

Increasing proximities and reducing distances through COIL Virtual Exchanges¹

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ABSTRACT

The Collaborative Online International Learning (COIL) teaching and learning methodology has gained increased recognition as a nuanced form of virtual exchange, especially in the last five years in South Africa and during the Coronavirus-2019 global pandemic era. COIL serves to connect local and global entities as strategic partnerships are developed between higher education institutions in different countries. An important condition for its successful implementation to achieve targeted learning outcomes is the active involvement, creativity, and collaboration of disciplinary teams. These teams address the epistemological (knowing), ontological (self-identity) and praxis (action) elements of the curriculum. Drawing from Boschma's dimensions of proximity, this paper uses a concurrent nested mixed methods research approach to explicate how the integration of COIL into the curriculum increases cognitive and social proximities while reducing geographical distances among students. This integration facilitates their access to and acquisition of various digital and research literacies, in addition to cognitive, functional, and social competencies.

Keywords: Boschma proximity dimensions, COIL, team-based collaborative learning, virtual exchange

BACKGROUND AND CONTEXT OF THE STUDY

As part of their mandate, universities face increasing pressure to transform curricula through internationalisation and virtual exchanges to create awareness and holistically prepare students for a globalised society and knowledge economy. This pressure escalated to higher levels during the Coronavirus-2019 (COVID-19) pandemic, when teaching and learning methodologies were strategically and creatively transformed to accommodate remote pedagogical and assessment practices. A notable example of one such transformation, especially in promoting scholarship and creative inquiry to facilitate students' awareness of the interdisciplinary nature of learning while enabling them to constructively acquire skills, abilities and dispositions, is Collaborative Online International Learning (COIL).

Coined by Jon Rubin in 2006, COIL is a bilateral exchange and associated pedagogy situated in a virtual exchange space. This innovative method facilitates the connection of two or more classes of similar course content in different countries, providing students with opportunities for intercultural and transnational learning (Rubin, 2017; Rubin & Guth, 2023). Once connected, faculty partners from geographically diverse universities co-develop a shared syllabus mediated by the relevant technology.

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This is typified as a dual/hybrid COIL model whereby student groups regularly engage in face-to-face meetings with their instructors, while the larger group collaborates online on specific assignments and shared productions (Jayendira et al., 2020). While there is no universally defined COIL methodology, a defining characteristic is the comprehensive integration of planned online activities and tasks into students' classwork. This integration aims to foster collaborative and constructive learning, enhancing cognitive (knowledge), functional (interpersonal and intercultural skills), and social competencies. It is also an intentional approach to training students to make informed decisions beyond the confines of their national institutional, linguistic, cultural, and disciplinary networks.

In 2014, the Durban University of Technology (DUT) was the first African university to join the State University of New York (SUNY) COIL Consortium (Samuels et al., 2023). In fact, in 2016 the author was the first pioneering academic at DUT to adopt this low-cost form of international activity within a virtual space. Notably, amid discussions on addressing South Africa's social capital inequalities, coupled with historical imbalances and inequities in access to and outcomes of traditional student mobility, COIL virtual exchange (VE) potentially promotes equity and active participation among all enrolled students (Rubin & Guth, 2023). Through meaningful international and intercultural experiences, COIL can contribute to bridging gaps and ensuring quality teaching approaches are accessible to students, irrespective of their social and cultural backgrounds (Naicker et al., 2022). The impetus of these objectives is gaining traction through the EU-funded Erasmus iKudu project, where 10 higher education institutions, five in South Africa and five in Europe, are intentionally structuring COIL across the curriculum. The project is also setting up North-South partnerships to foster cultural understanding and cultivate skills that enable individuals to thrive in a multicultural and interconnected world (DeWinter & Klamer, 2021).

Additionally, advocates of COIL contend that its integration into the curriculum serves more than a mere equalizer. They argue that it is a catalyst for students to develop basic research literacy and digital literacy skills (Hackett et al., 2023; Jie & Pearlman, 2018; Lenkaitis et al., 2019). The reported benefits also include the promotion of global identity, intercultural and diversity awareness, collaborative problem-solving, and the application of real-world and globally relevant problems and solutions. For instance, the inquiry-based activities in various COIL projects described in this paper prompt students to think critically about the challenges they encounter in COIL virtual exchanges. These activities involve scoping and reading relevant literature, interpreting, evaluating, and summarizing key findings, creatively presenting work via ePosters supported by appropriate technology, and publishing findings using various social networking sites. The aforementioned purposeful activities accord well with the high-impact practices (HIPs) identified by Kuh (2008), particularly collaborative team-based assignments and undergraduate research. Notwithstanding this, COIL projects that actively contribute to the sustainable development goals (SDGs) and underscore the aforementioned benefits align with employers' expectations for graduates, particularly their capacity to navigate a rapidly transforming globalised, technologized, and digitalised economy.

This article aims to enhance the existing literature on COIL VEs by delving into three projects involving partners from the global South (South Africa - SA), global north (United States of America - USA), and Brazil. The objective is to empirically assess how distinct forms of proximity either facilitate or impede collaboration and the acquisition of diverse competencies within COIL VEs.

The principal question leading this study is: To what extent do various forms of proximities facilitate or impede collaboration, as well as the development of cognitive, functional, and social competencies among students dispersed across diverse global contexts?

UNDERSTANDING PROXIMITY IN COIL VIRTUAL EXCHANGES

Boschma's (2005) typology of proximity dimensions provides a suitable conceptual and analytical lens to understand and assess the key factors that interactively shape the exchange of knowledge and learning during collaboration. He argued that the interplay between geographical, cognitive, social, organizational, and institutional dimensions of proximities profoundly influences the outcomes of collaboration. Proximity along each of these dimensions facilitates interaction, which is characterized by differences in the physical distance (geographical dimension); the extent of similarity in knowledge bases (cognitive dimension); the degree of common ownership required to protect the intellectual property of the knowledge created (organisational dimension); the strength of social (*personal*) embeddedness of collaboration (social dimension); and the extent of shared informal (*norms and habits*) and formal rules and laws under the same academic incentive structure (institutional dimension) (Hansen, 2014; Boschma, 2005; Broekel & Boschma, 2012).

Some key insights garnered from studies revealed that as a condition for geographical proximity to stimulate and facilitate processes of learning and innovation during collaboration, partners need to have synergies between their knowledge (cognitive proximity) and be able to interpret or absorb the knowledge exchanged (Davids & Frenken, 2018; Werker & Ooms, 2020; Hautala & Schmidt, 2019). The earlier work of Broekel & Boschma (2012) posited that to enable optimal levels of cognitive proximity there must be some cognitive distance to stimulate new ideas. Cognitive proximity is further enriched when collaborating partners are socially embedded, i.e., they have trust, are being and behaving respectfully and collegially, and are personally and professionally invested in a community of scholarship and practice (Broekel & Boschma, 2012). In fact, Vahed & Rodriguez (2019, 2021) demonstrated that former partners can reciprocally exchange knowledge more frequently as their social proximity from their past interactions generated the required level of mutual trust and respect. Moreover, the length of their sustained engagement in designing and developing several COIL modules made them familiar with each other's institutional contexts (organisational and institutional dimensions). This is consistent with the emphasis on faculty and student partners using other kinds of proximity to stimulate geographical proximity in order to effectively collaborate virtually (Hansen, 2014; Boschma, 2005; Broekel & Boschma, 2012; Hautala & Schmidt, 2019).

