Glasgow Caledonian University

University for the Common Good

Collaborative online international learning: a way to develop students' engineering capabilities and awareness to become global citizens

Munoz-Escalona, Patricia; Cassier de Crespo, Zulay; Olivares Marin, Mara; Dunn, Meg

Published in:
International Journal of Mechanical Engineering Education

DOI:
10.1177/0306419020934100

Publication date:
2022

Document Version
Author accepted manuscript

Link to publication in ResearchOnline

Citation for published version (Harvard):
Munoz-Escalona, P, Cassier de Crespo, Z, Olivares Marin, M & Dunn, M 2022, 'Collaborative online international learning: a way to develop students' engineering capabilities and awareness to become global citizens', *International Journal of Mechanical Engineering Education*, vol. 50, no. 1, pp. 89-104. https://doi.org/10.1177/0306419020934100

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy
If you believe that this document breaches copyright please view our takedown policy at https://edshare.gcu.ac.uk/id/eprint/5179 for details of how to contact us.

Download date: 03. Dec. 2022

Collaborative Online International Learning: A Way to Develop Students' Engineering Capabilities and Awareness to Become Global Citizens.

Patricia Muñoz-Escalona[1], Zulay Cassier de Crespo[2],
Mara Olivares Marin[3], Meg Dunn[4]

[1] *School of Engineering and Built Environment, Glasgow Caledonian University, Glasgow, UK.*
[2] *School of Engineering. Universidad Metropolitana, Caracas, Venezuela*
[3]*Universidad de Extremadura, Merida-Spain*
4University of the West of Scotland, Paisley-UK

Corresponding Author's email: patricia.munoz@gcu.ac.uk

Abstract

In the 21st century, academics must recognise the value of incorporating e-learning activities in teaching in order to provide students the opportunity to interact and engage with peers in collaborative learning. To achieve this, a Collaborative Online International Learning (COIL) activity was introduced to 2nd and 3rd year students in Mechanical and Industrial Design Engineering degrees, with the aim of enhancing aspects such as global manufacturing and reverse engineering. This activity was also used as an approach to internationalise the curriculum which is an important mechanism to promote intercultural competencies, international perspectives and ethical sensitivities, whilst also contributing to the enhancement of students' abilities to develop as responsible global citizens.

Three institutions were involved in this project, with results indicating that 93% of students felt they had a better understanding of the topic under study, 93% were satisfied with the learning experience and 90% enjoyed interacting with international peers

Keywords: collaborative, cooperative, engineering, global-citizenship, online, students

1. INTRODUCTION

In order to be effective academics, different tasks must be completed to assist with student development, for example i) share and transfer knowledge, ii) motivate them to learn and iii) prepare them for a global environment. Generation Z have also been defined as a unique and truly digital native generation, born between the mid-1990s and 2012 (1), which means that they expect the incorporation of more technology in teaching approaches, accompanied by more hands-on activities in classes (2).

However, since not all students in any given cohort belong to Generation Z, such as mature students, a more realistic approach is to refer to ‘visitors’ and ‘residents’ which is the term for digital users/online engagement and refers to a continuum of perceptual differences and behaviours, as opposed to a demographic demarcation, based on year of birth. In this model, the authors refer to ‘place’ and ‘tool’ to describe technology, where ‘visitors’ perceive the Web as a ‘place’, which can be accessed to complete goals or tasks. They tend to think ‘offline’ and are users, as opposed to members, of the Web (3).

By comparison, ‘residents’ view the Web as a place, which can host both friends and colleagues – they are likely to belong to a range of communities, all located in the virtual world, and they tend to make less of a distinction between the online concepts of content and personal interaction.

Clearly, these two discrete groups will respond differentially to an exercise in online collaboration and this may be a more accurate measure of impact than simply age.

To understand how students can learn, or which teaching approach should be used, different theories in teaching and learning have been developed. An example of a learning model/process is provided by Kolb's learning cycle, which illustrates learning as being divided into four stages describing different ways of learning, namely Concrete-Experience (Feeling), Reflective–Observation (Watching), Abstract-Conceptualization (Thinking), and Active-Experimentation (Doing). Effective learning is achieved when the individual has progressed through the four stages of the cycle, although the learning process can start in any stage but only two elements can be operational simultaneously (4).

Previous research has shown that the greater the student motivation, the more they want to learn (5), resulting in an increase in their engagement. This can be also enhanced by applying e-learning tools in part of the assessment, aligning with what is expected by teaching in the 21st century ('Technological Era') as a difference to traditional approaches (6).

Additionally, employers require workers who can collaborate and have problem-solving skills, as well as being global citizens, in order to improve our wellbeing as a society. The incorporation of e-learning tools will provide students with the opportunity to interact and engage with peers in cooperative and collaborative learning (5 and 7).

