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Enhancing Pharmacy Education Through Collaborative Online Integrated Learning (Coil): A Cross-Cultural Pilot Study Between Pharmacy Students Of Malaysia and The Philippines

(Meningkatkan Pendidikan Farmasi Melalui Pembelajaran Bersepadu Dalam Talian Kolaboratif (Coil): Kajian Rintis Silang Budaya Antara Pelajar Farmasi Malaysia dan Filipina)

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Abstract

Collaborative Online Integrated Learning (COIL) is a cost-effective approach to enhancing student's professional competency by exposing them to diverse cultural environments. Together with Problem-Based Learning (PBL), which engages students in active, scenario-based problem solving, this method further develops critical thinking and intercultural competence. The COVID-19 pandemic enabled COIL to be explored further in pharmacy education due to travel restrictions. The aim of the study was to compare the effects on perception, knowledge and participation before and after an anti-infective COIL module. Students from two international faculties from Malaysia and the Philippines were included in the study. Incomplete questionnaires were excluded. A total of 85 students were involved in the study, of whom 47 (55.3%) were year 4 Malaysian pharmacy students, and 38 (44.7%) were year 3 Philippine pharmacy students. An overall improvement in their perception of enjoying ($t=-13.4$, $df (82)$, $p<0.001$) and feeling confident when interacting with students from different countries was observed ($t=-17.5$, $df (82)$, $p<0.001$, respectively). Similarly, an overall improvement in total anti-infective knowledge scores between baseline and post-COIL was demonstrated ($t=-12.5$, $df=82$, $p<0.001$). Post-COIL assessments showed that 20 (24.1%) students reported being active, while 63 (75.9%) reported being very active during discussions on socio-cultural responses to anti-infectives. In discussions on rational anti-infective use, 4 (4.8%) students reported feeling neutral, 28 (33.7%) were active, and 51 (61.4%) were very active. COIL, paired with PBL, was an effective method for improving intercultural exposure and knowledge, indicating its potential for incorporation into pharmacy schools worldwide.

Keywords: Collaborative online integrated learning; pharmacy; Malaysia; Philippines

Abstrak

Pembelajaran Terintegrasi Dalam Talian Kolaboratif (COIL) adalah pendekatan yang menjimatkan kos dalam meningkatkan kecekapan profesional pelajar melalui pendedahan kepada persekitaran budaya yang pelbagai. Bersama-sama dengan Pembelajaran Berasaskan Masalah (PBL), yang melibatkan pelajar dalam penyelesaian masalah secara aktif berdasarkan senario, kaedah ini mengembangkan lagi pemikiran kritikal dan kompetensi antara budaya. Pandemik COVID-19 membolehkan COIL diteroka lebih lanjut dalam pendidikan farmasi disebabkan oleh sekatan perjalanan. Tujuan kajian ini adalah untuk membandingkan kesan terhadap persepsi, pengetahuan, dan penyertaan sebelum dan selepas modul COIL anti-jangkitan. Pelajar dari dua fakulti antarabangsa dari Malaysia dan Filipina disertakan dalam kajian ini. Soal selidik yang tidak lengkap dikecualikan. Sebanyak 85 pelajar terlibat dalam kajian ini, di mana 47 (55.3%) adalah pelajar farmasi tahun 4 dari Malaysia, dan 38 (44.7%) adalah pelajar farmasi tahun 3 dari Filipina. Peningkatan keseluruhan dalam persepsi terhadap keseronokan ($t=-13.4$, $df (82)$, $p<0.001$) dan keyakinan apabila berinteraksi dengan pelajar dari negara yang berbeza telah diperhatikan ($t=-17.5$, $df (82)$, $p<0.001$, masing-masing). Begitu juga, peningkatan keseluruhan dalam skor pengetahuan anti-jangkitan antara awal dan selepas COIL telah ditunjukkan ($t=-12.5$, $df=82$, $p<0.001$). Penilaian selepas COIL menunjukkan bahawa 20 (24.1%) pelajar melaporkan diri mereka aktif, manakala 63 (75.9%) melaporkan diri mereka sangat aktif semasa perbincangan mengenai respons sosiobudaya terhadap anti-jangkitan. Dalam perbincangan mengenai penggunaan anti-jangkitan yang rasional, 4 (4.8%) pelajar melaporkan diri mereka neutral, 28 (33.7%) aktif, dan 51 (61.4%) sangat aktif. COIL, digabungkan dengan PBL, adalah kaedah yang berkesan dalam meningkatkan pendedahan antara budaya dan pengetahuan, menunjukkan potensinya untuk dimasukkan ke dalam sekolah farmasi di seluruh dunia.

