

Online teaching and learning processes in an interdisciplinary course focused on design for social innovation during the COVID-19 pandemic in Peru

Procesos de enseñanza y aprendizaje en línea en un curso interdisciplinario focalizado en el diseño para la innovación social durante la pandemia de la COVID-19 en el Perú

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Abstract: This review shows the experience of industrial design professors at PUCP in their teaching and learning process during the pandemic COVID-19, of an interdisciplinary course between Industrial Design and Electronic and Civil Engineering, under a university social responsibility approach in a virtual mode. The aim was to develop a demonstration plot for the agricultural village of Chillaco in the highlands of Lima, affected by the pandemic. A research was conducted to find out the consequences of the virtual scenario on students. The main results were: uncertainty about how to develop ethnography remotely and demotivation due to the absence of face-to-face social interaction. As an action plan to face this scenario, a teaching and learning methodology was developed for the development of the interdisciplinary course and a didactic proposal for virtual classroom sessions based on 4 didactic strategies: problem-based learning (PBL), flipped classroom, synchronous and asynchronous environments, and computer-mediated collaborative learning. For the development of the remote ethnography, the Swiss NGO EcoHumanita was a strategic ally that facilitated the communication between the community and the interdisciplinary student groups, through the use of multimedia tools to learn more about the reality of the population. In conclusion, the methodological approach proposed for the non-classroom modality aimed at projects with a social focus, allowed students to empathize and propose solutions for a rural context, develop skills for autonomous learning, and recognize the contribution they can make to the development of society.

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Key words: Online teaching, inverted classroom, social design, social innovation, COVID-19, Chillaco (Lima)

Resumen: Esta reseña muestra la experiencia de docentes de diseño industrial de la PUCP en su proceso de enseñanza y aprendizaje durante la pandemia Covid-19, de un curso interdisciplinario entre Diseño Industrial e Ingeniería Electrónica y Civil, bajo un enfoque de responsabilidad social universitaria en modalidad virtual. Se buscó desarrollar una parcela demostrativa para el poblado agrícola de Chillaco en la sierra de Lima, afectada por la pandemia. Se realizó una investigación para conocer las consecuencias del escenario virtual en los estudiantes. Los resultados principales fueron: incertidumbre por cómo desarrollar una etnografía a distancia y desmotivación por la ausencia de interacción social de manera presencial. Como plan de acción, para afrontar este escenario, se desarrolló una metodología de enseñanza y aprendizaje para el desarrollo del curso interdisciplinario y una propuesta didáctica para las sesiones de clase virtuales basadas en 4 estrategias didácticas: aprendizaje basado en problemas (ABP), aula invertida, entornos sincrónicos y asincrónicos, y aprendizaje colaborativo mediado por computadora. Para el desarrollo de la etnografía a distancia la ONG suiza EcoHumanita fue un aliado estratégico que facilitó la comunicación entre la comunidad y los grupos de estudiantes interdisciplinarios, a través del uso de herramientas multimedia para conocer más de cerca la realidad de la población. En conclusión, el planteamiento metodológico propuesto para modalidad no presencial dirigido a proyectos con enfoque social, permitió que los estudiantes empatizaran y propusieran soluciones para un contexto rural, desarrollaran habilidades para el aprendizaje autónomo, y reconocieran la contribución que pueden aportar en el desarrollo de la sociedad.

Palabras clave: Educación en línea, aula invertida, diseño social, innovación social, COVID-19, Chillaco (Lima)

1. Facing uncertainty

This review presents the experience of three professors of the Industrial Design career of the Pontificia Universidad Católica del Perú (PUCP), their teaching and learning process in the virtual modality of an interdisciplinary course focused on university social responsibility and social innovation aimed at students of Industrial Design and Electronic and Civil Engineering. The objective was to develop solutions, at the conceptual level, for the village of Chillaco in the highlands of Lima.

In January 2020, the Swiss NGO EcoHumanita requested to develop a social design project in Chillaco. However, due to the COVID-19 pandemic, face-to-face classes were suspended in the country. As a result, teachers and students of the three careers taught the course virtually and conditioned the interactions between teachers, students, and the people of Chillaco.

Chillaco is a vulnerable agricultural population (Figure 1), which was affected by the pandemic and the consequent reduction in the commercialization of its agricultural products. Therefore, the project was based on the design of a demonstration plot to improve the quality of life of its inhabitants, increase productivity and economy, and improve the socio-environmental impact of the area.



