal, 2025; Wong et al., 2025; Naicker et al., 2021).

COIL experiences promote global learning and intercultural understanding. They represent an affordable alternative to studying abroad, as they allow more students to access international opportunities and develop essential skills for today's world without the need to travel (Huertas-Abril & Palacios-Hidalgo, 2023; Pantoja-Aguilar & Goodman, 2021). Likewise, they foster the development of professional skills such as cultural respect, teamwork, adaptability, critical thinking, and self-confidence, in addition to the acquisition of disciplinary knowledge (Banerjee et al., 2023; Rodríguez-Marconi et al., 2023; Robles-Pinto et al., 2023; Vargas-Gutiérrez et al., 2022; Restrepo-Maya, 2022; Lozada-Mondragón, 2021). Furthermore, they integrate students with different native languages who overcome intercultural and communication barriers, as in the case of nursing students from Ecuador and the United States who participated in a COIL experience in which they reflected on and discussed psychosocial vulnerability, mental health, and environmental justice (Newman et al., 2025).

Research on COIL experiences is supported by evidence from a systematic review conducted within the Latin American context between 2017 and 2023, which identified twenty-three reports from Argentina, Brazil, Colombia, and Mexico. This study showed that COVID-19 promoted implementation and improved the quality of COIL experiences, characterized by synchronous and asynchronous activities through social networks, as well as the frequent use of tools such as Spotify, Padlet, and Kahoot for interaction processes. Likewise, technological gaps among teachers and limitations among students in managing intercultural relationships and selecting appropriate online learning resources were identified, generating moderate institutional interest in improving these processes (Romero-Archila,

2025). In Europe, an experience involving Lithuanian and Polish students in a course on business opportunities stands out (Ambrusevič & Išoraitė, 2025), while in Asia its application has been reported among students from China and Malaysia for foreign language learning through the incorporation of artificial intelligence tools (Sun, 2024).

Although research related to the COIL model presents favorable results regarding participant satisfaction and positive perceptions toward intercultural exposure and the development of constructivist practices, many experiences present limitations in defining the variable and its composition, which reduces guarantees for evaluating the effect of internationalization on the educational process (Fernández-Cézar et al., 2024; Lemos-Shlotter & Espinal, 2023; Cuño-Bonito & Soto-Arango, 2022; Peña, 2019). Added to this condition is the fact that the implementation of a COIL experience depends on the available technological infrastructure, students' motivation and self-discipline, as well as teacher training and support and the quality of institutional coordination and communication (Ramírez-Fernández, 2023; Wiesner-Luna & Burgoa-Godoy, 2023; Avello-Martínez & Duart, 2016). This represents a genuine challenge for both implementation and evaluation.

In this sense, the present study aims to describe and compare the perceptions of Chilean and Peruvian students regarding a COIL learning experience within an entrepreneurship course, so that measuring the COIL construct through a structured scale may contribute to understanding the variables involved, such as the evaluation of learning, the use of information technologies, the teaching role, and student interaction.

Based on this objective, the present research seeks to reduce the existing gap regarding COIL experiences within the binational context of Chile and Peru, particularly in engineering programs. The only previous reference involving participation from both countries corresponds to a study that brought together medical and nutrition students from four Latin American countries to develop public policy proposals in education (González-Treviño et al., 2025).

No studies were identified that analyze learning processes associated with the development of pilot entrepreneurship projects, which require competencies related to creativity, intercultural management, and problem-solving. The available evidence mainly comes from virtual experiences conducted within a single country (Chen et al., 2022) and from a recent qualitative study on entrepreneurship and the COIL methodology based on in-depth interviews (Pirie et al., 2025). Likewise, no explanatory models were found for quantitatively evaluating perceptions of COIL experiences, which further reinforces the relevance of the present study.

Therefore, this process — which proposed a model for the quantitative measurement of COIL experiences, together with detailed course planning, the implementation of resources for its execution, the development of the teaching-learning process, and its subsequent evaluation — contributes to strengthening higher education from a globalized perspective, in association with the fourth and seventeenth Sustainable Development Goals: "Quality Education" and "Partnerships for the Goals" (United Nations, 2015). At the same time, it implies moving

toward a relational, inclusive, and immersive condition for students in identifying needs and proposing shared solutions aimed at improving services and quality of life.