Kata kunci: Pembelajaran bersepadu dalam talian kolaboratif; farmasi; Malaysia; Filipina

INTRODUCTION

The COVID-19 pandemic led to a pivot on education approaches especially in terms of international collaboration. The utilization of digital technology became front and centre in approaching teaching and learning activities due to the need for restricting social activities. The use of Collaborative Online Integrated Learning (COIL) was one method that was used to deliver teaching activities between universities of different countries to aid internationalization of previously limited curriculum prospects (Appiah-Kubi & Annan 2020). Problem-Based Learning (PBL) is an active, student-centered teaching approach that encourages learners to develop critical thinking and problem-solving skills by working through real-world scenarios in a collaborative environment (Hmelo-Silver 2004; Manuaba et al. 2022; Alexander et al. 2024).

In designing the COIL and PBL approaches, the module was grounded in constructivist learning theory, which posits that learners actively construct knowledge through interaction and collaboration within real-world contexts. The COIL model draws on social constructivism, emphasizing learning through cross-cultural collaboration and dialogue, which fosters the development of intercultural competence and global citizenship (O'Dowd 2018). In parallel, PBL is rooted in experiential learning theory, where students engage in problem-solving activities to develop critical thinking and apply knowledge in practice-based scenarios (Turula 2019). Both COIL and PBL align with the principle that learning is a dynamic process facilitated by collaboration and reflection, encouraging students to become self-directed, critical thinkers capable of addressing complex, real-world issues (Hmelo-Silver 2004; Manuaba et al. 2022; Alexander et al. 2024).

Traditionally, an effective approach for fostering international learning is through study abroad programs, where students travel to different countries. However, these programs often require significant resources, which may not be accessible to students with fewer financial means. As a more cost-effective alternative, COIL has gained considerable attention in recent years, offering a way to facilitate global interactions and learning without the need for travel (Appiah-Kubi & Annan 2020). COIL is also known as an innovative instructional method that promotes intercultural learning through online collaboration between faculty and students residing in different countries or locations within the context of a course (Borger 2022). Two or more international faculty teaching courses in different locations typically partner to co-facilitate online collaborative activities, such as assignments, projects, presentations and discussions, between their students. The courses delivered in COIL can be developed between or within academic disciplines, which may also lead to different approaches that is unobtainable when only one university is involved. The students are usually divided into smaller groups to solve a challenge or discuss a case. This will allow students from different universities to have the opportunity to exchange views on a given topic, which may lead to unique responses compared to when only one university is involved.

In addition to this, through the COIL activities, cross-cultural differences may also emerge, which is culminated during the collaboration (Rubin 2017). COIL continues to grow as an important intercultural instruction tool in higher education as universities around the world work to internationalize their campuses and curricula, as well as increase access to intercultural learning (De Castro et al. 2019). During the COVID-19 pandemic, COIL was a vital tool in continuing internationalization efforts of universities that was limited due to travelling restrictions. Indeed, previous work has shown that intercultural competence of students was shown to improve through COIL activities and assignments, as students agreed that they were able to improve their skills in intercultural interaction (De Castro et al. 2019).

To this day, there is limited work on COIL among pharmacy students. Therefore, this work investigates the effect of COIL among pharmacy students of two different universities in Malaysia and Philippines. The aim was to compare the effects on perception of intercultural confidence, knowledge of anti-infective use and participation among pharmacy students before and after COIL infectious disease (ID) module.