As previously mentioned, it is important that academics educate students to become global citizens, i.e. they should be encouraged to think globally and to become comfortable in a multicultural space, understanding people's differences, all of which are aspects that are highly important in enhancing societies' wellbeing.

Previous research has shown that incorporating online international collaboration activities as part of the teaching approach allows academics to achieve these goals, whilst simultaneously internationalising the curricula (8) through facilitating the development of intercultural competencies, international perspectives and ethical sensitivities (9). The Higher Education Academy in the

UK suggests that an internationalised curriculum should prepare students to be able to

'*contribute responsibly to a globally interconnected society irrespective of their geographical location or background" (10*)

One innovative online pedagogical approach is the Collaborative Online International Learning (COIL) activity, which provides students with the opportunity to interact with international peers. COIL projects usually involve the co-development of an activity by two or more instructors from different countries and students from different lingua-cultural backgrounds to communicate and collaborate online (11-12). These activities not only facilitate knowledge enhancement/exchange and deeper learning, but also permit cross-cultural learning, supporting students to integrate and enhance their international education, enhance their communication skills and to develop their teamwork ability. Moreover, COIL activities allow the easy inclusion of several e-learning activities such as online discussion forums, wikis, surveys, etc., all of which have been widely used to promote student engagement (13,14,15,16).

Previous research has shown that 80% of European students are not able, or willing, to study abroad, so the incorporation of COIL activities in students' curricula can provide them with the opportunity to engage with international peers, thereby providing them with the opportunity to become global citizens. Additionally, this international experience increases their employability as students with this experience improve their potential in the job market: their probability of being employed increases by 76% (17).

This research will analyse students' experiences and engagement when being involved in a Collaborative Online International Learning activity as part of the assessments for 2nd and 3rd year undergraduate students in mechanical engineering.

The research will address the following questions:

- Can COIL prepare students to be part of a global environment?

- Can COIL substitute the experience of living abroad?
- What are the benefits of COIL?

Based on the literature, it is suggested that a valuable learning experience can be created in an engineering environment, by using a COIL approach as part of students' assessment. The intention is that this will provide them with the possibility of experiencing not only a new learning environment, exchanging knowledge with international peers, but also the possibility of enhancing their confidence and communication skills, preparing them to be part of a global environment.

In the next section we will describe the method and context, followed by the results and discussion and finally the conclusions.

2. METHOD AND CONTEXT

82 students in their 2nd and 3rd year of undergraduate studies from three different universities, in Scotland, Spain and Venezuela, were enrolled in a three-week virtual collaborative project. The selected topic for the activity was a "Car Dissection" assignment, where students had to analyse and discuss four different aspects of a car component; i.e. i) functionality, ii) physics involved, iii) materials and iv) manufacturing process.

The images of each car component's microstructure were delivered to the students through the online discussion forums, to allow them to conduct a reverse-engineering process. From the analysis of the microstructures, students were able to identify the type of material, possible heat treatment and manufacturing process (i.e. rolling process).

Different e-learning activities were incorporated, such as asynchronous online discussion forums (ADF) and wikis, allowing students to discuss the selected car component and develop a poster to share with the whole class, outlining the major outcomes of the discussion that was generated between their peers.

The key benefit of using a wiki tool is that it allows users to edit and modify

contents, and, since the history of these modifications are also registered, academic evaluation of the students' engagement is simplified.

Table 1 details the demographic characteristics of the COIL participants from the different institutions.

Table 1. Demographic Characteristics of COIL participants

Country-University	**Degree**	**Male**	**Female**	**Total**
Scotland (Lead institution)	2nd year Mechanical Engineering	43 (1 international, 1 Erasmus*)	3 (2 Erasmus*)	46
Spain	Industrial Design Engineering degree	5	6	11
Venezuela	3rd year Mechanical Engineering	16	9	25

*Erasmus: European Region Action Scheme for the Mobility of University Students (a student exchange programme)

In order to guarantee a cross-learning and knowledge-transfer experience, groups were formed, based on the following:

- Each group involved at least one student from each participating institution. This restricted the amount of students per group as there were only 11 students from the Spanish institution taking part in the activity

- Students required to be proficient communicators in English. To asses this, a short questionnaire, testing English proficiency, was completed by students from Spain and Venezuela, the results of which facilitated allocation of Spanish-speaking students with lower ability in English with Spanish speakers with medium- to high-level abilities in English, in case information in the discussion forum was complicated and needed clarification.

- For diversity purposes, at least one female was allocated to each group, with these students being predominantly Venezuelan and Spanish, due to the low number of female engineering students in the UK

Since the hosting institution used Moodle as the Virtual Learning Environment

(VLE), this was the selected platform to conduct the activity. Students from foreign institutions were given special permission to enrol in the Moodle page created for the purpose.