Theoretical Foundation

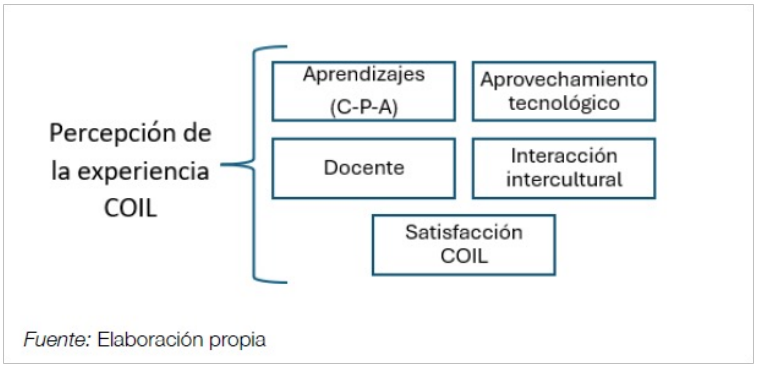
A Proposed Model for Measuring COIL Experiences

The present research proposes an explanatory model of the COIL experience within the process of professional education, associated with student perception. To achieve this, two basic components of analysis are proposed: (a) the acquisition of meaningful learning related to the course content (including conceptual, procedural, and attitudinal aspects [C-P-A]); and (b) the teacher's ability to provide an adequate process for facilitating content, proposing practical activities, motivating learning, and guiding students toward achieving the main outcome of the course. These two components are inspired by a perceived learning scale used in a curricular experience in psychology (Aguirre-Morales & Tantaleán-Terrones, 2021). In the same vein, student satisfaction with the process is also included, as it has been evaluated in different contexts (Tsang et al., 2021; Wang et al., 2021), although in this study the variable has been adapted to the particularities of COIL teaching.

Likewise, this proposal incorporates the use of technology within virtual environments and the interaction among students from different countries, elements inherent to the virtual learning context that facilitate intercultural encounters. Technological use is usually explored through open-ended questions from a qualitative approach, whereas the intercultural dimension is frequently evaluated through validated scales such as the Cultural Intelligence Scale (Ang et al., 2007), which has been widely used to measure intercultural effectiveness (Hackett et al., 2023).

It should be noted that no consensus has yet been established regarding the tools used to measure the effects of COIL interventions (Ramstrand et al., 2024), nor is there a specific theoretical framework supporting them. Nevertheless, given this emerging challenge, the present research proposes laying the groundwork for generating an explanatory model in this regard through a provisional approach that conceptualizes the evaluation of the COIL methodology as a construct composed of five components, grounded in student (user) perception, as illustrated in Figure 1.

Figure 1. *Proposed Model for Evaluating Perceptions of the COIL Experience*



Fuente: Elaboración propia

Teaching entrepreneurship effectively requires methodologies oriented toward the practical and attitudinal aspects of the student (Gunathunge, 2020). This implies an evolution in methodological criteria, moving from "teaching about entrepreneurship" toward "educating through entrepreneurship" (Linton & Klinton, 2019). Such a condition influences the development of competencies through the identification of opportunities and the consolidation of a creative, resilient, and empathetic mindset (Semerikov et al., 2020), dimensions that this model seeks to measure within the framework of the COIL experience.

Methodology

This research is applied in nature, as it evaluates the implementation of teaching techniques in solving practical problems in education (González, 2021). Furthermore, it presents a non-experimental descriptive-comparative design, with a quantitative approach and an explanatory scope (Hernández, 2023).

Participants

The study population consisted of university students from Universidad de La Frontera (UFRO, Temuco, Chile) and Universidad Nacional Agraria La Molina (UNALM, Lima, Peru), enrolled in an Entrepreneurship course lasting one academic semester, in which they developed a COIL project through international and interdisciplinary teams guided by Chilean and Peruvian instructors. Participant selection was conducted through intentional non-probabilistic sampling (Hernández, 2023), including all students enrolled in the course; therefore, no sample size calculation was performed. In total, 153 students between 20 and 24 years old participated ($\bar{x}$ = 22.02; s = 1.08); 92 (60%) were men and 61 (40%) were women. Likewise, 93 students (61%) came from UFRO and were enrolled in Civil Engineering programs, while 60 students (39%) belonged to UNALM and studied Business Management Engineering. The course is elective in Chile and mandatory in Peru.