METHODS

Study design

This was a retrospective observational study based on a COIL performed among pharmacy students in Universiti Kebangsaan Malaysia and San Pedro College, Davao, Philippines for an ID clerkship module. The module was delivered online and included a presentation on appropriate use of anti-infectives as well as a discussion of a problem-based learning (PBL) activity. As part of the module, an assessment was performed at the beginning, as well as after delivery of the COIL module. All students that attended the COIL was assessed as part of the module. Those that did not complete the assessment were excluded. The study was reported in accordance to STROBE guidelines.

Module delivery

The objective of the COIL ID module was to promote (1) intercultural confidence, (2) ensure appropriate use of anti-infectives and (3) discuss socio-cultural factors that may affect inappropriate use of anti-infectives, as well as recommendations for rational use of anti-infectives. Assessment was performed to determine the level of perception of intercultural confidence, knowledge of anti-infective use and participation of students during COIL discussions in accordance to its objectives.

The COIL module was a one-day event embedded within the clinical clerkship course, focusing on the ID topic for the purpose of this study. The PBL activity was conducted in five groups, each facilitated by a lecturer also known as the facilitator, for the discussion in each group. Each group, comprising 9-10 Malaysian and 7-8 Filipino students, was assigned a clinical case to collaboratively analyze and propose an intervention, which they then presented. The PBL session was a one-off activity designed to foster clinical reasoning, intercultural communication, and teamwork. All activities were conducted online, starting with an ice-breaking session to promote familiarity among the students.

Before the module was delivered, a baseline assessment was performed to determine demographics, the level perception of intercultural confidence and knowledge of anti-infective use. An online infectious disease module on basic infection and rational antibiotic use was then delivered. Following this, a PBL was used for the students to apply their understanding of the module as well as share intercultural differences within their groups. At the end of the module, a post-test assessment was administered using the same questionnaire with an additional assessment on participation of PBL discussion among pharmacy students during the COIL ID module.

The primary challenges encountered as part of the module delivery included technical issues such as connectivity problems, communication barriers due to language and accent differences, and cultural variations in teamwork dynamics. Despite these challenges, students actively participated in the guided discussions, demonstrating a willingness to collaborate and learn from their international peers.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the Medical Research Ethics Committee of Universiti Kebangsaan Malaysia (NF-RES-2023-64). Upon approval from the Ethical Review Board, agreement was also obtained from the module convener of the relevant universities, to perform assessments before the COIL sessions.

Questionnaire

The assessment was performed based on a questionnaire that was adapted from previous studies to reflect the current module (Suaifan et al. 2012; Thriemed et al. 2013; Justo et al. 2014; Rubin 2017; Hackett et al. 2023). The questionnaire consisted of four sections which include (1) demographics, (2) perception, (3) knowledge, and (4) participation. The student demographics were based on the students' university affiliation.

The second section, consisting of two items, assessed respondents' perception towards enjoying interacting with students from different countries as well as their confidence interacting with students from different countries. The response was a 5-point Likert scale from 1: Strongly disagree to 5: Strongly agree.

The third section, assessed knowledge that included basic infection and rational antibiotic use consisting of 20 statements. Responses to the statements were either 'True' or 'False. A score of '1' was given for a correct answer and '0' for an incorrect answer. The maximum possible score of the questionnaire was 20.

The final section, consisting of two items, assessed their participation during discussion on socio-cultural factors of anti-infective use and recommendations of rational anti-infective use based on the PBL. The response was a 5-point Likert scale from 1: Very inactive to 5: Very active participation. A comment section was also added to allow for positive or negative feedbacks regarding the discussions, however this was not a compulsory component to be answered to submit the form.

The questionnaire was written in English, as the medium of instruction in both universities is English. The content and format of the questionnaire was evaluated for face validity on 6 pharmacy students and 2 pharmacy lecturers from Universiti Kebangsaan Malaysia and San Pedro College, Philippines. The pharmacy students provided feedback on the design, relevance, readability, of individual questions. Changes were made to improve the questionnaire.

Data analysis

The Statistical Process for Social Sciences (SPSS) software (Version 22.0 SPSS IBM, USA) was used to analyse descriptive and inferential data.

