Implementing Online Internalization Experiences in Higher Education Within COIL Method: The Case of Interdisciplinary Mexico-Ecuador Collaborations

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Abstract
The impact and importance of online internationalization, as proposed by Collaborative Online International Learning (COIL) initiative, were implemented and analyzed. It emphasized the influence in academic development, intercultural competencies as well as the preparation of the students towards globalization. Three implementations of COIL collaborations were performed between Ecuadorian Universidad San Francisco de Quito (USFQ), in collaboration with the Mexican higher education institution Tecnologico de Monterrey (ITESM), Campus Toluca. Six different courses were selected, each one with a head professor. The topics discussed by the professor included migration, decision-making, and volcano modeling. To validate the implementations, a survey written in Spanish, was applied to 108 students enrolled in COIL courses. This instrument included 12 closed questions, in Likert scale, as well as 2 open ones. Two variables were analyzed: 1) Sense of usefulness of COIL activities. 2) Effectiveness of international teams. The results showed that students consider time zones and communication are the most important limitations to face online, and international collaboration. Additionally, in student's opinion, compromise and responsibility are valuable as well as necessary features to achieve a successful international collaboration. Moreover, there is a clear relationship between the liking of the COIL activity and the sense of usefulness identified by students. It was shown that COIL activities promoted collaboration between international universities as well as global citizens. In fact, it is perceived that COIL is a more democratic way to promote international collaborations beyond the physical limitations.

Keywords: Educational Innovation, Higher Education, Global Perspective, Professional Education, COIL

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Introduction

The International Online Collaborative Learning (COIL) initiative emerges in higher education to cultivate global students, capable of creating intercultural learning networks through integrated curricula between courses from universities in different countries (Zhang & Pearlman, 2018). Zhang & Pearlman (2018) mention that higher education nowadays seeks interactive and effective methodologies that promote new forms of learning, instead of programs that generate new study topics. In this way, the COIL methodology emerges as an approach that allows internationalization and interdisciplinarity in the classroom, building global learning communities (Zhang & Pearlman, 2018; Vahed, 2022), and overcoming the barrier of geographical distance by the possibility of teaching synchronously and asynchronously through virtual means, which Naicker, Singh & Genugten (2022) mention as the experience of studying abroad without leaving your home.

The success of the COIL methodology lies in collaboration both in planning and in execution and evaluation of results, ensuring that students take ownership of their learning, demonstrating autonomy, and expanding their opportunities (Zhang & Pearlman, 2018; Naicker, Singh & Genugten, 2022). Additionally, Naicker, Singh & Genugten (2022) mention that in collaborative learning, students acquire knowledge through processes of assimilating and comprehending information that requires sharing, investigating, and actively engaging. They also develop interpersonal skills and teamwork abilities.

However, one of the biggest challenges facing the COIL methodology is to ensure that this international collaboration is efficient through effective and cost-effective means (Zhang & Pearlman, 2018), increasing awareness of the importance of interculturality and diversity in learning, as well as the development of cultural competencies (Vahed, 2022). Additionally, it is mentioned as one of the most frequently studied factors that hinder the achievement of these objectives the inconsistency in interaction among students from different geographical locations (Vahed, 2022), hence the importance mentioned by Naicker, Singh & Genugten (2022) of nurturing students' autonomy and commitment in implementing this methodology.

Interdisciplinarity in the COIL methodology strengthens its learning objectives: the creation of shared experiences and the acquisition of common knowledge that enables students to solve problems with cultural sensitivity and greater flexibility in their education (Petrova, Steffen, Piumatti & Lingán, 2022); in addition to nurturing the dimensions of interculturality and internationalization in learning.

Methodology

In the semester of August-December 2023, three different COIL collaborations between Universidad San Francisco de Quito, Ecuador (USFQ), and Tecnológico de Monterrey Campus Toluca (ITESM) were simultaneously implemented. Table 1 summarizes the information about the participating professors, courses, topics addressed, and the number of participating students.