Instruments and Materials

Perception Scale of Collaborative Online International Learning (EP-COIL)

A specific instrument was designed for this study, developed by mentors specialized in the COIL methodology with advisory support in psychometrics. The scale was constructed based on five dimensions: C-P-A learning outcomes (10 items), technological use (6 items), teaching performance (9 items), intercultural interaction (7 items), and COIL satisfaction (5 items). These dimensions comprised a total of 37 items, which were submitted to expert judgment to evaluate their clarity, relevance, and pertinence according to the criteria proposed by Escobar-Pérez and Cuervo-Martínez (2008). The evaluation panel consisted of four specialists: two psychometric researchers, one expert in the COIL methodology, and one specialist in university teaching methodology.

The analysis of the scale's validity coefficient yielded an overall value of 0.933 (excellent category), with dimension values ranging from 0.893 to 0.960, corresponding to categories between good and excellent (Aiken, 1985). Furthermore, as a contribution to content validity and internal consistency, item-test analysis, Cronbach's alpha (α), and McDonald's omega (ω) were conducted. The indicators obtained through this evaluation process were favorable, demonstrating adequate validity and excellent reliability of the instrument (see Table 1).

Table 1. *Item-test validity analysis and reliability of the COIL instrument overall and by dimensions.*

Dimensión	Correlación ítem-total corregida (r_itc)	Alfa (α)	Omega (ω)
Escala general	> 0,529	0,977	0,977
Aprendizaje	> 0,736	0,956	0,958
Aprovechamiento tecnológico	> 0,791	0,929	0,930
Desempeño docente	> 0,576	0,937	0,938
Interacción intercultural	> 0,715	0,938	0,939
Satisfacción COIL	> 0,793	0,961	0,961

Fuente: Elaboración propia.

COIL Curricular Experience: Chile – Peru

The course was developed within the framework of the design, implementation, and execution of entrepreneurship projects, based on the Lean Canvas strategic planning tool and the methodological support provided by the Wadhwani Foundation. This organization collaborated with Universidad Nacional Agraria La Molina and Universidad de La Frontera during the years 2023 and 2024. This initiative evolved into an international online learning process between the aforementioned universities.

The course was structured around the components of Lean Canvas: (a) problem/customer identification, (b) solution definition, (c) business strategy establishment, and (d) success measurement. The final product involved the design, implementation, and execution of an entrepreneurial initiative applied in Chile and Peru up to the testing phase with early adopters. The following sections present the elements that guided the design, implementation, and execution of the course under the parameters of the COIL methodology.

Procedure

The research involved various interconnected actions and milestones, including the interinstitutional coordination necessary to formalize the course within the participating universities, the articulation between instructors and mentors from the Wadhwani Foundation, the management of access to the platforms where the sessions were conducted, and the planning and design of the instrument intended to measure the COIL experience from the students' perspective. Likewise, intercultural groups were formed, the course was implemented, and the perception instrument was administered through an online form during the final class session.

Once the evaluation process was completed, a database was created and subsequently exported and coded using Excel and SPSS. For the descriptive analysis, scales were developed based on the minimum and maximum scores of the overall variable and its dimensions in order to establish score ranges corresponding to high, medium, and low levels.

In addition, the final perception scale was obtained through the sum of the five dimensions described in the model conception presented in the previous section.

Data Analysis

A descriptive analysis of frequencies and percentages regarding students' perception levels was conducted after reviewing missing data and removing outliers. Subsequently, a normality analysis was applied to the different comparison groups according to sex and country (scores obtained), as well as to the COIL dimensions (scores transformed into averages per item), in order to determine whether parametric or non-parametric tests were appropriate for comparative analyses. Finally, effect size measurement was incorporated as a complementary indicator for the first two comparisons. The tests used included Student's t-test and the Mann-Whitney U test for independent samples, as well as the Friedman test for related groups. Cohen's delta and its corresponding non-parametric measure, Pearson's r, were used to calculate effect size. The entire procedure was carried out using the statistical packages SPSS (version 29) and RStudio (version 4.5.1).