Descriptive analyses were used to analyze frequency and percentage. A students T-test was performed to determine difference between scores of difference groups, whilst a paired T-test was performed to determine the difference between overall understanding level of students at baseline and post module. The limit for statistically significant differences was set at $p < 0.05$.

RESULTS

Demographics

A total of 85 students were involved in the study. Of these, 47 (55.3%) were year 4 Malaysian pharmacy students and 38 (44.7%) were year 3 Philippine pharmacy students.

Pre-COIL characteristics

The baseline perception towards the statements 'I enjoy interacting with students from different countries' as well as 'I am confident interacting with students from different countries' was an average of 3.7 (0.8) and 3.4 (0.7), respectively (maximum score 5). There was no difference in baseline scores between Malaysian (3.9±0.8) and Philippine students (3.5±0.8) for the statement 'I enjoy interacting with students from different countries'. There was no difference in baseline scores between Malaysian (3.5±0.7) and Philippine students (3.3±0.7) for the statement 'I am confident interacting with students from different countries'.

Before the ID COIL was initiated, the average knowledge score was 12.7 (SD1.9) out of a total of 20 scores, ranging from 9-17. Students were found to score highest for the statement, 'Common colds, dengue fever and influenza are examples of viral diseases' (n=83, 97.6%). Whilst the lowest score was for the statement 'A patient must complete an antibiotic regimen before any changes are made to the treatment' (n=9, 10.6%) (Figure 1). When comparing pre-COIL ID knowledge scores between Malaysian (12.9±1.9) and Philippine (12.2±1.8) pharmacy students, there was no significant difference in average scores.

Post-COIL characteristics

After the ID COIL module was delivered, perception towards the statements 'I enjoy interacting with students from different countries' as well as 'I am confident interacting with students from different countries' was an average of 4.7 (0.5) for both (maximum score 5). There was no difference in scores between Malaysian (4.8±0.5) and Philippine students (4.7±0.5) for the statement 'I enjoy interacting with students from different countries'. There was no difference in scores between Malaysian (4.6±0.5) and Philippine students (4.7±0.5) for the statement 'I am confident interacting with students from different countries'.

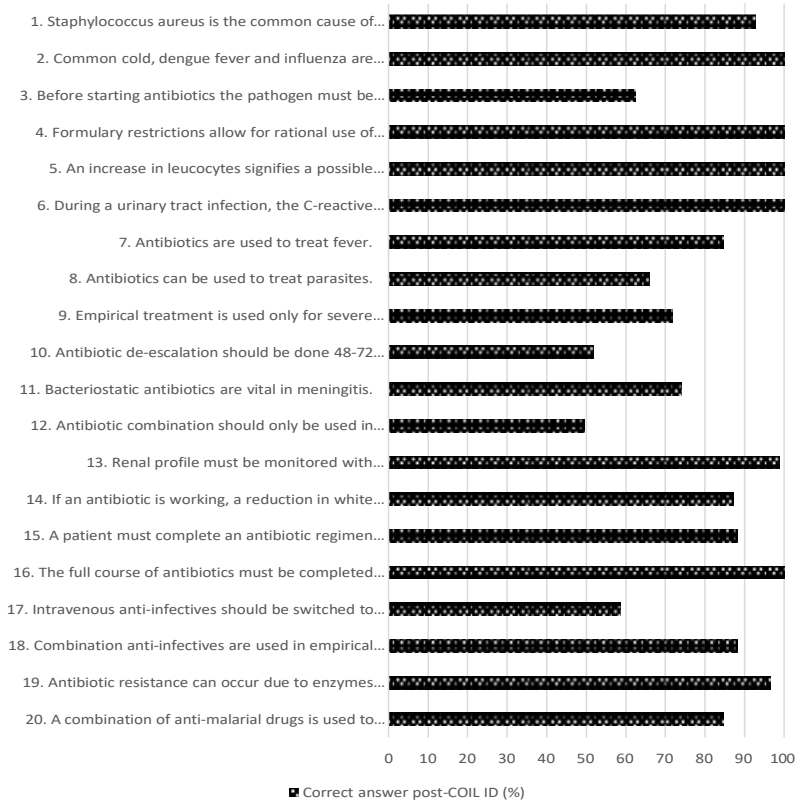

Figure 1 A comparison of knowledge of students based on correct answers response rate pre-COIL and post-COIL ID module (%)