Following suggestions provided by previous researchers (18) students were informed through the Moodle page set-up about different aspects of the activity, such as: i) the purpose and importance of the COIL activity as part of their assessment, ii) the importance and how to use e-learning activities (ADF, wikis, surveys, etc.) and iii) brief information about car components and equations involving physics behind the functionality of the components, with the information presented as an online lesson.

The following general information was also highlighted

- List of students and corresponding group
- How and where to locate each activity
- Time period for each activity
- List of car components
- General instructions on how to navigate in the different stages of the activity i) from the social forum to selection of component ii) discussion and analysis of component, iii) use of wiki and iv) poster development)
- General discussion forum in case of doubt or query
- Feedback survey for future improvement.

2.1. Activities and time period of different stages of the COIL project

Students were divided into groups of 7-8 members. A time period of three weeks was assigned for completion of the entire project, which was divided in different stages. Table 2 show the sequence of the different activities assigned to the COIL project as well as a brief description and its time period.

Table 2. Activities and time period assigned to the COIL project

	Activity	Description/Purpose	Time period
1	Social Forum	To have the opportunity to virtually meet their groupmates.	5 days
2	ADF	i) To select car's component	2 days
		ii) To discuss and exchange knowledge of car component's aspects: - Functionality - Physics involved - Materials - Manufacturing	1 week
3	Wiki	To include major findings of each aspect involved in the car component analysis. Possibility of editing the information before developing an A3 poster	5 days
4	Poster	Include major information in an A3 poster to be shared with the whole class in Moodle page. This was done using Power Point or Publish and shared through ADF.	2 days
5*	Vote	Students judged and vote for best poster based on quality and clearness of information provided.	2 days
6*	Survey	For feedback purposes	2 days

* not part of the three weeks' activity)

2.2. Assessment of students' performance (feedback)

To assess students' performances and attitudes towards the COIL activity, a survey/questionnaire was conducted after the activity concluded, which also facilitated an evaluation of the students' overall satisfaction and engagement, as well as aspects to improve in future iterations of the project.

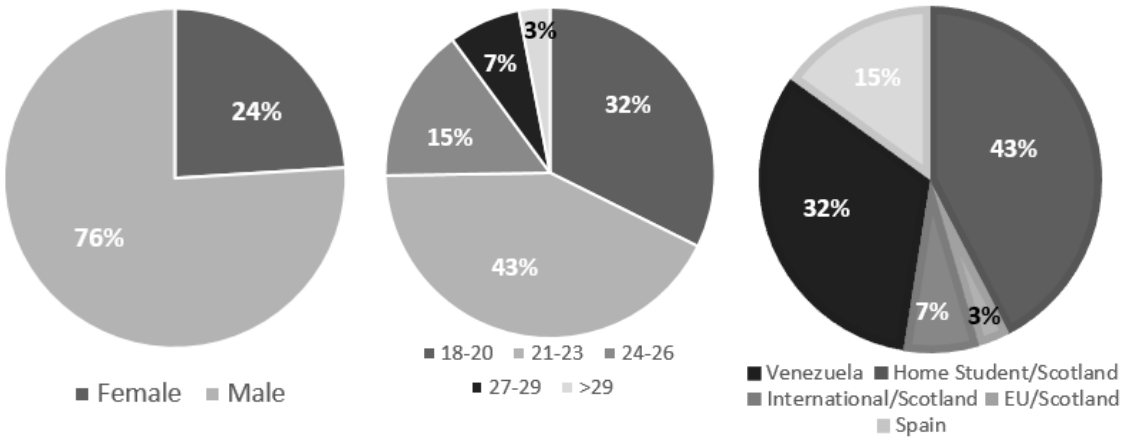
It should also be highlighted that, since all activities were conducted in Moodle, a log-in history, with user tracking, also facilitated an evaluation of each student's engagement with the range of activities.

3. RESULTS AND DISCUSSIONS

From the 82 students enrolled in the activity, three (4%) did not participate, all of whom were from the Scottish institution. The reason for non-participation was determined to be illness, although only 1 student provided formal evidence. It

should be noted that the activity was compulsory for all students from Scotland and Venezuela.

11 out of 40 Spanish students (all with at least a basic ability in English) took part in the activity, which was not compulsory; however, participation in the project resulted in a weighting of 15% over the whole assessment. Figure 1 shows general demographic information regarding students who took part in the activity and answered the survey, where the participation rate across the cohorts was 72% (59/82).



a) b) c)

Figure 1. Demographic information regarding students who participated in the COIL activity and took part on the survey

It is worth mentioning the high contrast between the number of female students undertaking engineering degrees in Scotland when compared to Venezuela. Table 1 shows that, of the Venezuelan students, 9/25 students (36%) were female, whilst, in Scotland, there were only 3/46 (7%) female students, of whom two were from the Erasmus programme. This low figure highlights the lack of female students in STEM (Science, Technology, Engineering and Math) degrees, particularly in the field of engineering in the UK, the reasons for which have been widely investigated (19). The high number of females undertaking engineering degrees in Venezuela is probably due to the fact that all subjects in high schools are compulsory; i.e. students are not allowed to pick, or drop, any subject, as is the case in the UK system. Thus, by the time students finish high

school, they are eligible to apply for a wider range of degrees at higher institution level, because of the breadth of qualifications they have achieved.

