Transdisciplinary design of virtual learning environments: the case of a xMOOC on the study of electrical energy

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ABSTRACT
The man objective of transdisciplinarity is the quest for the unity of knowledge through the elimination of disciplinary boundaries. Implementing transdisciplinarity implies the creation of a common conceptual, theoretical and empirical structure among disciplines, therefore, its execution processes often offer interesting opportunities in educational research. This case study seeks to investigate the experience of a group of professionals from different disciplines who participated in the design of a xMOOC entitled "Electrical Energy: Concepts and Basic Principles", which is part of the Bi-National Laboratory on Smart Sustainable Energy Management and Technology Training, project financed by CONACYT-SENER's energy sustainability fund. This paper explores the challenges faced by team members to achieve the objectives of course design, investigating personal characteristics that determine the tendency of solutions or problems in the development of the course, and exploring the implications of their participation in further teaching and research practices. Using a variety of methods, including semi-structured interviews, recorded conversations (dialogue in interaction), field journals-Participant Observation and the analysis of official documents, it was found that the consequence of the joint work of multiple disciplines in a related project causes the absence of individualism, generating opportunities for revision, reflection and intellectual discussions that enrich both the contents and the learning environment. In this type of projects, sharing information was not the essence of collaboration, but the common understanding that evolves through dialogue, discussion, tolerance and consensus building. Although working in a transdisciplinary manner involved hard work when there was no clarity or hierarchy in the roles, when there were differences in terminology and domain models, or communication flaws, this type of projects produced synergistic effects which steered more efficient educational processes and products, fostering mutual support and leading to the transformation and improvement of teaching and research practices.

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CCS Concepts
- **Education→e-learning**
- **Education→Collaborative learning**
- **Education→Computer-assisted instruction**
- **Education→Interactive learning environments**

Keywords
Transdisciplinarity; MOOC; collaboration; educational practices; e-learning

1. INTRODUCTION
Consciously or unconsciously human beings learn every second of their lives. But learning unconsciously does not mean that the process is simple, actually it is quite the opposite. Learning encompasses both, thoughts, feelings and perceptions that are realized within individuals, as well as actions and decisions that are made before a learning experience. Most of these decisions are the result of previous learning, in other words, the action of learning implies not only the accumulation and structuring of knowledge, but also its use and transformation. In addition, learning is developed in a social, cultural, and material context, therefore, it is part of the interactions with other people who possess diverse skills, knowledge and perspectives. In this sense, learning is linked to the context and practices of the community in which the individual is immersed [14]; [31].

The context and practices of communities in which we learn are in a continuous evolutionary process. To learn efficiently today, it is necessary to manage patterns and structures that are increasingly complex and diverse; with technology, resources to access knowledge are vast, and communication channels are borderless. The vastness of information and communicative diversity, are key features of our time, both fundamental concepts that concern the changing nature of learning, educational research, and the future of education.

In higher education, technological resources have played an important role as facilitators of new ways of teaching and better ways to build interconnections, leading to different ways to train experts. As a result, new technology-based environments or ecosystems have emerged, one of which has demonstrated great potential in recent years: MOOCs (Massive Open Online Courses).

Although MOOCs have been very well welcomed by educational institutions, the insertion of these ecosystems has been rather complex. Like all emerging movements, MOOCs have been subject to scrutiny in empirical research, questioning its functionality, purpose, impact and utility in education. This has resulted in a set

of challenges that mainly fall into two types of sources: in one hand participants and in other hand designers. As for the challenges of participants, for the first time in history of education they are responsible to determine for themselves when and how to get involved, what elements to focus on, and how to manage their resources, thus defying their ability to motivate themselves and self-regulate their own learning [23]; [35]. As a result, the challenge of designing learning environments that optimize students' ability to learn, keep them motivated, and strengthen their autonomy and self-control, falls into the team that designs them. In most cases, the team is comprised by professionals from different disciplines, among them instructional designers, web programmers, multimedia materials producers, and content experts.

Thus, one of the main challenges facing MOOCs designers is the process of design itself. Previously, teachers were the only figure responsible for designing learning environments to instruct knowledge of their discipline. Developing a MOOC, however, requires the participation of people from different disciplinary domains, who need to merge their knowledge, experiences and tools to work together for the same purpose. Therefore, developing a MOOC is challenging in terms of collaboration and communication for experts from different disciplinary areas, due to the use of different terminology and management of different models and techniques [34].

A second challenge for MOOC developers is the presentation of the content and its technical quality, as well as the visual and structural design, base language, and platform compatibility [33]; [30]. Designing a technology-based learning environment means that the team has to have a solid understanding of technology tools and equipment, as well as designing video, audio, style, among others [1]. Another important challenge of MOOC developers is the importance of having up-to-date knowledge about participants' learning, cognition and motivation processes; if they do not understand how they learn and solve problems, they will have little chance of having an effective and efficient instruction [27].