The average post-COIL knowledge score was 16.5 (SD2.1) out of a total score 20, ranging from 12-20. Students were found to score the highest (n=85, 100%) for statements; 'Common cold, dengue fever and influenza are examples of viral diseases', 'Formulary restrictions allow for rational use of anti-infectives', 'An increase in leucocytes signifies a possible infection', 'During a urinary tract infection, the C-reactive protein can increase' and 'The full course of antibiotics must be completed by the patient'. The lowest score was for the statement 'Antibiotic combination should only be used in severe infections' (n=42, 49.4%) (Figure 1). There was no significant difference in post COIL ID knowledge scores between Malaysian (16.8±2.2) pharmacy students and Philippine (16.1±1.9) pharmacy students.

Post-COIL assessments of their discussion on factors associated with socio-cultural use of anti-infectives demonstrated that 20 (24.1%) students admitted to being active, whilst 63 (75.9%) students admitted to being very active in the discussion. From the open comments section, two students noted that the discussion was lively as they discussed their different socio-cultural responses to anti-infectives based on the PBL.

When discussing recommendations on rational anti-infective use based on the PBL, 4 (4.8%) perceived they were neutral towards that participation, 28 (33.7%) students were active and 51 (61.4%) students were very active in participating in the discussion. From the open comments section, three students noted that they were a little unsure of the discussion as they were afraid of giving wrong responses.

Comparison between pre and post COIL

There was an improvement of their perceptions towards enjoying interacting with students from different countries for both Malaysian (t=-8.4, df(46), p<0.001) and Philippine students (t=-11.5, df(35), p<0.001). An overall improvement of their perceptions was also observed ((t=-13.4, df(82), p<0.001). Similarly, there was also an improvement of their perceptions towards their confidence when interacting with students from different countries for both Malaysian (t=-14.2, df(46), p<0.001) and Philippine students (t=-11.2, df(35), p<0.001). An overall improvement was also observed for both groups of students (t=-17.5, df(82), p<0.001, respectively).

The knowledge on all 20 statements improved between pre and post COIL (Figure 1) with 5 statements (statements 2, 4, 5, 6 and 16) achieving a 100% correct answer response rate post-COIL ID. Overall, there was also a significant improvement of total knowledge scores after the COIL ID module for both Malaysian (t=-9.9, df(46), p<0.001) and Philippine pharmacy students (t=-7.8, df(35), p<0.001) compared to baseline (Table 1). Similarly, an overall improvement was seen in total scores for all students between baseline and post-COIL ID (t=-12.5, df(82), p<0.001). Out of the 20 knowledge statements, there was a significant improvement in correct answers for 11 statements. The statements were; 'Before starting antibiotics the pathogen must be identified', 'Formulary restrictions allow for rational use of anti-infectives', 'During a urinary tract infection, the C-reactive protein can increase', 'Antibiotics can be used to treat parasites', 'Empirical treatment is used only for severe infections', 'Antibiotic de-escalation should be done 48-72 hours after normalisation of leucocytes', 'Antibiotic combination should only be used in severe infections', 'If an antibiotic is working, a reduction in white cell count will be observed within a day or two', 'A patient must complete an antibiotic regimen before any changes are made to the treatment', 'Intravenous anti-infectives should be switched to oral after 24 hours' and 'Combination anti-infectives are used in empirical treatment'. The remaining seven statements did show an improvement in scores although the scores were not significantly increased.