The Spanish institution included 54% female participants but this proportion, as previously mentioned, only included those students with English language abilities. For the Spanish institution, no data regarding the gender divide, across the total number of students enrolled in the degree, was provided.

In order to obtain a thorough perspective and evaluation of the COIL activity, an analysis of three different stages took place: i) Before conducting the activity, ii) During the activity and iii) After the activity.

3.1. Before conducting COIL activity

Students were asked to rate their experience related to e-learning tools before conducting the COIL activity. It must be highlighted that a major concern, raised by the Venezuelan academic, related to the use of Moodle as the VLE since these students were not familiar with this platform. Concerns mainly focused on whether Moodle would be user-friendly enough, to ensure that students' performance would not be affected, based on the fact that time period allocated for the activity was 3 weeks. Figure 2 shows results related to students' experiences with the use of e-learning tools (e.g. COIL, VLE, ADF, Wiki and Online Surveys), from 1 (Non-experience) to 5 (High experience).

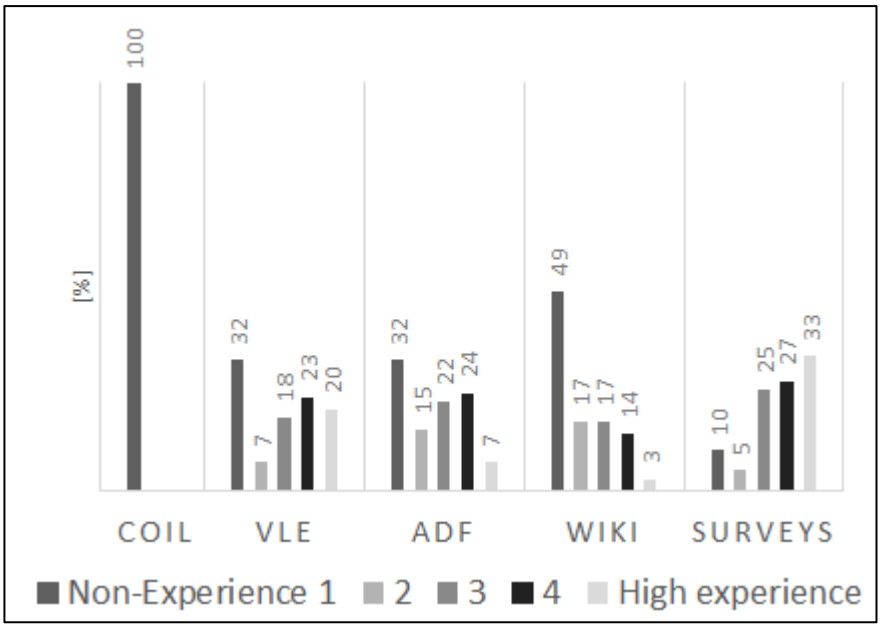


Figure 2. Students' experience with different e-learning tools prior to COIL

When analysing Figure 2, it is evident that no students had participated in, or were aware of, COIL activity. 32% of the students had non-experience using VLE (Moodle). This percentage coincides with the percentage of students from Venezuela, who raised concerns about their performance as they were not familiar with this VLE. 61% of the students had average to high-experience of using Moodle as a VLE, a proportion which matches the participation level of students from Scotland and Spain.

Moodle is the most popular Learning Management System in Europe based on a survey of 1,600 Higher Education institutions (20). Regarding the asynchronous online discussion forums (ADF), 53% of the students had medium- to high-experience. Further investigation indicates that only 15% of these students, who did have some experience in online forums, obtained this experience from a previous module, where this e-learning tool was used to manage questions and answers (not as a discussion) with the aim of avoiding emails for this purpose.

80% of the students who were familiar with online discussion forums were members of Reddit, a very popular platform which deals with different topics (21). 49% of the students had no experience of wikis, compared to 17%, who

had very good- to high-experience. 84% of the students were familiar with surveys and further investigation concluded that students were familiar with this tool, as they had specific experience of completing student satisfaction surveys and/or completing online surveys for different purposes.

3.2. During the activity

First it should be noted that, to evaluate the ADF, the Salmon model was applied, which outlines the five stages to guide and support students to build confidence and expertise in online discussion forums (22-23).

Following the Salmon model, the activity first included a social forum to facilitate 'virtual' introductions by encouraging students to exchange comments regarding their culture, typical food, places to visit, hobbies, interests, etc.