Table 1: *Summary of information on the three COIL implementations between USFQ and ITESM.*

Topic	Dates	Course	Professor	Number of students
Migration	Start: October 30	Quantitative methods II. (ITESM)	Maritza Peña (ITESM)	11
	End: December 03	Learning service (USFQ)	Viviana Guerrero (USFQ)	25
Decision making	Start: September 18	Modeling in engineering by dynamic systems (ITESM)	Alan Miralrio (ITESM)	26
	End: November 16	Cognitive Psychology (USFQ)	Daniela Ziritt (USFQ)	27
Volcano modelling	Start: September 18	Computational modeling of the movement (ITESM)	Isaac Juárez (ITESM)	18
	End: October 20	Cosmos (USFQ)	Andrea Ayala (USFQ)	24

The design and implementation of each COIL collaboration were exclusively handled by the professors. There was no interaction or communication between the professors from different collaborations during these processes. At the end of the collaboration, a survey was delivered to all students from the three collaborations. The survey was conducted in Spanish and consisted of 12 closed-ended questions on a Likert scale and two open-ended questions. The survey instrument was designed to assess students' perceptions of the international COIL experience, without considering the topic studied, the courses, or the professors. The aim was to validate two general variables:

1. The sense of utility of the COIL collaboration.
2. The effectiveness of international teams.

To analyze these variables, a subset of questions was chosen. In the case of the sense of the utility of the collaboration, questions 4 and 8 of the instrument were considered:

- Question 4. How significant was it to carry out this collaboration project in an international group?
- Question 8. How much would you recommend taking a course that includes the international attribute "global classroom"?

To analyze the variable of effectiveness of international teams, closed-ended questions 9 and 10, and open-ended questions 13 and 14 were selected.

Close-ended questions 9 and 10 respectively:
- Question 9. How challenging was it for you to organize within an international team?
- Question 10. To what extent were agreements respected within your international team?

Open-ended questions 13 and 14 respectively:
- Question 13. What limitations did you find when collaborating in an international and multidisciplinary team?
- Question 14. What qualities should a student have to succeed in an international and multidisciplinary collaboration?

The analysis of the aforementioned questions was conducted using a mixed-method approach. For the quantitative aspect, descriptive and inferential statistics were employed, whereas for the qualitative aspect, traditional response classification analysis was implemented. The text analysis was performed using Voyant Tools, an open-source web environment to analyze the corpus of digital texts.

Results and Discussion

To analyze the effectiveness of the international teams we used the qualitative methodology of text analysis. The 108 student responses were analyzed through the free Voyant Tools application. Figure 1 displays the word cloud with the 25 most recurrently used words by students in response to the question "What limitations did you encounter when collaborating in an international and multidisciplinary team?" The size of the words is related to their frequency. It can be appreciated that communication and scheduling are the most frequently mentioned limitations.

In Figure 2, the network graph presented shows the strength in the occurrence of words mentioned by students in response to question 13 too. It confirms once again that if someone mentioned a communication problem, it was immediately associated with scheduling or tasks.

Note. The size of the words is related to their frequency.

Figure 1: *Word cloud with the 25 most mentioned words in response to question 13.*
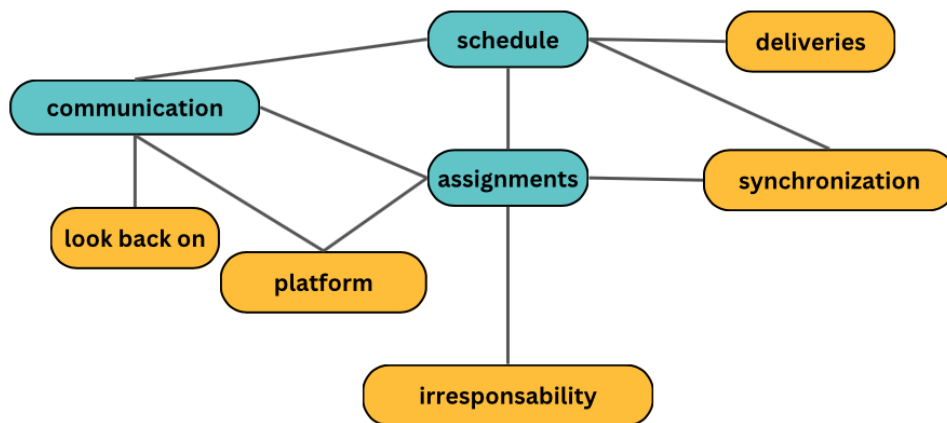
Figure 2: *Network graph displaying the strength of the relationship between words, derived from students' responses to question 13.*

On the other hand, question 14 was analyzed and peer-ranked using traditional qualitative methodology. The authors decided to classify these responses into 4 groups of qualities: academic, personal, social, and emotional (OECD, 2020).