Table 1 A comparison between perception and knowledge scores pre- and post-COIL infectious disease module among pharmacy students (n=85)

Characteristics	COIL ID		p-value
	Pre	Post	
I enjoy interacting with students from different countries	3.7 (0.8)	4.7 (0.5)	p<0.001*
I am confident interacting with students from different countries	3.4 (0.7)	4.7 (0.5)	p<0.001*
Knowledge of basic infection and rational antibiotic use	12.7 (1.9)	16.5 (2.1)	p<0.001*

*Paired T-test, p<0.05 for significance

DISCUSSION

COIL is a sustainable and cost-effective method that was utilized during the pandemic, in which student international mobility was restricted. Although COIL has been shown to be an effective method for graduate students (Asojo et al., 2019; Garcia et al., 2023), its application among pharmacy students is still limited. Interestingly, the current work showed that student's perception towards interacting with others from different countries showed improvement post-COIL compared to baseline. Positive responses towards COIL have been reported in previous work, with students often finding the experience exciting due to their ability to share knowledge and different cultural experiences (Hackett et al. 2023). Although initial perception was often intimidating, similar to the current work, COIL is usually able to show that student's belief in their abilities to fit in and succeed when working with international partners improved (Naicker et al. 2022). Among the use of COIL is to improve intercultural competence that has become important as globalization continues to grow, especially among healthcare professionals (Côté 2013; Schellhase et al. 2021).

The use of COIL among the current pharmacy students have shown to be beneficial in improving knowledge of students of both countries that were involved. This demonstrates its effective delivery in teaching, similar to previous work using online methods among pharmacy students (Battaglia et al. 2012). Online methods have been successfully used in teaching students within their own faculty, in both science and non-science related topics (Lee et al. 2018; Nazar et al. 2019). Despite this, the introduction of other international faculties during online teaching is still limited within pharmacy schools. Among the challenges are the limited facilities in certain universities as well as differences in time-zones of collaborating universities (Stefano et al. 2019). However, in this particular work, both universities were able to come to an agreement due to the relatively close proximity of the two countries involved, as well as the current online home teaching methods already in place during the pandemic. To the best of our knowledge, this is the first study to show improvement in students knowledge using COIL among pharmacy students.

One of the key feedbacks during the discussion sessions within the COIL between the two institutions was the interest in sharing cultural experiences among their peers based on the recent COVID-19 pandemic experiences. Students found the discussion surrounding intercultural differences in managing COVID-19 to be interesting, with the majority taking part actively in the discussion. Despite this, the discussion concerning recommending appropriate use of anti-infectives was slightly less enthusiastic as a few students raised their concerns regarding their lack of confidence due to the need to know specific facts on the topic. Students noted that an ice-breaking session would be useful to reduce anxiety and build more confidence during discussion, similar to previous experiences in COIL (Stefano et al. 2019).

Hence, COIL was successfully implemented within the pharmacy course during the COVID-19 pandemic, thereby promoting intercultural linkage despite travel restrictions. Further studies could be performed to reduce limitations within the current work. Firstly, a larger sample size could be included. Assessments could also be performed after each session within the module to determine continuous improvements in perception, knowledge and intercultural experience. A qualitative study could be included in future research to determine student's individual experience during the COIL session, in order to specify which areas to improve.

This study has several limitations that must be acknowledged. The COIL sessions were limited in scope, with only one session per topic, which may not have provided sufficient depth for comprehensive learning assessment. Additionally, the sample size was relatively small, which limits the generalizability of the findings. Furthermore, the study included only a narrow set of items to evaluate students' perceptions of the COIL approach, compared to broader assessment tools used in similar studies. As a result, this study should be viewed as a pilot, laying the groundwork for future research that can expand on these findings and offer a more robust evaluation of the COIL approach.

CONCLUSION

The current work establishes a foundational understanding of the potential benefits of COIL among pharmacy students. By fostering intercultural competence and enhancing students' ability to collaborate internationally, COIL provides a valuable platform for preparing future healthcare professionals to navigate global challenges. Its implementation can improve students' experiences by building their confidence in cross-cultural communication, promoting international collaboration, and broadening their perspectives on healthcare practices in different countries. Expanding COIL to other pharmacy courses will further equip students with the necessary skills for working in an increasingly interconnected healthcare industry. Future studies should aim to refine this approach by addressing specific challenges, such as time-zone differences and content-specific anxiety, to optimize student engagement and learning outcomes.

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