As alluded to above, faculty collaboration, project facilitation, and peer assessment are critical in addressing the institutional and organisational distance challenges that are pervasive in COIL virtual exchanges. These include but are not limited to managing and aligning the variances in semester sequences, curriculum goals, educational resources and institutional cultures/values/norms, which impact the overall quality of COIL virtual exchanges (Cifuentes & Shih, 2001; Ambrose et al., 2017; Jayendira et al., 2020). Apart from the culturally diverse student populations who are either English second or third language speakers, it is also strongly recommended that faculty partners conduct pre-COIL training sessions (Marcillo-Gómez & Desilus, 2016; Hautala & Schmidt, 2019; King de Ramirez, 2021). The objectives of these sessions are to initiate cultural awareness and sensitivity through structured cultural engagements, nurture positive learning attitudes and enthusiasm for international collaboration, and to enable students to navigate the learning management system of partner institutions. Further objectives are to create an awareness of the technologies available and invoke a culture and process that encourage trust building, and behaving responsibly, respectfully, and confidently, especially during team activities.

Drawing on a range of scholarly articles, another frequently cited hallmark of collaborative learning is teamwork, which is the process of learning through which a problem is solved (Hurst & Thomas, 2008; Suarez & Michalska Haduch, 2020; Lenkaitis et al., 2019). There is compelling evidence in the higher education literature on teamwork underpinning inquiry-based collaborative approaches to learning, which respond to employers' demand for 21st century graduates. For instance, Luna Scott (2015a, 2015b) explained that collaborative learning prepares students for real-life social and employment

situations, exposes them to differing viewpoints and diverse backgrounds, and leads them to higher levels of discussion and debate. Following this understanding, Appiah-Kubi and Annan (2020) elaborated that for team members to learn collaboratively online, a climate of respect must be cultivated where each member steps up and is accountable for their task, which contributes to the common project goal. Arguably, collaborative learning supports a constructivist pedagogy as students engage in meaningful inquiry- and problem-based learning with their peers, where new concepts learned are integrated with their existing knowledge and skills (Vahed et al., 2019; Ashwin et al., 2020).

Equally important, to invoke fresh perspectives and advance creativity in their case studies, international student teams need to be comfortable with collaborating at a distance (Luna Scott, 2015a; Suarez & Michalska Haduch, 2020). Several studies have postulated that cognitive proximity between geographically dispersed students increases when learning is supported by the appropriate technology (Vahed et al., 2019; Hautala & Schmidt, 2019; Anderson, 2008). These technologies empower students to co-create, share disciplinary knowledge, and collaboratively learn synchronously and/or asynchronously. This reiterates Northedge and McArthur's (2009) earlier arguments that instructors need to be adept at creating states of intersubjectivity, i.e. where two or more people participate in an activity of mutual meaning-making.

Technologies Strengthening Intersubjectivity and Proximities between Globally Distributed Partners

Research literature prominently documents how the various online collaboration technologies drive transformation and enable multi-professional teams to collaborate synchronously and asynchronously (Ceo-DiFrancesco & Bender-Slack, 2016; Niu, 2019; Liu, 2023; Carpenter et al., 2020). Proponents have argued that a technology-enhanced COIL course generally involves instructors and students using online collaboration tools existing on partner campuses or freely available to conduct synchronous video conferencing (e.g. Skype) during face-to-face sessions (Jie & Pearlman, 2018; King de Ramirez, 2021; Villar-Onrubia & Rajpal, 2016). As illustrated in Table 1, varied learning management systems, multimedia presentation tools, instant messaging applications, and social networking sites provide options for communicating asynchronously and outside of scheduled class time. These technologies mitigate the challenges related to time zone differences and encourage sustained collaboration while cultivating a virtual learning community of COIL scholars.

Table 1:
Overview of COIL Virtual Exchanges

Year	2020	2019	2018
COIL Project	Green Dentistry: Incorporating Sustainability and Conservation Concepts into Clinical and Laboratory Dental Practices.	Green Dentistry: Incorporating Sustainability and Conservation Concepts into Clinical and Laboratory Dental Practices.	The 4ps of Digital Business Practices in Dental Technology.
Duration (Date)	9 weeks: 2 October – 27 November 2020.	8 weeks: 27 February - 30 April 2019	5-weeks: 5 September - 5 October 2018
Collaborating Institutions (Country & Programme)	<ul style="list-style-type: none"> Durban University of Technology (<i>DUT, SA</i>) – Dental Technology Programme. Federal University of Pernambuco (<i>UFPE, Brazil</i>) – Dentistry. 	<ul style="list-style-type: none"> Durban University of Technology (<i>DUT, SA</i>) – Dental Technology Programme Monroe Community College (<i>MCC, USA</i>) – Dental Assisting Programme Federal University of Pernambuco (<i>UFPE, Brazil</i>) – Dentistry. 	<ul style="list-style-type: none"> Durban University of Technology (<i>DUT, SA</i>) – Dental Technology Programme Nassau Community College (<i>NCC, USA</i>) – Business Administration Programme
Participating Students	<ul style="list-style-type: none"> DUT: 2nd Year National Diploma in Dental Technology (n=23). UFPE: 4th and 5th Year Dentistry (n=10). 	<ul style="list-style-type: none"> DUT: 4th Year Bachelor of Dental Technology (n=10). MCC: 1st Year Dental Assisting (n= 7). UFPE: 4th and 5th Year Dentistry (n=10). 	<ul style="list-style-type: none"> DUT: 2nd Year National Diploma of Dental Technology (n=14). NCC: 1st Year Business Management (n=21).
Technologies Used	UFPE Moodle Learning Management System (LMS); Skype; WhatsApp; Facebook; ePosters; and Instagram.	UFPE LMS; WhatsApp; Facebook; ePosters; and Skype.	NCC Blackboard LMS; WhatsApp; Facebook; Voice Thread; and Skype.
Description Of Inquiry-Based Activities	<p>Case-based scenario: Investigate sustainability protocols that will reduce the environmental impact of dental and laboratory practices by considering the four 'Rs' of <i>Reduce, Reuse, Recycle and Rethink</i> with regards to:</p> <ol style="list-style-type: none"> Water and energy conservation. Use of non-toxic versus toxic products/materials. 		<p>Business Plan: Students are to:</p> <ul style="list-style-type: none"> Discuss the different perspectives and worldviews in connecting the 4Ps of Business Practice (<i>Product, Place, Promotion and Price</i>) and the 4Ps of

	<ol style="list-style-type: none"> 3. Eco-friendly infection control practices. 4. Waste Management and reduction of pollution. 5. Technology innovations and integrative practice. 6. Ergonomics. 	<p>Dental Technology, which is to be <i>patient</i> and <i>passionate</i> in <i>persevering</i> to produce <i>precision</i>-made appliances.</p> <ul style="list-style-type: none"> ➤ Identify the target market in order to complete the business plan. ➤ Develop a prototype to reduce material wastage in dental laboratories. 	
<p>Learning Outcomes</p>	<ul style="list-style-type: none"> ▪ Four-minute Videos and inquiry-based activities were shared via Facebook. ▪ e-Posters ▪ Infection Control Protocols published on Instagram. ▪ Reflective Report using Gibbs Model. 	<ul style="list-style-type: none"> ▪ Four-minute Videos and inquiry-based activities were shared via Facebook. ▪ ePosters ▪ Reflective Report using Gibbs Model. 	<ul style="list-style-type: none"> ▪ Two-minute Videos were done via Voice Thread. ▪ Inquiry-based activities were shared via Facebook. ▪ Completion of a Business Plan.