Fig. 1

Figure 1. Photographs by Claudia Cardenal, 2020. Entrance to the Centro Poblado Chillaco (Village of Chillaco), view of the Lurin River valley and a Chillaco villager.

The course had 2 sessions per week. Each session lasted 3 hours and was attended by 44 students (15 Design students and 29 Engineering students), 3 industrial design teachers, 4 electronic engineering teachers, and 1 civil engineering teacher.

Industrial Design teachers developed a research to know the consequences of the virtual scenario on students. The results were: perception of high academic load, physical and mental impact due to the continuous use of technological tools, stress due to deficiencies in the internet connection, anxiety and uncertainty due to the impossibility of carrying out face-to-face ethnographic research, and demotivation due to the absence of face-to-face social interaction.

To face this scenario, a didactic proposal was presented using the following learning methodologies:

- **Problem-based learning (PBL).** The strategy allowed learning by discovery and construction. According to Temporetti (2010), Bruner mentions that teaching and learning processes involve the nature of knowledge and what remains to be known. This strategy allowed the student to face the project with autonomy, decision, action, and research of their own to build knowledge.
- **Flipped classroom.** Students were introduced to learn through audiovisual material content prior to the class (Talbert, 2012 and Tucker, 2012, cited in Martínez, Esquivel, and Martínez, 2014). Class time was used to develop dynamic and interactive activities guided by the teacher (Berenguer, 2016).
- **Synchronous and asynchronous environments.** Synchrony in virtual environments fostered information sharing, team decision-making, correspondence, and feedback (Branon and Essex, 2001, Gunawardena et al., 1997, Park and Bonk, 2007, cited in Vuopala, Hyvönen and Järvelä, 2016). In the asynchronous environment, Andresen (2009) mentions that time allows space to think, respond and make decisions.
- **Computer-mediated collaborative learning.** It determined the interaction between students, interpersonal communication, and the achievement of team goals (Vicente, 2019) in a virtual way.

2. Solutions to connect with social issues

The design of the course rescued what Margolin and Margolin (2012) stated about design skills in relation to vulnerable populations, which need to be developed in multidisciplinary or individual groups to investigate and analyze social needs that can be solved with design solutions.

Remote ethnography was used considering virtual education and the distance to Chillaco, which is a research method that allowed to know more closely the reality of the population with the online approach and the use of multimedia tools. Miller (2020) comments that, despite the limitations in the research, it is possible to carry it out in an original, meaningful and revealing way, and that the interaction, adaptation and understanding will be particular to each population.

Chillaco has limited telephone and internet connection, which made it difficult to hold videoconferences. However, the Swiss NGO as a partner and intermediary facilitated the connection and communication with the community. For the remote ethnography, students conducted telephone interviews and exchanged videos and photographs with villag-

ers during their daily work, and focused on participant observation, but from a distance (Miller, 2020).

The first cycle of the course began with investigating the context and problems, carried out by each specialty and then shared to analyze the information. In the next cycle, five interdisciplinary groups were created to design a demonstration plot according to the needs identified in the population, which required information exchange and constant dialogue among the groups (Figure 2).

The action plan (Figure 3) for the virtual class sessions was to implement classrooms or collaborative work spaces for each group of students. This allowed the presentation of progress, review of (pre-recorded) theory, information and assignments, as well as personal and group tutorials. Vuopala E., Hyvönen, P. and Järvelä, S. (2016) mention that group interaction focuses on coordinating, planning, and organizing activities. In addition, the classrooms generated social spaces for informal expression and communication, which encouraged interaction and mutual support.

This change brought great dynamism, greater exchange of information, collaborative work, and development of creativity in the projects. Many students commented that this change was very similar to the classroom style at the university.

The strategies implemented in a short time gave very good results and saved time in the integration of the teams and communication.

Despite the impossibility of conducting ethnography *in situ*, the students developed empathy and ethnographic workskills through virtuality and ubiquity, by searching for their own information and communicating with the villagers, who in some cases assumed a collaborative role as they felt part of the process. (Figure 4)

3. Achievements of the methodological proposal

The methodological proposal allowed the students, despite the distance, to understand a context alien to their reality through the use of the ethnographic method, technological tools, new interaction dynamics, and information search strategies. This allowed a result of social innovation that represents a contribution to the population, such as the design of Allpa, a demonstration plot for Chillaco, comprised of five conceptual design proposals, shown in Figure 5: design of terraces, cultivation system, irrigation system, renewable energy system and sustainable housing.