Academic qualities include those related to cognitive abilities, knowledge, and academic performance. Personal qualities refer to motivation, attitude, responsibility, perseverance, and autonomy. Social qualities include communication skills, teamwork, leadership, empathy, and respect. Finally, emotional qualities include self-esteem, self-control, resilience, and emotional well-being. Figure 3 summarizes the results of this classification in terms of a bar graph, where it can be seen that students consider personal qualities to be the most valuable tool for success in a COIL course (OECD, 2020). Thus, personal characteristics, such as attitude and responsibility, surpass social and even academic ones. It is pertinent to mention that all the groups were formed randomly, without any previous personality or attitude test.
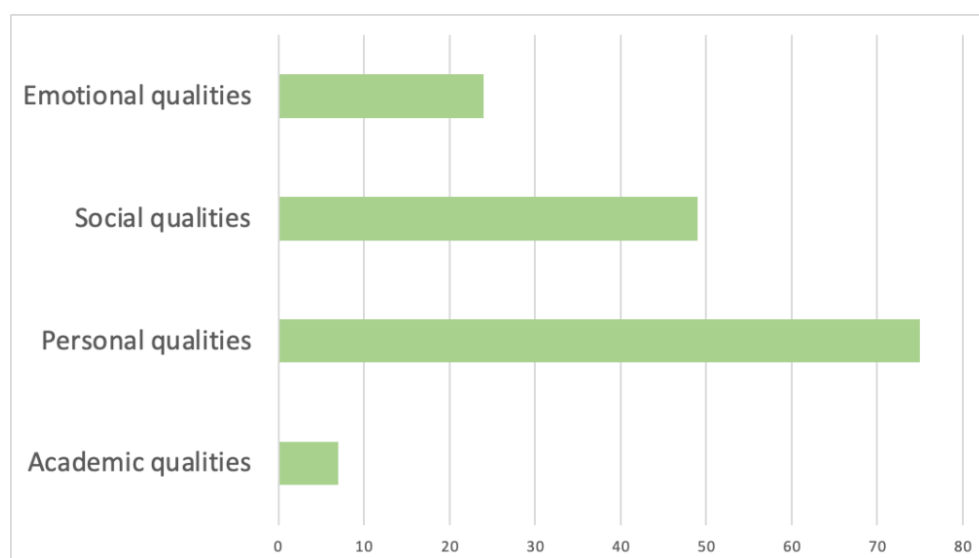
Note. Responses are categorized into academic, personal, social, and emotional qualities.

Figure 3: *Classification of students' responses to the question 14.*

Relating the answers given by the students to questions 9 and 10 contributes to the analysis of the variable effectiveness of international teams. Consequently, a cross-check was made to