In addition, the technologies outlined in Table 1 support 'social constructivist forms of participation by allowing comments and annotations by others, and by sharing resources' (Luna Scott, 2015b: 4). Subsequently, student-content, student-instructor, and student-student online interactions transpire (Anderson, 2008). For students to effectively engage with the case-based scenario and business proposal detailed in Table 1, they need to engage with each other (for example, having a shared understanding of the content of the ePosters through team discussions; peer-evaluation of the two- or four-minute videos), as well with the instructor (for example, teams discussing the formative feedback received from instructors on various tasks) throughout the duration of the COIL course/module. These examples accord with the earlier notion of creating states of intersubjectivity for students to work alongside the instructor or other students, especially when they are geographically distant.

Ultimately, the quality of learning in a dual/hybrid COIL model depends on course content and design, pedagogical practices sustained by technical and technological support, and having adequate infrastructure, which partner instructors from the participating institutions considered from the outset. Moreover, it is worth noting that prior to implementing their COIL VE projects, partners from the participating institutions mentioned in Table 1 actively engaged in an eight-week 'COIL Academy' with SUNY in 2016 and 2017 to scale up their COIL-enhanced modules and be part of a community of 'COILers' (Rubin, 2017). During this time, they intensely collaborated on defining learning outcomes, co-designing tasks and sequences, and co-crafting course syllabi. To ensure the students' COIL projects meet the shared expectations for quality and to encourage equitable contributions and fairness in various activities and tasks, their collaboration also extended beyond the Academy. This was facilitated through frequent Skype discussions across different time zones. Resonating with Rubin (2017), it became clearer from these engagements that the technology is to align with the specific task at hand. Disregarding this and crafting tasks exclusively to fit predetermined tools are bound to impede students from achieving their productivity goals, which introduces cognitive distance (Vahed et al., 2023).

RESEARCH DESIGN AND METHODOLOGY

Following the paradigm of pragmatism, a case study research design within a concurrent nested mixed methods research framework was used to examine the various forms of proximities between student partners who were geographically dispersed during COIL. Chadderton and Torrance (2011: 53) elaborated that the strength of using a case study approach to research is 'to engage with and report the complexity of the social and educational activity, in order to represent the meanings that individual social actors bring to those settings'. This aligns with Creswell and Plano-Clark's (2011) arguments that pragmatists do not see the world as an absolute unit, but are driven to use multiple methods as knowledge, and perceptions of the world are created from socially shared experiences. Ethical approval to conduct the research was granted by the Durban University of Technology (DUT) Institutional Research Ethics Committee (REC 33/18), Monroe Community College (MCC) Institutional Review Board, and Federal University of Pernambuco (UFPE) Dentistry School (IVE-148). The sample population was purposively selected and included 2020 (n=35), 2019 (n=27), and 2018 (n=33) students from the participating institutions outlined in Table 1. Written consent was received from all participating students.

In terms of institutional distance (Boschma, 2005), it must be noted that the semester structure and times differs between the global North (MCC and NCC), global South (DUT), and Brazil (UFPE) universities. The Dental Technology programme annually commenced in February as opposed to the Dental Assisting (MCC), Business Management (NCC), and Dentistry (UFPE) programmes commencing in August (Fall Semester). Given these differences, the instructors included ice-breaker tasks, which also introduced the cultural component that extended beyond 2-3 weeks, taking note that the DUT instructor introduced this as part of her pre-COIL training sessions. The DUT students, therefore, engaged in ice-breaker activities for weeks 2, 3, and 4 in 2018, 2019, and 2020, respectively. It must also be noted the NCC instructor continued with the teaching of the business management module concurrent with the COIL module.

Data Collection, Data Analysis, Validity & Reliability (Trustworthiness)

For the predominant quantitative phase, students completed an anonymised descriptive questionnaire, which consisted of four sections: Section A collected students' demographic details; Sections B and C assessed students' use of technology and online tools, respectively; and Section D used a 5-point Likert scale (5 = strongly agree and 1 = strongly disagree) to capture students' opinions about their COIL virtual experiences. The questions in Section D were adapted, with permission, from the post-COIL project survey developed by the Global Learning Experience (GLE) team at DePaul University (email communication with Rosita Leon, Assistant Director on 11 April 2018 – DePaul University survey). Descriptive (univariate and bivariate analysis) and inferential (Chi-Square) statistics were used to analyse the data with $p < 0.05$ set as statistically significant (SPSS-Version 26®). Factor Analysis was performed for data obtained from the Likert Scale to identify underlying variables/factors and explain the pattern of correlations within a set of observed variables. Content validity was used to ensure the questionnaire focused on concepts and constructs that emerged from the literature review on online learning. The internal consistency of the survey was assessed through Cronbach's alpha.

For the secondary or nested qualitative phase, students' responses to the three open-ended questions, which focused on content delivery, project implementation, and use of technology, together with their reflective reports ($n=30$) were used to augment the quantitative phase. The data were thematically analysed and followed the two-level coding principles advocated by Punch (2014). Low inference codes were used to summarise segments of the data for level one. In pulling the data together into smaller meaningful units, higher-order conceptual codes (themes) were used for level two. In addition to the author being immersed in the data, and reading it multiple times, elicitation materials such as Moodle and Blackboard discussion threads together with WhatsApp asynchronous communication messages, and debriefing sessions between instructors maintained the trustworthiness of the data (Creswell, 2014).

DISCUSSION OF THE FINDINGS

Predominant Quantitative Phase: Demographics, and students use of technology and online tools

In 2020, 2019, and 2018 the questionnaire response rate was 76% ($n=25$); 67% ($n=18$); 80% ($n=28$), respectively. Although a higher number of females ($n=49$) than males ($n=22$) participated in this study, no significant differences were noted for gender per year ($p=0.849$). More than 60% of the students were in the 21 – 29 age group, which corresponds with the expected age group of the 5th/6th year Dentistry and 4th year Dental Technology students. In contrast to 58% of students in 2018 and 53.5% in 2020, 88.9% of the 2019 students declared that it was their first time participating in an online module. Across all years more than 75% of students conveyed that they use social networks every day citing Facebook, Instagram, and WhatsApp as the top three technologies (Table 2). In fact, more than 60% of students across all years confirmed using WhatsApp to communicate synchronously.