During the activity, the following were observed:

i) 70% of the posts initially placed in the social forums came from students from Spain and Venezuela. When analysing the data, it was thought that this behaviour was probably due to the fact that students from Spain and Venezuela were in their 3rd year of studies, compared to students from Scotland, who were in their 2nd year; however, further analysis indicated that 25% of students from the Scottish institution were mature students with ages between 25-40
ii) Despite students being encouraged to exchange information with peers, related to their culture, only 40% of the students continued the thread discussion, with the remaining students making limited use of the social forum, although they did 'lurk', acting as observers, rather than actively participating in the discussion thread
iii) 70% of students logged into the formal discussion forum as observers but appeared to avoid being the first to post
iv) 90% of the groups (10/11) decided to share the workload by dividing the different aspects of the car component to be analysed
v) In 80% of the groups (9/11), it was clear that one student immediately took the leading roll and 70% of these groups (6/9) were led by mature students

vi) 60% of group's initial posts (7/11) were made by Venezuelan students (3rd year of mechanical engineering)

vii) 20% of the groups (2/11) lacked of leadership, which resulted in a weaker overall performance and a weak submission.

One explanation for the fact that 70% of students logged into the ADF as initial observers, but then waited for other students to be first to post, could be that they did not want to be exposed as a weak student if the post was not of a high standard. This was later confirmed through results from the focus group and is consistent with previous research (24).

60% (7/11) of the groups' initial posts were placed by Venezuelan students, probably due to the fact that these students were in the 3rd year of a mechanical engineering degree, meaning that they had more experience in the area, compared to students from Scotland, whohad only recently been introduced to these topics. By comparison, students from Spain, who were students from an Industrial Design Engineering degree, had not been exposed to the topic in as much depth as the mechanical engineering students.

3.3 After the activity concluded

Once the activity concluded, students were asked three main questions; i.e. 1) How do you feel as a learner? 2) What you have learned? 3) How did you learn? with a summary of results provided in Table 3.

Table 3. Summary results regarding how students felt as a learner and what and how they learned through the COIL activity.

Aspects	**Students**
Students who felt they had a deeper understanding of materials topic, the use of phase diagrams and manufacturing process by studying and analysing a real application.	76/82 93%
Students that felt that the activity allowed them to be introduced to new e-learning activities.	80/82 97%
Students who felt they learned something new through other students' posts/comments.	72/82 88%

The COIL activity was received well. The great majority of students (93%) felt they had a better understanding regarding materials and manufacturing and the COIL activity improved their understanding of global manufacturing, as students were interacting with international peers. It was also observed that 88% (72/82) of the students learned something new through the posts provided by other students, which relates to Kolb's learning cycle, i.e. students were able to learn through Reflective–Observation (Watching) and Abstract-Conceptualization (Thinking), (4)

Students were asked to describe the COIL activity in 3 words, with one word noting 'the worst thing' about it. Figure 3 and Figure 4 summarise these results.

Figure 3. Word Cloud summarizing the most 3 common words to define the COIL activity

Figure 4. Word Cloud summarizing the worst thing about COIL.

In Figure 3, the majority of descriptions were positive, such as collaborative, different, enjoyable and unique.

This was very encouraging as students clearly recognised the benefit of the activity and enjoyed having an interactive and different activity that helped them enhance not only their learning process but also their interaction with international peers, whilst improving their communication skills. The activity was also used as a benchmark, where students were able to compare their knowledge or the teaching approach used by the academics in their home institution to teach a specific topic.

When asked to report worst thing about COIL (Figure 4), the majority of the students focused on the lack of engagement by some team members. Venezuelan students focused on problems with their internet connection and the Moodle page as a Virtual Learning Environment, complaining that they had to constantly log into the forum in order to see new posts. Unfortunately, this feedback was provided at the end of the activity. Additionally, no comments related to customising forum settings, to receive immediate email notifications, were made. However, this entire area was not problematic for Spanish and Scottish students, probably because of their knowledge of Moodle.

Another negative area focused on the deadlines that were established. Two main aspects were involved around this issue: i) set-up deadlines suited the hosting institution but it clashed with other activities scheduled for the Venezuelan students, making it a more demanding period for the final submission and ii) 70% of students from the hosting institution preferred to have the activity in the early weeks of the trimester but, because of the complexity of the activity, this request could not be accommodated as the first weeks are when topics, that would be used later for the COIL activity, were introduced.

3.4 Benefits of the COIL activity

Students were asked to rate their improvement in, and benefits of, the COIL activity and Figure 5 shows these results.