For those working in the design and development of this type of ecosystems, it is possible that some challenges could lead them to feel insecurity, uncertainty or resistance; the path from unidisciplinarity to transdisciplinarity in course design, and from presence to distance in course delivery is not a simple process. Therefore, change management should be planned and implemented with caution by higher education institutions [12].

This research main objective is to investigate the experiences of a team integrated by web programmers, producers of multimedia materials, instructional designers and experts of content, with respect to the challenges and possibilities of the design of an xMOOC. Specifically, it investigates the challenges they face in order to achieve the objectives of course design, studying personal characteristics that determine solutions and problems, and also implications of their participation in their teaching and research practices. In the first part of this paper, a definition of cMOOC and xMOOC is presented, then, some characteristics of the xMOOC "Electrical Energy: basic concepts and principles" are presented, followed by the main challenges of a transdisciplinary MOOC design. The method is presented afterwards, along with the results, discussion and some final remarks as conclusions. As research in education works in this direction, it will be possible to understand how to promote the collegial work of teachers from different disciplines in the design of environments mediated by technology, making a great step towards the improvement of educational processes and resources, specifically the design processes of self-directed teaching and learning environments.

2. THEORETICAL BACKGROUND

2.1 cMOOCs and xMOOCs

MOOCs origin is linked to two main phenomena, on one hand the emergence and growth of Open Educational Recourses (OER), and on the other hand, the impact of open education. MOOCs are a type of virtual learning environment but with free and open registration option, characterized by having a common public study plan, open participation, social network integration, and use of OER. They are massive in the sense that they can attend an unlimited audience, and open in the sense that in some cases there is no fee to participate with no entry requirements are requested; to enter only internet is indispensable [10]. In this way, OER specifically MOOCs, emerged as a very good and structured opportunity to acquire online knowledge, demonstrating a unique role in ecosystems that offer educational environments [3]; [9]; [21] and [22].

The first MOOC that emerged was based on a connectivist learning theory, it was named cMOOC. In cMOOCs knowledge is acquired through a collaborative community to transform previous knowledge through new learning [25]; [26]; its emphasis is in the creation of knowledge by students who are basically autonomous and collaborate through social networks. Shortly thereafter xMOOCs emerged, focusing on a traditional cognitive learning theory [26]. The xMOOCs use the lecture mode or popular exposure by the teacher, but the content is delivered online to the participants who download the video-recorded lectures. They also use traditional assessment methodologies such as quizzes or quizzes, sometimes students complete online assessment and receive immediate computer feedback, and in others it serves only to give feedback to participants; alternatively tests are used to determine a certificate grant. In sum, xMOOCs allow the registration of large numbers of participants, provide facilities for storing and transmit demand for digital materials, and automate student performance assessment and monitoring procedures [26].

2.2 Contextual framework

The Bi-National Laboratory on Smart Sustainable Energy Management and Technology Training is a project financed by CONACYT-SENER's energy sustainability fund. It consists of a training platform that seeks to offer high-impact solutions to the national and global challenges of sustainable energy. Its main beneficiary is the electricity sector of Mexico through the Federal Electricity Commission (CFE, for its initials in Spanish). This project is joined by five national and international higher education institutions, leaders in sustainable energy and technological development, among them the *Tecnologico de Monterrey*, the National Technological Institute of Mexico, the Institute of Electrical Research, the State University of Arizona and the University of California at Berkeley.

One of the objectives of the Bi-National Laboratory is the training of specialized talent in the electrical sector. Therefore, a set of courses based on xMOOC technology are being developed to meet the training needs of this objective. One of them corresponds to the course "Electrical Energy: basic concepts and principles", chosen as the scenario for the present investigation.

The MOOC "Electrical Energy: basic concepts and principles", corresponds to an xMOOC mounted on the MexicoX platform, its focus is on a traditional teaching model of transmission of information with high quality content delivery. Although xMOOCs are based on cognitive and behavioral theories, the activities of this course are also driven by theories of learning construction along

with teaching techniques aimed at educating adults. Evaluation is marked by computer mainly for student feedback purposes; all key transactions between participants and the learning platform are automated. In addition, it corresponds to a type of basic experimental theoretical course which seeks to address the principles of electric energy as well as explore processes for its application. The implicit aim of this course is protecting the environment and reducing electricity service costs. Therefore, it offers the basic concepts and principles of electric energy to understand how it works, how it is measured, and how it is used efficiently.