Table 2:

Social Networking Sites Commonly Used by Students

Social Networks	2018	2019	2020
Facebook	60.0%	55.6%	56.4%
Instagram	84.0%	72.2%	71.4%
WhatsApp	56.0%	66.7%	64.3%

Despite a high percentage of the students in 2020 (78.6%) and 2019 (94.5%) agreeing to have been prepared for the technology aspects of COIL, more than 68% of the 2018 students disagreed. Qualitative feedback from the open-ended statements corroborates this as the students declared that 'the connection between the students did not start early' nor did they receive the relevant training with the

various technologies, which resulted in them experiencing endless 'difficulties to upload videos'. Unfortunately, what appears to have happened is that the inadequate preparation at an institutional/instructional level reduced the cognitive and social proximities between students with a fair percentage of DUT students perceiving NCC students as being apathetic. This limitation seems to have perpetuated throughout the 2018 COIL module with a fair number of NCC students (>50%) proposing the following:

I think this project should be presented at the end of the school year when we have all the knowledge on marketing.

...it should be done after a while in the semester when we at least have learnt most of our business course.

Learning the marketing component before starting the project would be easier.

Don't do it at the beginning of the semester. Do it more towards the end.

Do the project towards the middle or end of the semester.

The above recommendations clearly point to the NCC students not having sufficient discipline-specific knowledge, which suggests that a state of intersubjectivity was lacking (Northedge & McArthur, 2009). This was acknowledged by the NCC instructor during the debriefing session with the DUT instructor post-COIL. The DUT and NCC instructors also identified other areas needing improvement to increase cognitive and social proximities between student partners such as:

- A COIL module must never be initiated at the beginning of the semester as the number of students enrolled on the course does not stabilise until after the third week of the term.
- Undergraduate students, especially at lower levels, should be familiar with, or at least have some knowledge of the discipline-specific component of COIL before its commencement.
- The COIL module should be a gradable component of a module/subject.
- Pre-COIL training sessions must be conducted to afford students the reported benefits of such sessions.

Cognizance of the above was considered in the planning of the 2020 and 2019 COIL VEs.

The reliability scores for the Likert scale for Question 19 in Section D of the questionnaire exceeded the recommended Cronbach's alpha value of $\alpha = 0.700$, which indicates the consistency of scoring (Table 3).

*Table 3:
Reliabilities*

Section D – Q 19 of the Questionnaire	No. of Items	Cronbach's α
I. Project Introduction and Preparation	3	0.915
II. Cultural and Diversity Competence	4	0.948
III. Impacts on Personal Behaviour	5	0.834
IV. Quality of Learning	3	0.911
V. Overall Experience & Course Quality	4	0.910

As presented in Table 4, the test results from the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO > 0.50) and Bartlett's Test of Sphericity ($p < 0.05$) indicated that the conditions to conduct factor analysis were satisfied.

Table 4:

Results from the Kaiser-Meyer-Olkin Measure of Sampling Adequacy and the Bartlett's Test of Sphericity

Section of the Questionnaire	Kaiser-Meyer-Olkin Measure of Sampling Adequacy	Bartlett's Test of Sphericity		
		Approx. Chi-Square	df	Sig
I. Project Introduction and Preparation	0.742	153.686	3	0.000
II. Cultural and Diversity Competence	0.867	290.385	6	0.000
III. Impacts on Personal Behaviour	0.790	153.140	10	0.000
IV. Quality of Learning	0.734	143.453	3	0.000
V. Overall Experience & Course Quality	0.755	239.833	6	0.000

Factor Analysis was performed for the Likert Scale data to identify underlying themes and to explain the pattern of loading within a set of observed variables (Table 5). The responses to the statements per section of the questionnaire revealed that students could see the direct link of the statements to the overall theme.

Nested Qualitative Phase

Two prevailing themes emerged: team-based collaborative learning, fostering the acquisition of cognitive, functional, and social competencies; and the co-construction of knowledge, facilitating the acquisition of research and digital literacies. These identified themes underscore the ensuing discussions in the subsequent sub-sections, delving into students' perspectives on their COIL virtual experiences. In particular, how the different forms of proximities either facilitated or impeded collaboration, as well as the development of cognitive, functional, and social competencies.

Table 5: Factor Analysis

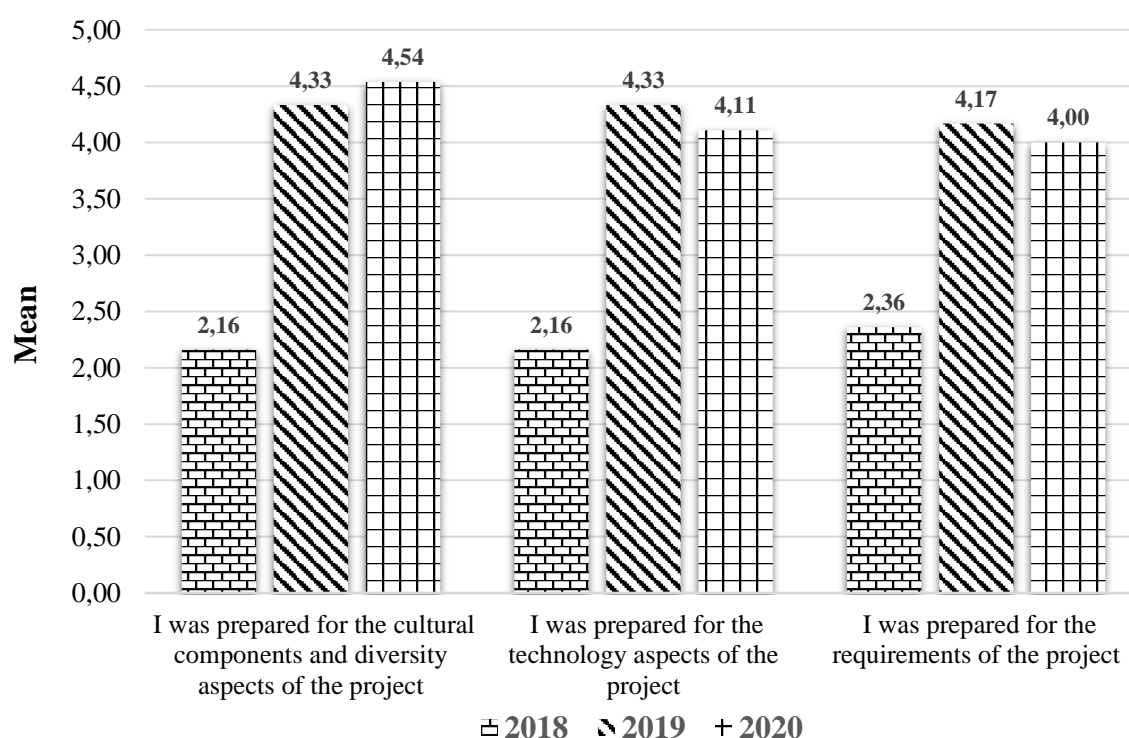
Section D of the Questionnaire: Q 19 Statements	Project Introduction & Preparation	Cultural & Diversity Competence	Impacts on Personal Behaviour	Quality of Learning	Overall Experience & Course Quality
1. I was prepared for the cultural components and diversity aspects of the project.	0.903				
2. I was prepared for the technology aspects of the project	0.932				
3. I was prepared for the requirements of the project.	0.945				