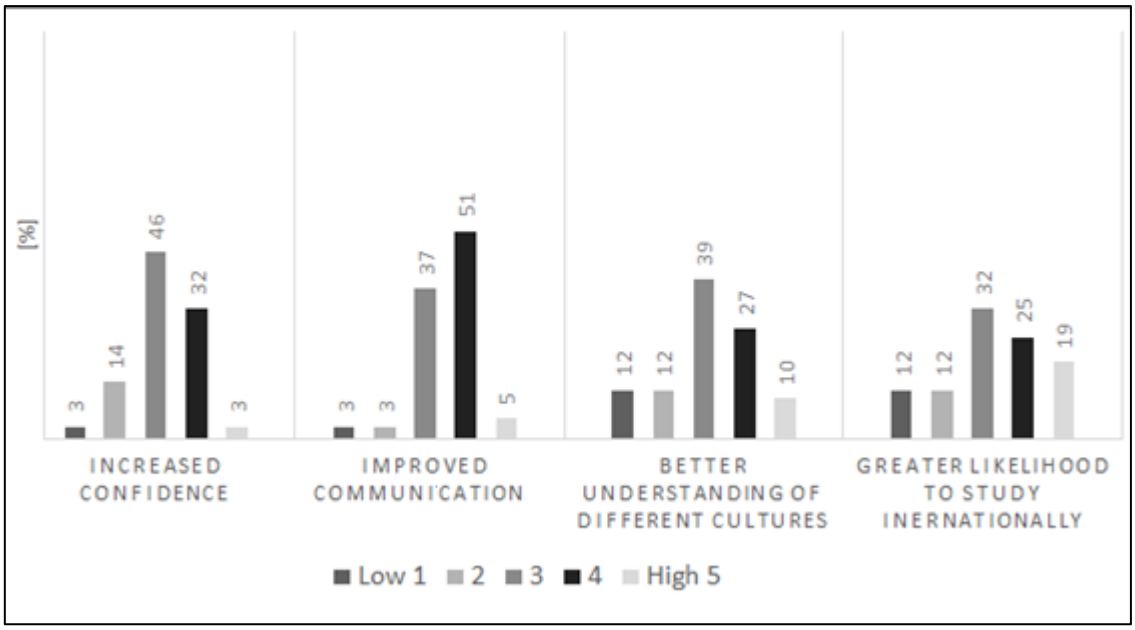


Figure 5. Benefits of the COIL activity

It is evident, then, that strongest response levels were towards an increase in students' confidence and in an improvement in their communication skills, with 78% and 88% response levels respectively. It must be highlighted that Spanish students were very excited about the opportunity to participate in this type of activity as it allowed them to practice, and improve, their English ability, whilst simultaneously interacting with different culture. They also saw the opportunity as a way to improve their CV by being involved in a collaborative online international assessment.

3.5 Students perceptions towards the activity:

Students were also asked about their experience in different aspects of the activity. Figure 6 shows these results

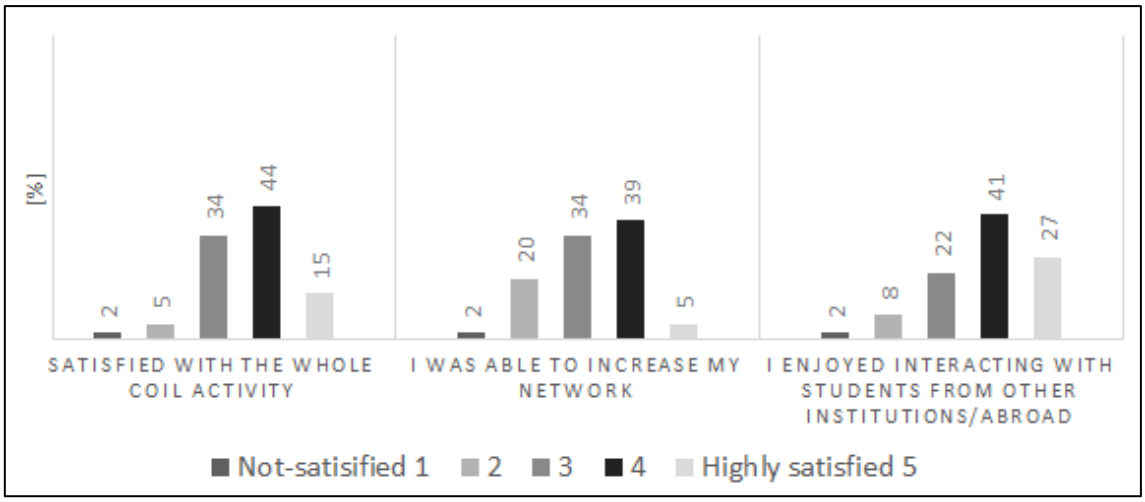


Figure 6. Students' experiences towards different aspects of the COIL activity

In general, 93% of the students (76/82) were satisfied with the whole experience. Students enjoyed the activity and they felt their level of knowledge and understanding of the topic has increased. 90% of the students (74/82) enjoyed interacting and working with students from other institutions or from abroad, which they described as 'an eye-opener'.