find out if in the teams where there was difficulty in organizing themselves, as well as how much of the agreements made by the members were respected. The resultant Sankey diagram, plotted in Figure 4, shows the relationship between the answers to the questions "How difficult was it for you to organize yourself in an international work team?" and "How well were the agreements in your international work team respected?". As can be seen, there is no clear relationship between self-organization and the accomplishments of the agreements within the group. However, it is noticeable that personal qualities are perceived as the most notable ones to produce a successful collaboration.
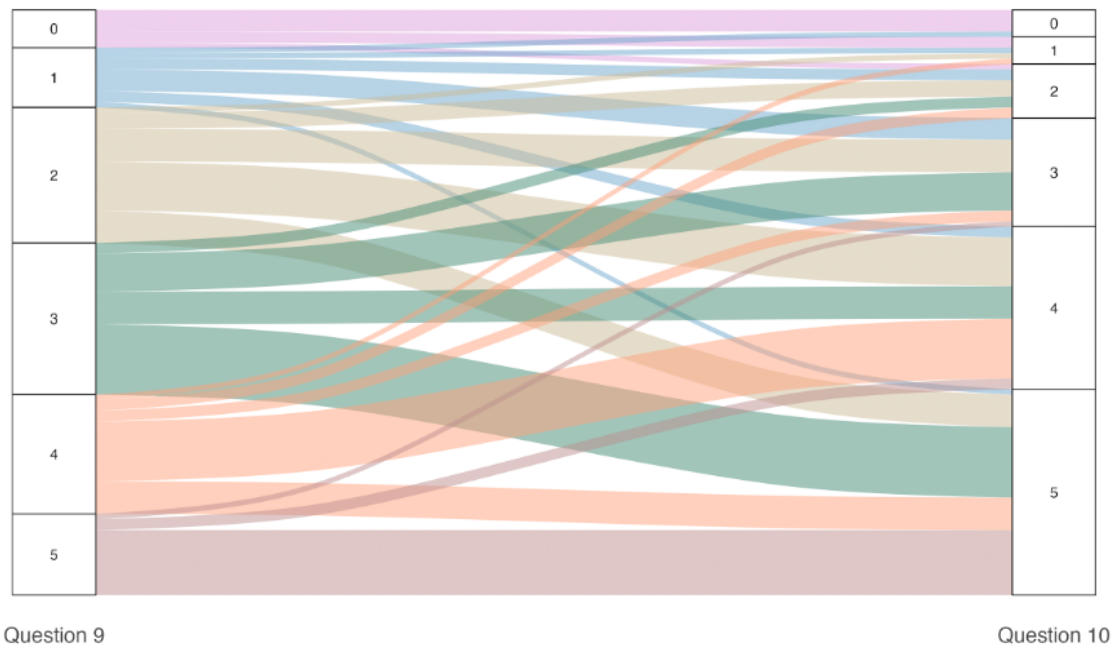

Note. Line width is proportional to the importance of the relationship between responses.

Figure 4: *Sankey Diagram, illustrating the relationship between responses to questions 9 and 10.*

For the variable sense of usefulness of international collaboration COIL, questions 4 and 8 were analyzed, which are, respectively: How meaningful was it to carry out this collaborative project in an international group? And How much would you recommend taking a subject that contains the attribute international global classroom? However, there is a potential hidden variable that can be taken into consideration, gender. For this purpose, a hypothesis test was carried out to find a relationship between the sense of usefulness of the project and the student's gender.

Table 2: *Organized data from student responses to question 4.*

Gender	Level of sense of usefulness					
-	0	1	2	3	4	5
H	1	3	5	20	13	16
M	2	4	2	7	21	14

Table 2 shows the organized data for question 4 concerning student gender and the level of sense of usefulness. In contrast, matrix A contains the observed frequencies of the relationship between question 4 and students' gender, and matrix B the expected frequencies. In the current case, the level of significance was assumed as 5 %. The null and alternative

hypotheses are stated as follows: H_0 = There is no relationship between gender and the level of significance of the COIL project, whereas H_1 = Gender and the level of significance of the COIL project are related.

$$A = \begin{bmatrix} 1 & 3 & 5 & 20 & 13 & 16 \\ 2 & 4 & 2 & 7 & 21 & 14 \end{bmatrix}$$

$$B = \begin{bmatrix} 1.61 & 3.75 & 3.75 & 14.5 & 18.25 & 16.11 \\ 1.39 & 3.24 & 3.24 & 12.5 & 15.74 & 13.88 \end{bmatrix}$$

The Pearson's chi-square was computed as follows:

$$\chi^2 = \Sigma (f_0 - f_e)^2 / f_e \tag{1}$$

Where f_0 are the observed frequencies, and f_e the expected ones.

Consequently, the chi-square statistic is obtained as $\chi^2 = 9.72$. Besides, the critical value of the chi-square distribution χ_c^2, with 5 degrees of freedom, was found as 11.07. Comparing the two quantities, the calculated Chi-square statistics is lower than the test statistic, so it is affirmed that there is statistical evidence to affirm that we do not reject H_0. This means that there is no relationship between gender and the significance level of the COIL project. Therefore, the analysis of the relationship in questions 4 and 8 should be performed without considering the gender of the students.