Results

The descriptive analysis of perceptions regarding the COIL experience reveals a higher percentage of students at the high level for the overall variable, with values ranging from 59% to 82% among the 153 students evaluated. Likewise, among female students, the percentages within this level range from 61% to 90%, while among male students the range varies between 58% and 78%. In both cases, the dimensions of technological use and teaching performance stand out in particular.

Table 2. *Levels of perception of the COIL experience for the overall group and according to sex.*

Grupo	Nivel	A		AT		DD		II		SC		EP-COIL	
		f	%	*f*	%	*f*	%	*f*	%	*f*	%	*f*	%
General n = 153	Alto	107	70 %	126	82 %	124	81 %	90	59 %	108	71 %	115	75 %
	Medio	41	27 %	25	16 %	28	18 %	56	37 %	38	25 %	36	24 %
	Bajo	5	3 %	2	1 %	1	1 %	7	5 %	7	5 %	2	1 %
Mujeres n = 61	Alto	48	79 %	55	90 %	52	85 %	37	61 %	47	77 %	48	79 %
	Medio	11	18 %	5	8 %	8	13 %	23	38 %	12	20 %	12	20 %
	Bajo	2	3 %	5	8 %	1	2 %	1	2 %	2	3 %	1	2 %
Hombres n = 92	Alto	59	64 %	71	77 %	72	78 %	53	58 %	61	66 %	67	73 %
	Medio	30	33 %	20	22 %	20	22 %	33	36 %	26	28 %	24	26 %
	Bajo	3	3 %	1	1 %	0	0 %	6	7 %	5	5 %	1	1 %

Nota: A = Aprendizajes; AT = Aprovechamiento tecnológico; DD = Desempeño docente; II = Interacción intercultural; SC = Satisfacción COIL; EP-COIL = Escala de percepción COIL.

The comparative analysis according to sex reports the absence of significant differences between female and male students regarding perceptions of the COIL experience, both in the total score and across its dimensions, with $p > .087$. Likewise, a predominance of effect sizes of $d = -.271$ and $r < .138$ is observed (see Table 3).

Table 3. *Comparison of perceptions of the COIL experience according to sex.*

Variable	Grupo	*x*	*s*	*gl*	*t*	*α*	*d*
EP-COIL	Hombres Mujeres	146,89 153,38	24,403 23,179	151	-1,658	,956	-,271
Variable	Grupo	Rango promedio	*SE*	*gl*	*U*	*α*	*r*
Aprendizajes	Hombres Mujeres	73,57 82,18	267,334	151	3122,000	,237	,095
Aprovechamiento tecnológico	Hombres Mujeres	72,09 84,41	264,343	151	3258,000	,087	,138
Desempeño docente	Hombres Mujeres	72,36 84,00	265,808	151	3233,000	,108	,129
Interacción intercultural	Hombres Mujeres	73,52 82,25	266,695	151	3126,000	,229	,097
Satisfacción COIL	Hombres Mujeres	72,62 83,61	262,483	151	3209,000	,125	,124

Nota: El total de estudiantes hombres fue de 92, mientras que el total de estudiantes mujeres fue de 61.

With regard to the students' country of origin, the analysis reveals differences in the overall COIL variable and in the dimensions of learning outcomes, intercultural interaction, and COIL satisfaction ($p < .045$). However, only the intercultural interaction dimension presents a small effect size ($r < .231$), favoring Peruvian students over Chilean students (see Table 4).