A few students thought, when analysing their component, that they had a language barrier as they could not understand certain things, only belatedly realising that this was a miscommunication: for example, despite students talking about identical steel, these steels were named differently in each country (e.g. a low carbon steel is named EN3 in Europe but an AISI 1020 in America). However, this small issue demonstrated the type of different issues they could face when involved in global manufacturing.

Another aspect that was raised was social networking - as demonstrated in Figure 6, 78% of the students (64/82) indicated that this activity led to them increasing their network.

Students were asked if they used a different source of communication with their peers, other than the social forum provided in the activity. Figure 7 show these results.

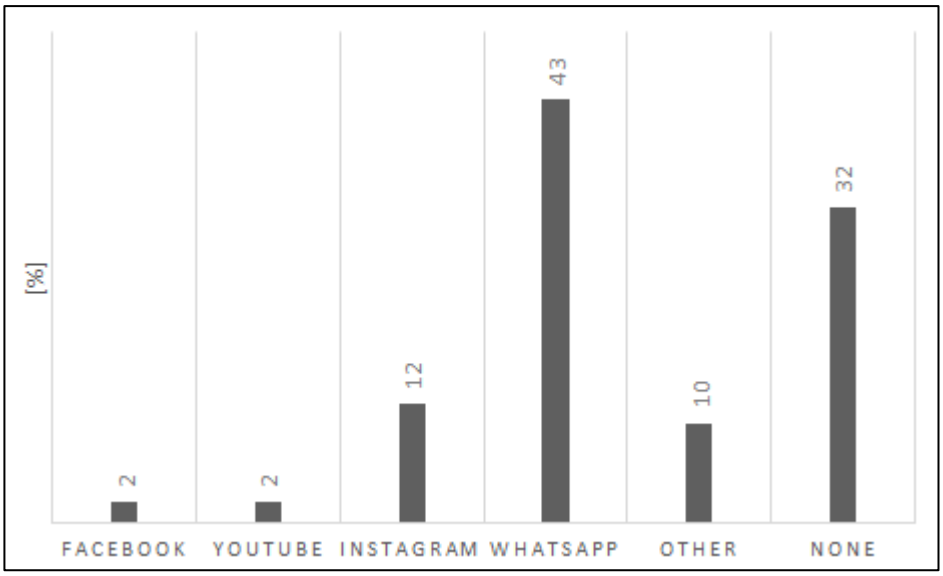


Figure 7. Different social media used to connect with their peers a part from the social forum.

24% of the students (20/82) did use a different source of communication and WhatsApp was selected by 43% of these students (9/20). Further analysis indicated that Venezuelan students arranged for group chats in this platform because of its instant connection with their peers, which overcame the problems associated with time differences between countries and the lack of instant notifications when posting in the discussion forum.

Students were also asked if they included any of their new peers in any of their social media account and 12% indicated that they had done so, using their personal media account.

3.6 Other students' comments

Students were asked to note any additional comment they wanted to share regarding the COIL activity and these comments are shown in Table 4.

Table 4. Additional comments from students that participated in the COIL activity

Student	Comment
1	*"The best thing was to learn how to work together as a group even if it was not possible to talk to each other in real life, But I guess this will be the future, because most companies will be global and work with other countries so you have to work with different people from around the world. This was a great experience to see how things like this can work"*
2	*"The activity was about a car which is an everyday thing, it is good to relate what we learn in the classroom back to things we use or experience everyday"*
3	*"This activity made me aware of how to gather quality information in research as there was only limited space on the poster"*
4	*"I felt I got a better understanding of the materials subject due to the further study that was required for COIL"*
5	*"A collaborative and educational activity with other cultures in a common theme. Good initiative!*

4. CONCLUSIONS

The COIL activity was defined as a success and the activity provided students with the opportunity to work in an international context to resolve a real life problem, with the introduction to global manufacturing and reverse engineering. 92% of the students that completed the survey (54/59) felt they had a deeper understanding after sharing knowledge and conducting the activity as it was a real life case study. 97% (57/59) indicated that the COIL activity allowed them to be introduced to new e-learning activities/tools (Wikis and ADF) and that they felt confident in using them.

Overall students also realized that, irrespective of the country in which they are studying, they were prepared to become an Engineer and they used the COIL activity as a benchmark: they were able to compare their knowledge with students in other universities and countries, whilst simultaneously benchmarking their capabilities.

Students highlighted that the activity allowed them to prepare for a global environment by providing them with the opportunity to interact with international peers; they also felt that, by taking part in this activity, their confidence and communication skills had improved by 80%.

Despite these positive results, it is recognised that COIL is not a substitute the experience of living or studying abroad, but it can at least provide a stimulus to encourage students to consider international opportunities in the future.