Finally, Figure 5 shows the Sankey diagram relative to the ratio of students for whom the COIL implementation was significant and their willingness to recommend it. For the vast majority, it was significant, but the range of students who would recommend it is greater. It is noticeable that students attributing the highest meaning to international collaborations are also those with the highest tendency to recommend it. Thus, designing highly significant COIL experiences is a way to promote virtual international collaborations.
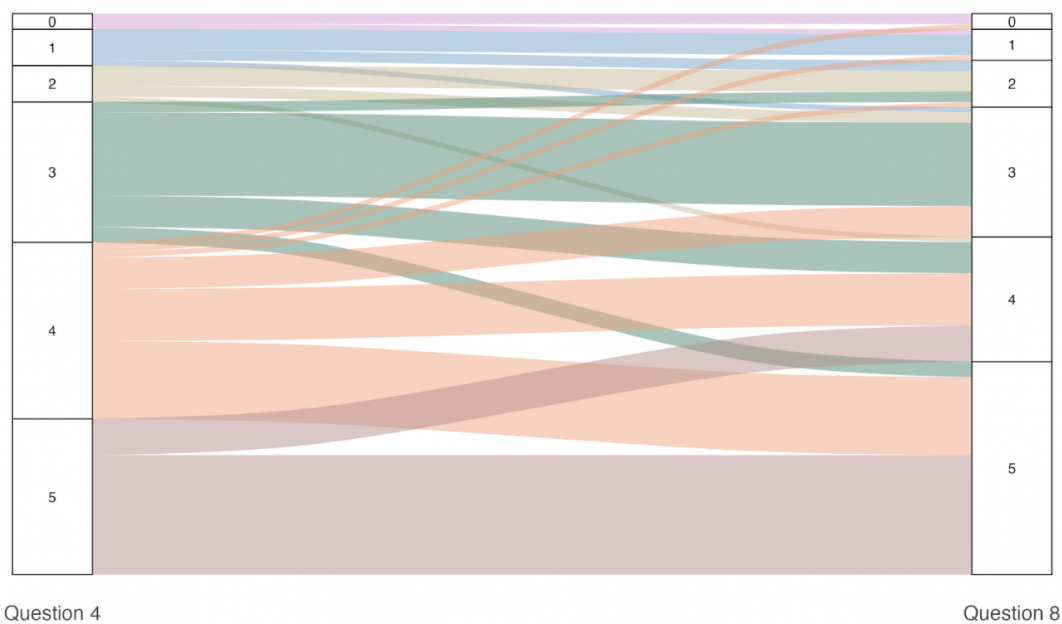

Question 4

Question 8

Note. Line width is proportional to the importance of the relationship between responses.

Figure 5: *Sankey Diagram, illustrating the relationship between responses to questions 4 and 8.*

Conclusions

Three COIL experiences, at the higher education level, were carried out by the collaboration of pairs of professors from the Ecuadorian Universidad San Francisco de Quito and the Mexican Tecnologico de Monterrey. These implementations were reported and analyzed in terms of two variables, related to the sense of usefulness and effectiveness of the international collaboration. The impact of the international collaborations, in the aforementioned variables, was evaluated through a mixed methodology, by the analysis of the student's responses to open-ended and close-ended questions in a written survey. According to the students, the most important limitations, in the case of an international and multidisciplinary collaboration, are the communication among participants as well as the scheduling. It is important to note that there is only an hour of difference between the Mexican and Ecuadorian time zones. Through a network graph, it is highlighted that communication and scheduling problems were related to the performance of the tasks and assignments required. Besides, personal qualities were identified as those crucial to succeed in the COIL experience. These qualities include motivation, attitude, responsibility, perseverance, and autonomy. Thus, personal attributes are perceived as more important than emotional, social, and even academic ones. Through the chi-squared tests, it was determined that gender is not related to the sense of usefulness of the collaboration. In addition, for the majority of the students, the COIL collaboration was significant as well as they recommended it in a greater extent.

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