Table 4. *Comparison of perceptions of the COIL experience according to country of origin.*

Variable	Grupo	*Rango promedio*	*SE*	*gl*	*U*	*α*	*d*
EP-COIL	Chile Perú	70,60 86,93	267,48	151	3385,500	,026	,179
Aprendizajes	Chile Perú	71,26 85,89	*266,57*	*151*	*3323,500*	,045	,161
Aprovechamiento tecnológico	Chile Perú	73,57 82,18	267,334	151	3122,000	,237	,095
Desempeño docente	Chile Perú	73,12 83,01	265,05	151	3150,500	,174	,109
Interacción intercultural	Chile Perú	68,80 89,71	265,93	151	3552,500	,004	,231
Satisfacción COIL	Chile Perú	70,77 86,66	261,73	151	3369,500	,027	,178

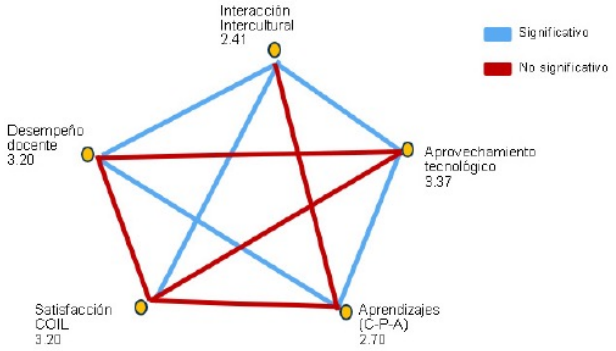
Nota: El total de estudiantes chilenos fue de 93 y peruanos, 60.

According to the comparison of equivalent scores across the dimensions of COIL perception, the highest average rank is observed in the technological use dimension ($M = 3.37$), while the lowest corresponds to intercultural interaction ($M = 2.41$). Likewise, the Friedman test indicated significant differences among the five factors ($p < .005$). This result justified conducting a post hoc analysis with Bonferroni correction (pairwise comparisons), in which

significant differences were identified in 5 of the 10 comparisons (padjusted < .005).

More specifically, intercultural interaction differs from COIL satisfaction, teaching performance, and technological use; meanwhile, learning outcomes (C-P-A) differ from teaching performance and technological use (see Figure 3 and Table 5).

Figure 3. *Pairwise comparison of the dimensions of COIL perception (Chile – Peru).*



Fuente: Elaboración propia

Nota: El color azul indica las diferencias significativas y el rojo en las que no hay.

Table 5. *Friedman test and post hoc comparisons with Bonferroni correction for the dimensions of the EP-COIL scale.*

Prueba	X^2	*gl*	*p*
Friedman	58,188	4	< .001
Comparación (M1 – M2)	ΔR	z	p_{ajust}
Interacción intercultural – Satisfacción COIL	-0,784	-4,339	,000
Interacción intercultural – Docente	0,908	5,026	,000
Interacción intercultural – Aprovechamiento tecnológico	0,958	5,297	,000
Aprendizajes (C-P-A) – Docente	-0,618	-3,417	,006
Aprendizajes (C-P-A) – Aprovechamiento tecnológico	-0,667	-3,688	,002

Nota: χ^2 = Chi-cuadrado; gl = grados de libertad; ΔR= diferencia de rangos; z = estadístico estandarizado; p_{ajust} = p ajustado con corrección de Bonferroni. Nivel de significación: p < .05.

Discussion

Satisfaction with the COIL model, technological use, and perceptions of teaching performance notably exceed intercultural interaction within the students' experience. This difference may be partly explained by communicative adaptation processes between the two countries. Although Chilean Spanish incorporates colloquial expressions and a more informal and direct communicative style — which may pose comprehension challenges for other Spanish speakers — the Spanish used by Peruvian students tends to be more neutral and formal, characteristics that may influence interaction fluency. Even so, the COIL methodology

proves highly effective, as it promotes the development of intercultural competence in terms of cultural intelligence (Hackett et al., 2023). Therefore, the design of the experience is essential for mitigating cultural barriers and maximizing the development of soft skills.