4. The COIL project introduced me to a new perspective on culture and diversity.		0.950			
5. The experience changed my perception of another cultural or diverse group.		0.948			
6. The experience introduced me to a different worldview.		0.948			
7. The experience increased my interest in further opportunities for international exchanges.		0.881			
8. The experience changed the way I behave in interpersonal and cultural encounters.			0.775		
9. The experience increased opportunities for discussion and debate outside the online class.			0.892		
10. The experience provided me with skills and knowledge that I will use in the future.			0.873		
11. I made connections with international students that I will maintain in the future.			0.455		
12. This project experience will affect my future career.			0.835		
13. Participating in the COIL project made me feel more engaged with my learning.				0.911	
14. The COIL project directly improved the quality of my learning experience in this course.				0.946	
15. I acquired the pertinent discipline knowledge required by the project case.				0.909	
16. I would recommend a course/subject that includes a COIL module to other students.					0.907
17. I would choose another course/subject that includes a COIL module.					0.788
18. Overall, the learning experience in this COIL module was positive.					0.946
19. Overall, the quality of the COIL module content contributed to a valuable learning experience.					0.902

Project Introduction and Preparation: Reducing geographical distance and strengthening institutional proximities

In terms of being prepared for the culture and diversity, and technology aspects of COIL, figure 1 depicts significant differences in the mean scores ($p < 0.001$), with higher levels of agreement observed amongst the 2020 and 2019 students (>75%). It can be gleaned from the results that invoking cultural awareness and sensitivity, and exposing students early on how to use the relevant technologies through pre-COIL training sessions reduces geographical distance and strengthens institutional proximities. These findings are consistent with Ceo-DiFrancesco and Bender-Slack (2016) and Naicker, Singh, and Van Genugten (2022).

Figure 1: Project Introduction and Preparation



Cultural and Diversity Competence: Strengthening social and cognitive proximities

Figure 2 shows significant differences in the mean scores ($p < 0.001$), with higher levels of agreement also noted for the cultural and diversity competence aspects amongst the 2020 and 2019 students (>75%). Similar to the positive outcomes experienced between the Taiwanese and American students in the reciprocal, intercultural, participatory, and peer e-learning or RIPPLE programme (Cifuentes & Shih, 2001), the cultural exchanges in this research led to shared expressions around food, music, personal philosophies of life, and information of both family and academic lives. In turn, the cognitive and social proximities amongst the geographically distant and culturally diverse students were strengthened, as evidenced by their positive remarks:

It was a supercalifragilisticexpialidocious experience meeting new people from different backgrounds...It was exciting to have the opportunity to make the video and introduce myself... I got to even know a little bit about different Brazilian cultures.

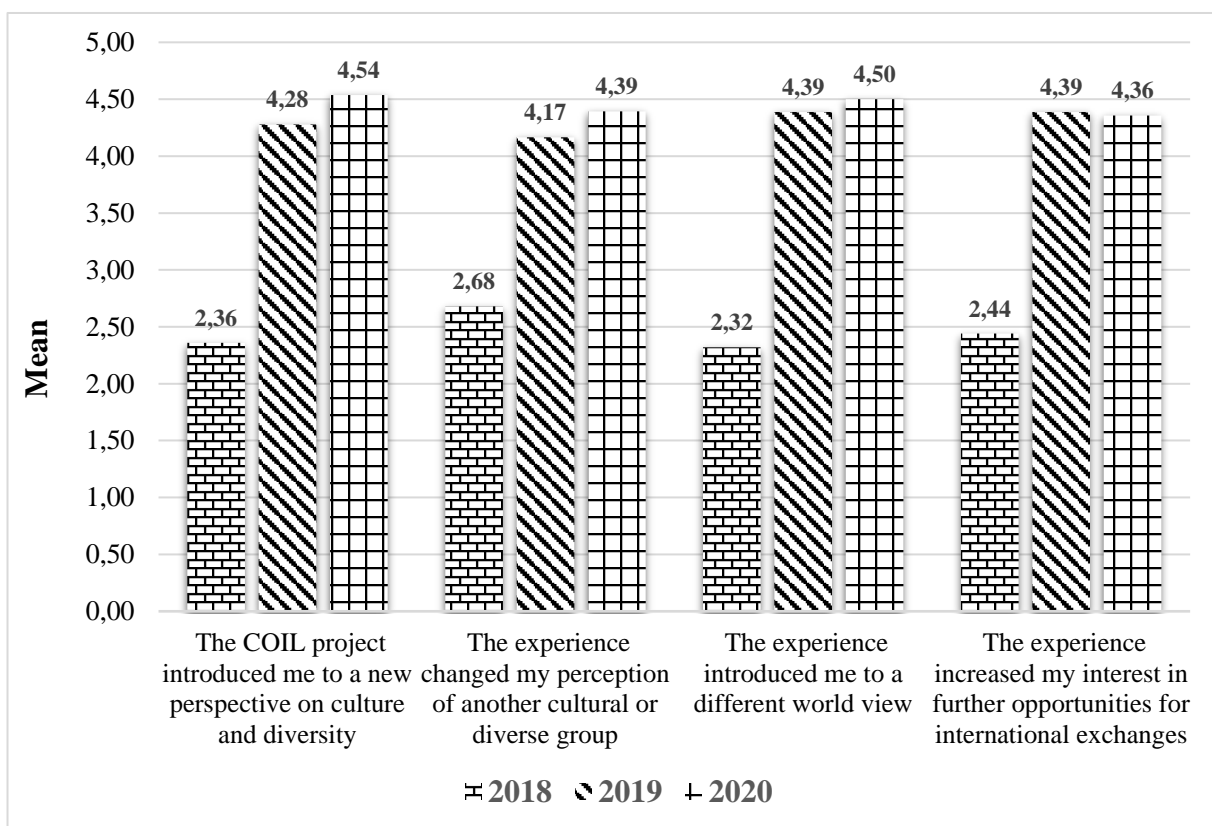
... individuals from Brazil had so much love and respect towards us as South Africans as they went all the way teach us about their cultures, values, favourite food and favourite music genres from Brazil even offering to sing for us during our video calls.

... I was able to express who I am as a young African Zulu woman through my Zulu culture and got to experience such great cultural exchange in a very creative, visual, and exciting way. I got to understand and appreciate the beauty as well as the uniqueness of our cultural diversity across our collaboration. I learnt to value and appreciate all cultures and embrace my culture without being arrogant or disregarding another's, instead embracing all our different cultures combined through our tasks of watching and commenting on each other's posts on Facebook and sharing our thoughts applauding each other and celebrating humanity in the process.