The methodological approach with the non-attendance modality aimed at projects with a social focus enabled the development of competencies for the students' professional future and their adaptation to the post-COVID-19 work context. In addition, with the interactions generated, the flipped classroom and collaborative learning, the students developed skills for autonomous learning, interdisciplinary teamwork and recognized the contribution that the discipline of industrial design can make to the development of society.

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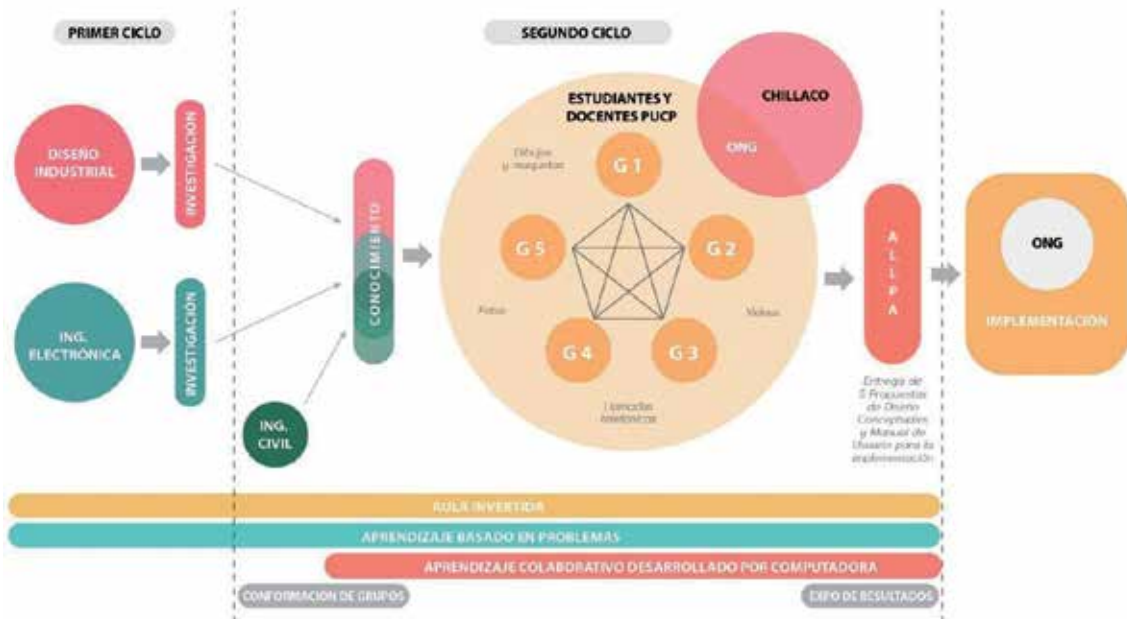


Fig. 2

	CLASE					TAREAS	ASESORÍAS
	INTRODUCCIÓN	DESARROLLO			CIERRE		
SOPORTE TECNOLÓGICO	ZOOM	ZOOM BREAK ROOM 1 (EXPO Grupo 1)	ZOOM BREAK ROOM 2 (TEORÍA Grupo 2)	ZOOM BREAK ROOM 3 (TAREA Grupo 3)	ZOOM	MOODLE	ZOOM
MODO		Sincrónica				Asincrónica	Sincrónica (Fuera de Clase)
INTERACCIÓN	Estudiantes - Docente	Estudiantes - Estudiante			Estudiantes - Docente	Aprendizaje Autónomo	Conversación Bidireccional con Docente
TIEMPO	30 minutos	Grupos de Estudiantes en Simultáneo*			20 minutos	Según el estudiante	20 minutos por alumno (Opcional)
CANALES MULTIMODALES	Pantallas Compartidas	Exposición PPT	Diálogo - Video	Diálogo - Pantalla Compartidas	Pantallas Compartidas	Elaboración de PPT Foros, Informes	Pantallas Compartidas
EVALUACIÓN	-	Retroalimentación	-	-	-	Autoevaluación Rúbrica Retroalimentación	-

Fig. 3

Figure 2. General annual methodological plan for the development of the interdisciplinary course
 Figure 3. Didactic proposal for the virtual classroom session



Fig. 4



Fig. 5

Figure 4. Photograph by Claudia Cardenal, 2020. Villager testing student César López's prototype for land habilitation.

Figure 5. Allpa: Demonstration plot designed by students of the interdisciplinary course 2020 - 2.

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