Regarding the analysis by country, a systematic and statistically significant advantage in favor of Peru is observed in four variables: EP-COIL, learning outcomes, intercultural interaction, and COIL satisfaction. Certain aspects related to the implementation of the strategy and the institutional context may have influenced this result. On the one hand, for Chilean students the course is elective, whereas for Peruvian students it forms part of their professional curriculum, a condition often associated with a more proactive attitude toward learning and a stronger interest in developing competencies that add value to professional practice (Alemany et al., 2016). On the other hand, there are differences in the academic context: Universidad de La Frontera is a regional public university located in an area with lower industrial development, whereas Universidad Nacional Agraria La Molina is located in Lima, a city with more than ten million inhabitants and significantly greater industrial activity. In addition, the time difference between the two countries — with Chile being two hours ahead of Peru — may also have influenced students' willingness to work, given that classes were held from 6:00 p.m. to 9:00 p.m. Chilean time. In contrast, no differences between countries were observed regarding technological use and teaching performance.

While maintaining similar levels of teaching performance and technological use, the Peruvian group reported higher levels of learning, better intercultural interaction, and greater satisfaction with the COIL experience. The learning outcomes dimension (C-P-A) consistently appears below the dimensions of teaching and technology, whereas the elements driving COIL satisfaction remain at a high level and demonstrate a sustained effect. Intercultural interaction, meanwhile, occupies an intermediate position. These findings reinforce the idea that teacher training is essential to fully leverage COIL, as instructors must prepare students for the demands of a globalized world (Huertas-Abril & Palacios-Hidalgo, 2023). To achieve a more inclusive internationalization process within the home country, it is crucial to incorporate facilitators while simultaneously addressing the challenges of the COIL component. This ensures the smooth integration of the COIL strategy into the future development of academic courses (Naicker et al., 2021).

According to the study results, a high overall evaluation (75%) of the COIL experience was observed among students. These findings coincide with those reported among Colombian and Mexican students, who value COIL satisfaction as a highly meaningful learning process in both educational and emotional dimensions (Montoto-González et al., 2024; Restrepo-Maya, 2022). Similarly, Rodríguez-Marconi et al. (2023) report comparable results among Chilean and Argentine speech therapy students. It should be noted that no other studies were identified that precisely evaluate the dimensions proposed in the perception instrument. Nevertheless, some experiences highlight the benefits that a COIL experience offers to both teachers and students, fostering mutual commitment in the construction of the teaching-learning process (Cipagauta, 2022). Likewise, the descriptive analysis reveals a higher proportion of women reporting high evaluations in this regard; however, these differences are not statistically significant in the comparative analysis and therefore present a null effect size.

Conclusions

At the conclusion of the study, a highly favorable perception of the COIL experience was observed, both overall and across each of its five dimensions, among all participants and according to sex, although with slightly higher percentages among women. However, the comparison of ranks did not show significant differences between sexes; differences were identified by country, with higher scores among Peruvian students in the dimensions of learning outcomes (C-P-A), intercultural interaction, and COIL satisfaction.

The comparison among the five dimensions of COIL perception also revealed significant differences, both globally and through pairwise comparisons. Intercultural interaction showed important contrasts with technological use, COIL satisfaction, and teaching performance. In turn, technological use differed from learning outcomes (C-P-A), and this latter dimension also differed from teaching performance. Finally, it is noteworthy that technological use obtained the highest average rank, whereas intercultural interaction and learning outcomes (C-P-A) registered lower values.

Based on the study results, it is suggested that the dimensions with lower average ranks — intercultural interaction and learning outcomes (C-P-A) — should be strengthened. In this regard, for intercultural interaction, it is proposed to reinforce guided activities, include explicit intercultural objectives, and assign binational roles to balance participation. Likewise, it is pertinent to implement formative assessment processes aimed at building trust-based relationships that allow participants to identify and resolve differences that may emerge during the process and achieve balanced participation within international teams. Concerning the learning outcomes dimension, it is recommended to align rubrics and evidence with training objectives and to make learning achievements more visible through metacognitive strategies. Regarding COIL satisfaction, it is recommended to clarify expectations from the beginning, provide timely feedback, and conduct a joint reflective closure between both countries. As an implication of the study, future research is proposed to evaluate the psychometric properties of the instrument and determine its construct validity criteria.

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Conflict of Interest Statement

All authors declare that they have no conflicts of interest.

Ethics Statement

Voluntary participation of students was ensured through informed consent. All data were anonymized using codes, and no personal data were used in the analysis.

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