It was indeed a great learning curve that also opened a new perspective on online collaboration, in the way I view it and also taught me to engage more and enjoy each other's differences.

I learnt that having differences whether it be culturally or socially doesn't mean that a group cannot work efficiently, effectively and cohesively.

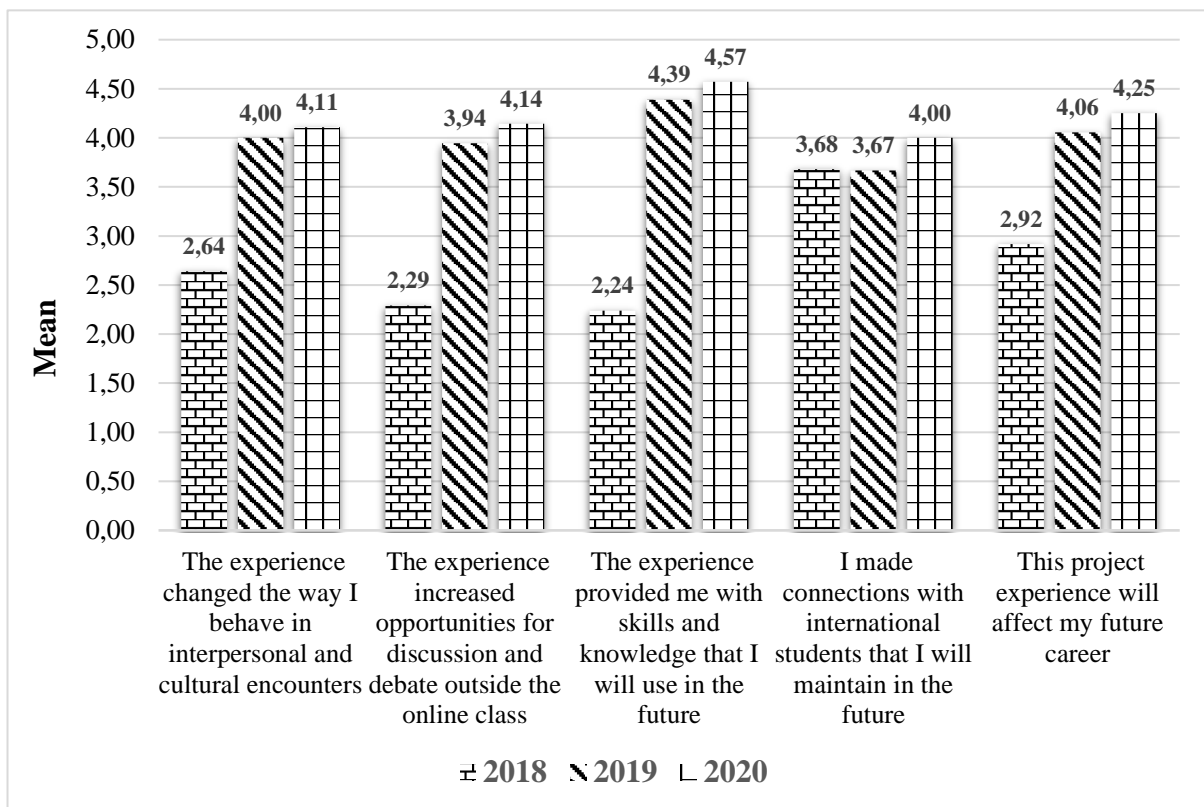
Figure 2: Cultural Diversity and Competence



Impacts on Personal Behaviour: Collective Students Agencies Mitigating Cognitive and Social Distances and Facilitates Collaborative Learning and the Acquisition of Functional and Social Skills

Apart from the statement, *I made connections with international students that I will maintain in the future* ($p = 0.214$), significant differences in the mean scoring patterns on the 'impacts on personal behaviour' were observed ($p < 0.05$) for all other statements in Figure 3.

Figure3: Impacts on Personal Behaviour



Reflective reports and the responses from open-ended statements permeated with evidence on the extent to which students valued learning about each other's culture and acquiring functional and social skills that will help to advance their careers long-term.

I believe that the goal of this collaboration which was to expose students to different cultural perspectives and develop intercultural and critical thinking skills was reached.

The collaboration has also taught me that as a person you have to be tolerant and empathetic because we all are faced with different challenges each day and that we should be able to accommodate the situations of others and find a way forward from them because at the end of the day 'umuntu ngumuntu ngabantu' (a person is a person through other people).

...I have learnt how to communicate with other people from other countries...build good relationships and share ideas.

...I have learnt how to communicate with other people from other countries...build good relationships and share ideas. It helps train us for the workplace such as learning how to share ideas, express opinions and manage time.

Even though <40% of the students reported being frustrated by the lack of communication or having to persist in establishing communication with team members to complete various tasks, this probably contributed to international student partners struggling to connect with each other (p = 0214). The 2020 and 2019 Dental Technology students expressed that

...COIL could have been better if all team members were engaged in the project and had better exploited their potential.

The project would have been enjoyable if the partners we had were as committed as us, but they were not, so it made this experience to be bad and I did not enjoy it.

I did sometimes feel as if I was alone on this project as other students from other countries did not seem as enthusiastic as I was.

Despite the frustrations experienced, the collective agencies of students within a team mitigated the non- or low participation by individual:

Even though some members did not participate nor communicate on the WhatsApp group that was created, we were able to submit on time.

A closer analysis of the qualitative feedback revealed that students' collective agency stemmed in part from their motivation and expectations of themselves to progressively advance their own personal and academic growth:

Some people were dedicated to doing the work and some never cared, however, we worked pretty fine with those who participated.

These findings are reflective of the reports from other international online courses (Suarez & Michalska Haduch, 2020; Cifuentes & Shih, 2001; Ambrose et al., 2017; Rubin & Guth, 2023; Naicker et al., 2022).

Quality of Learning: Collaboration at the Crossroads of Cognitive Proximity/Distance Divide

As presented in Figure 4, significant differences in the mean scoring patterns on the 'quality of learning' were noted ($p < 0.05$). Students' engagements ($p = 0.004$) 'facilitated idea generation and creativity' and enabled them to acquire discipline-specific knowledge ($p = 0.002$). The 2020 and 2019 students qualitatively reported that they were forced out of their comfort zones and had to 'think beyond and outside the box' in co-constructing knowledge. This entailed them critically reading and summarising scholarly articles, analysing, and collaboratively communicating their research findings with their teammates, and creatively sharing ideas in developing ePosters and Instagram posts. It can be gleaned from the students' excerpts below that in addition to acquiring cognitive (*knowledge*) and functional (*skills*) competencies (Table 6 - *excerpts in verbatim*), students further acquired knowledge and skills in research and digital literacies:

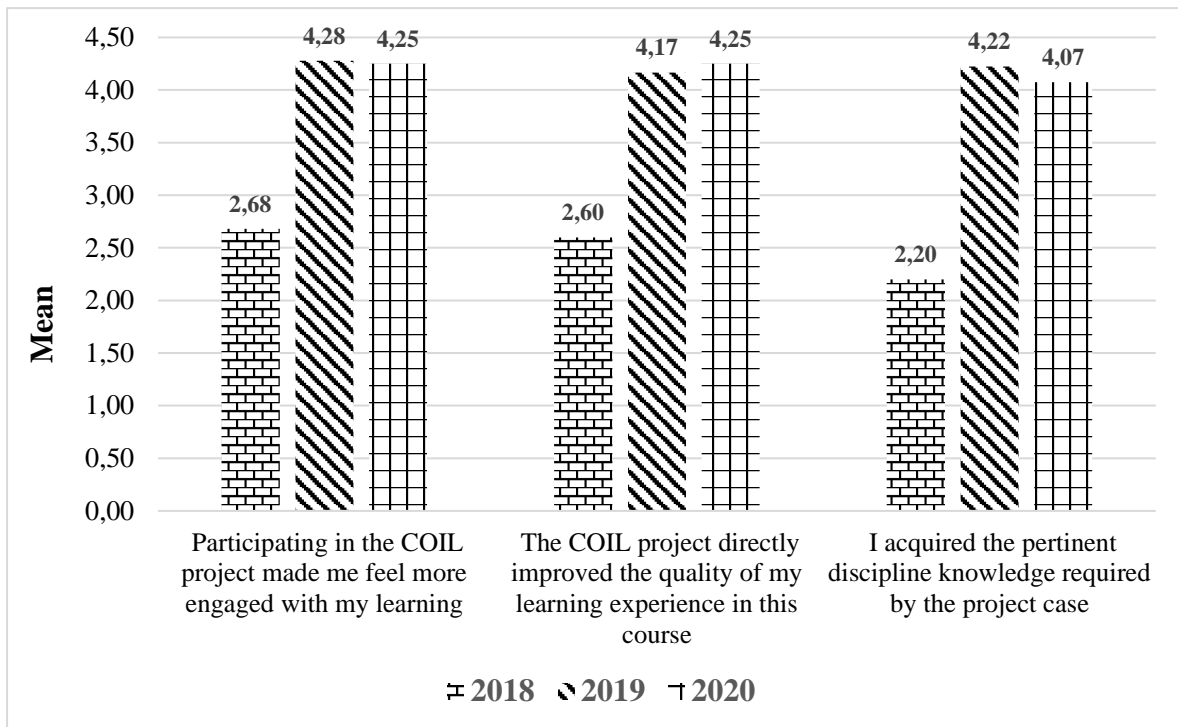
...we were required to research multiple things that we did not know such as the topics of ergonomics, how some materials are toxic in the lab and some of the clinical aspects. It was constructive to learn about them as we carried out the research.

Our activity through Instagram was very good to help us develop our creativity and at the same time made us research a lot about a specific topic.

I learned how to do an Instagram post in Module 4. My team members were very informative. I have learned to accept negative feedback and use it to help me improve my work rather than give up.

... the culmination of the whole COIL experience was when we had to be innovative in making posters and videos for the Instagram publication.

Figure 4: Quality of Learning



Despite the positive results in Figure 4, there was a cognitive distance between the different levels of undergraduate students in the 2019 COIL virtual exchange. As deduced from the qualitative feedback the 4th/5th year Dentistry and 4th year Dental Technology students possessed the know-how knowledge in doing research in comparison to the 1st year Dental Assisting students, who were perceived to be 'free-riders' during the case-based task due to their lack of communication. This influenced the way Dental Assisting students were able to exercise their agency and thus emerged as a constraint to more equal participation. In addition to mixing students within a team, instructors engaging in COIL are advised to provide their students with pre-COIL training where team dynamics, roles, and responsibilities for virtual exchanges are explained. Moreover, instructors need to be more explicit on the learning outcomes and their grading per level of study to mitigate the challenges associated with involving different levels of students.

As illustrated in Table 6, the functional competencies commonly cited included teamwork, time management, increasing confidence, improving communication, and writing skills, and being a good listener who is patient and open-minded. These attributes increased social and cognitive proximities, enhanced the co-construction of knowledge and shared meanings, and strengthened team-based collaborative learning and the quality of the outcomes, which in this case were the business reports and ePosters. Another noteworthy point is that academic instructors facilitated the co-construction of knowledge through formative feedback. The excerpts below confirm that this form of deep learning further stimulated students to collectively co-create ePosters, which was shared with the wider community via Instagram.

I was inspired to do more analysis by the low mark, went back to the drawing board with team members, and we ended up recognizing the ergonomics principle and how to report it because it was important to be able to handle the last module.

My colleagues and I realised that we had to go back to the drawing board. We arranged a private loop gathering on WhatsApp specifically to talk about the dental laboratory aspect. We

chose to redo everything. My colleagues and I decided to talk about Rapid Prototyping, Plaster trap modification and lighting systems in dental laboratories.

All four groups were able to put together a post on Instagram regarding their given topics. These posts were all very formative, creative, and educational; those that needed improvement were positively criticized and resubmitted.

The results outlined above confirm that the learning experiences of students improved ($p=0.013$), particularly in preparing them to be future-ready graduates of a globalised 21st century 'who can treat knowledge not as a nourishment that can be consumed passively, but rather a muscle that needs to be exercised to stay in top shape' (Suarez & Michalska Haduch, 2020: 333).

Overall Experience and Course Quality: Converges organisational/institutional, social, cultural, and cognitive proximities