5. RECOMMENDATIONS

The activity generated a range of positive key aspects. However, as a teamwork-based activity, the main limitation was the lack of engagement/communication of some team members, which hindered the progress of activity generally, particularly for other team members, who were keen to get a response or comment on a post. To avoid this situation, a few things can be considered: i) compulsory subscription to the forums, ii) students should post at least once and answer to two different posts, iii) assign roles to students (leader, administrator, etc.) and iv) a penalty for late engagement.

6. REFERENCES

1. Seemiller G. (2016). Generation Z goes to college. Jossey-Bass, San Franicsco, CA
2. Malat, l., Vostok, T., & Eveland, A. (2015). Getting to know Gen Z. Available at https://next.bncollege.com/wp-content/uploads/2015/10/Gen-Z-Research-Report-Final.pdf. Accessed 9/08/18
3. White D and Le Courne A, 2011. Visitors and residents: A new Typology for online engagement. Available at https://firstmonday.org/ojs/index.php/fm/article/view/3171/3049. Accessed 20/05/2019
4. Kolb David. A. (1984). Experiential Learning: Experience as the source of learning and Development. Prentice-Hall, Inc. Englewood Cliffs, N.J. USA, 38
5. Wankat P and Oreovics F. (2015). *Teaching Engineering*. Second edition. USA
6. Rovai A, Ponton M, Wighting M and Baker J (2007). *A Comparative Analysis of Student Motivation in Traditional Classroom and E-learning Courses*, Vol 6.3. 413-432
7. Bach.S, Haynes.P and Smith.J.L. (2007) Online Learning and Teaching in Higher Education. UK: Open University Press
8. Green, W and Whitsed, C (2015). Critical Perspectives on Internalising the Curriculum in Disciplines. Global Perspectives on Higher Education. https://www.sensepublishers.com/media/2366-critical-perspectives-on-internationalising-the-curriculum-in-disciplines.pdf
9. Leask B (2015). Internationalisation of the Curriculum (IoC) in action. A Guide. https://www.internationalisering.nl/wp-content/uploads/2015/04/internationalisation-of-the-curriculum-in-action1.pdf
10. Higher Education Academy (2014) Internationalising Higher Education Framework, [Online]. Available: https://www.heacademy.ac.uk/ [Accessed: 10/10/2018]
11. Muuro, M; Wagacha, P; Oboko, R and Kihoro J. (2016). Students' perceived challenges in an Online Collaborative Learning Environment: A Case Study in Kenya, Available at http://www.irrodl.org/index.php/irrodl/article/view/1768/3124. Accessed 15/01/2019
12. Kayumova, A.R. & Sadykova, G.V. 2016, "Online Collaborative Cross-Cultural Learning: Students' perspectives", Journal of Organizational Culture, Communications and Conflict, vol. 20, pp. 248-255
13. Cole M. (2009) Using Wiki Technology to Support Student Engagement: Lessons from the Trenches. Computers & Education 52, 141-146

14. Ramanau R and Geng F. (2009). *Researching the Use of Wiki's to facilitate Group Work*. Procedia Social and Behavioral Sciences 1, 2620-202
15. Ioannou A, Brown S and Artino A. (2015). *Wikis and Forums for Collaborative Problem-Based Activity: A Systematic Comparison of Learners Interactions*. Internet and Higher Education. 24, 35-45
16. Harandi S. (2015). Effects of E-Learning on Students' Motivation. Procedia –Social and Behavioural Sciences, 181, 423-430
17. International facts and Figures, 2017. Available from: https://www.universitiesuk.ac.uk/policy-and analysis/reports/Documents/International/International Facts and Figures 2017.pdf
18. Cukusˇic´ M, Garacˇa Z and Jadric´ M. Online self-assessment and students' success in higher education institutions. Comput Educ 2014; 72: 100–109
19. WISE Campaign. 2018. Not for people like me? Under-represented group sin science, technology and engineering. Available at: https://www.wisecampaign.org.uk/wp-content/uploads/2018/06/not_for_people_like_me-full-report.pdf. Accessed 20/05/2019
20. Moodle News, 2016. Available at https://www.moodlenews.com/2016/moodle-continues-to-dominate-the-european-lms-market-with-almost-23rd-share-moodle/. Accessed 9/08/2018
21. Reddit, 2016. Available at: https://www.wix.com/blog/2016/04/why-is-reddit-so-much-fun/. Accessed 8/08/2018
22. Gillian Salmon: 2013. E-tivities. The Key to Active Online Learning. Roulegdge
23. Gillian Salmon: 2011. E-moderating. The Key to Teaching and Learning Online. Roulegdge.
24. Muñoz-Escalona P, Savage K, Conway F and Mclaren A. (2018). Promoting undergraduate student engagement through self-generated exam activity. International Journal of Mechanical Engineering Education. DOI: 10.1177/0306419017743215