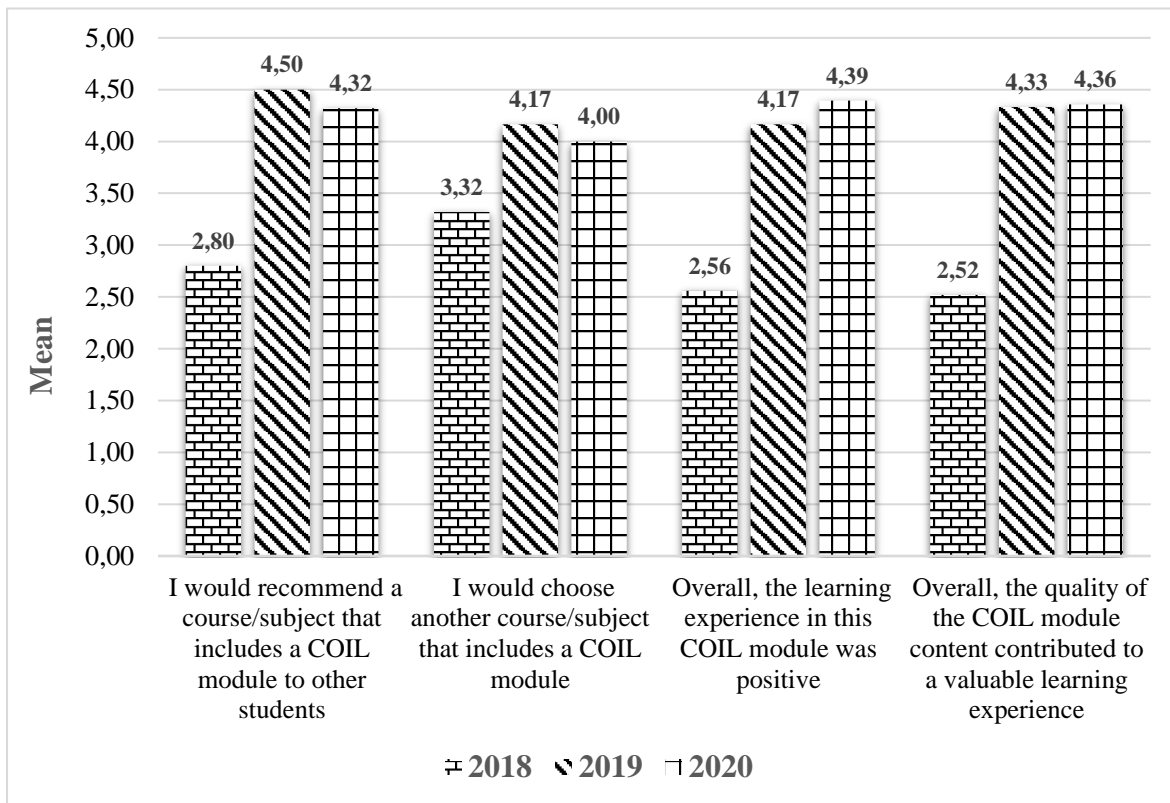
As presented in Figure 5, contrary to their recommendation that COIL be included in a course/subject ($p<0.001$), students unanimously agreed that they would not choose another course/subject that includes a COIL module ($p = 0.220$). Students' contrasting opinions above signal the early identification of instructional and institutional constraints at project planning and development stages. Consistent with Jayendira et al. (2020), Rubin and Guth (2023), and Suarez and Michalska Haduch (2020), course design and course content sustained by the relevant technologies are directly proportional to the quality of learning. It is therefore imperative that faculty attend COIL training with their partners and plan their course/module to enable organisational/institutional, social, cultural, and cognitive proximities in terms of scaffolding and structuring students' learning. The attempts made by the COIL instructors to achieve is motioned by the students statistically confirming that they had meaningful learning experiences ($p<0.001$).

Table 6: Team-based Collaborative Learning Enabled the Acquisition of Cognitive and Functional Competencies

Functional Competencies		Cognitive Competencies	
<ul style="list-style-type: none"> ▪ This collaboration has taught me patience in terms of working together as a team and being understanding and considerate of everyone's opinion. ▪ One important quality I obtained from this online collaboration was to be confident as an individual and not feel inferior. ▪ The COIL experience has taught me patience with others and to be always selfless and considerate. ▪ The coil project taught me a lot of patience and polished my teamwork skills, in the sense that I realised that our differences can greatly enhance our teamwork. ▪ COIL is a beautiful project it gives information in many aspects, it teaches discipline, respect, how to be dedicated, organizing yourself on and off the workstation and also teaches us how to be good at managing time as we collaborate with peers who 	<ul style="list-style-type: none"> ▪ How to work as a team through the project and I learned about other safety measures in the dentistry field. ▪ It helps train us for the workplace such as learning how to share ideas, express opinions and manage time. ▪ One of the great things about my group was the freedom to speak, everyone had their chance to write their ideas and we would listen to them ... my views and comments were respected and well listened to. ▪ ... helped me to be an attentive listener, in a way that I now listen to understand rather than listening to decline another person's view on certain matters. ▪ My communication and writing skills have improved because of COIL. I'm also a different person than I was a few months ago because I'm now able to talk and seek help when needed...all the knowledge, skills and empowerment I have 	<ul style="list-style-type: none"> ▪ Being part of the COIL 2020 Green Dentistry project has helped me look at my lab with a more precise eye, I now know how bad it is to waste materials including gas, gypsum products and water and how important it is to save everything possible. ▪ Green dentistry is a necessary component in the dental industry as there is a great deal of pollution and ecological damage caused by dentistry that can easily be avoided with the incorporation of a few minor "green" changes by those working in the industry. ▪ ... one group educated us on how to correctly handle monomers and the effects of not wearing protective clothing. They educated us on the risks of not wearing proper clothes which are acquiring diseases such as asthma and silicosis. ▪ ... learned a lot about the clinical aspects of dentistry 	<ul style="list-style-type: none"> ▪ ...the information learnt about green dentistry and the environment will most certainly be utilized in my future career as a dental technician and one day if I have the opportunity to own a dental laboratory of my own it will most certainly be a "green" laboratory that utilizes ideas garnered from this coil collaboration. ▪ I discovered the benefits of the digital and electronic gadgets and technologies adopted within the dentistry industry in upholding the green dentistry philosophy. ▪ The value of good posture to prevent exhaustion and other skeletal muscular disorders in ergonomics is one of the questions raised that I never knew before participating in this learning experience. It is necessary to utilize machines that will conserve water and use disposable plaster filters therefore only less water can be wasted, and reuse would

<p>are on a different time zone ...</p> <ul style="list-style-type: none"> ▪ I have improved my skills of being on group work I know how important it is to voice out your opinion even if you doubt it other teammates might be able to manipulate it and make a good point out of it basically this experience has also improved my confidence. 	<p>acquired will be very valuable for future use ...</p> <ul style="list-style-type: none"> ▪ ... taught me that time management is important and vital, and voicing out constructive criticism amongst your teammates at an appropriate time is not a bad thing. 	<p>such as how to keep the dental practice a hygienic and economically friendly environment. I also learned about other laboratory-related topics such as ergonomics that I was previously not aware of.</p>	<p>also help to minimize the expense of dental practices water bills.</p> <ul style="list-style-type: none"> ▪ The experience encouraged me to treat the laboratory facilities and equipment in an eco-friendly manner, conserving the environment while protecting myself from harmful and toxic substances.
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Figure 5: Overall Experience and Course Quality



CONCLUSION AND FUTURE DIRECTIONS

The prominent features of this study confirm that a COIL course/module that uses inquiry and problem-based learning, especially around global issues in relation to the SDGs, enables students' epistemological development in terms of acquiring pertinent discipline-specific knowledge, together with critical thinking, collaborative problem-solving, creativity and communication skills that are sought after by 21st century employers. An underpinning condition for this, however, is the ability of the instructors to carefully plan and deliver course content that is actively monitored and includes tasks that are constructively graded. This positively influences the cognitive, social, and institutional proximities between globally disparate students who can also self-regulate their learning and develop their agency in ways that are meaningful to them.

In the pursuit of internationalising and innovating the curriculum, the author has initiated COIL VEs at a Sino-foreign transnational university, which she recently joined. Apart from the benefits of COIL reported in this paper, the objective is to ensure inclusive and equitable quality education while promoting lifelong learning opportunities for all (Sustainable Development Goal: SDG4). Undoubtedly, VEs create cross- and inter-disciplinary spaces for students to acquire the cognitive, functional, and social competencies needed to address significant global issues. In bolstering the Sino-foreign transnational learning agenda, COIL, a nuanced eHigh Impact Practice (eHIP), can make a difference to education for a sustainable future.

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