2.3 Challenges in the design of an xMOOC

The interest of this section is located in the analysis of challenges while designing MOOCs in the framework of higher education, given the importance of monitoring the communities of various disciplines that converge in their development.

2.3.1 Transdisciplinary design

The challenge of creating online, massive and open learning environments that optimize students' ability to learn, motivate, and strengthen their autonomy falls into the team that develops them. This team is comprised by people who have different skills, practice, and master certain techniques or methodologies within different disciplines. In the literature it is possible to recognize the value of diverse teams when designing learning environments based on technologies [20]; these teams' products are usually called multi-, inter- or transdisciplinary projects.

Although there is a current ongoing debate regarding the delimitation, use, and application of the concepts multi-, inter-, or transdisciplinarity, in this research the latter concept is chosen for several reasons. [17] mentions that transdisciplinarity is the quest for the unity of knowledge through the elimination of disciplinary boundaries. According to the author it refers to what is in turn between disciplines, across different disciplines, and beyond all disciplines. Its main objective is the understanding of the world today, seeking as its imperative the holistic characteristic of knowledge. Compared with the interdisciplinary cooperation processes in which knowledge and techniques are integrated in a common framework, transdisciplinarity occurs when the process of collaboration goes one step further and the concepts and methods of one discipline transcend to another, creating an epistemological change [15]. Moving from inter- to trans- is not easy, the process requires coherent interpretation and mutual understanding among the different disciplinary domains.

According to [6], transdisciplinary action focuses on complex real-world issues and challenges, such as globalization, climate change and sustainability; in this regard, projects of this nature address the current challenges using integrative approaches to knowledge training. The same author mentions that transdisciplinary work implies a critique of the conception of academic work as a pure form of knowledge creation disconnected from real world contexts.

A design of a transdisciplinary project has openness to a multiplicity of perspectives, characteristic of team works [7]. There are many challenges in the realization of a transdisciplinary design project, one of them is communication of experts from different areas due to the different terminology, models, and domains, present in the design [34]. At this point, communication, listening, and negotiation skills are extra needed. [33] and [30], argued that another challenge is the presentation of the content and its technical quality in visual, structural, base language and compatibility. It is necessary for the design team to develop certain kind of base knowledge in technological areas in order to succeed. Another challenge corresponds to attitudes and aptitudes that team members should seek; for example, in the literature it is found that instructional designers must have excellent dealings with people, being able to communicate effectively with other team members, both verbally and in writing, they should be able to provide advice on design models and teaching strategies, so they must be aware of new theories of education or training and research to apply them, should also have knowledge of the important software tools, and finally, they must have problem-solving and decision-making skills [8]; the list of attributes of team member could go on. Despite the challenges mentioned above, the shift to multi-inter- or transdisciplinary action is considered to be increasingly important in the contemporary production of knowledge and educational recourses. Some benefits of transdisciplinarity found in the literature are the unity of knowledge that provides the complementarity of disciplines [17], cross-fertilization, peer review, evaluation and reflection of teaching-learning approaches [18].

In the design of virtual learning learning environments and specifically in the design of MOOCs, transdisciplinarity is essential, for instance, while the content expert chooses the material to be addressed in the course, the instructional designer supports the development of the training experience by providing pedagogical ideas to the content expert, the graphic designer complements it with visual communication and image of the course, and the producer supports the recording of resources [20]. It is clear that this union of knowledge generates cooperation processes that integrate different techniques in a common framework, permeating the concepts and methods from one discipline to another, creating an epistemological change.

2.3.2 Peers collaboration

Given the influence of social context on the construction of individual knowledge [29], much has been argued in favor of collaboration between different disciplines in educational settings. Although it is well known that professionals learn through reflection on their own practices [2], peer collaboration provides communication systems that mediate learning in different ways [11], besides, it is in the exercise of dialogue and listening of different points of view form different domains, that knowledge is redistributed, diversified, and expanded.

A number of studies have provided empirical evidence that professional networks offer excellent opportunities to work and learn together, as well as to improve the quality of life of their communities [13]; [16]; [19]; [32] and [4], resulting in better practices and thus better learning outcomes. The exchange of knowledge and experience generates reflections on each other's practices and ideas, which in turn can result in an expansion of knowledge and refinement of professional practices [5].

For instance, according to [4], when teachers participate in environments where they are encouraged to respect reflective, growth-oriented and practice-oriented thinking, they may be able to generate less in-depth explanations of their actions and become more receptive and confident to change to improve their own practices. According to the author, there are three conditions necessary to generate a shared dialogue to promote teacher learning: (1) first, when teachers talk to each other about their work, they evaluate the decisions of the other. If tensions are seen as opportunities for change, they are more likely to make sense and conflicts become productive and new solutions; (2) if they know

that the purpose of sharing their teaching is to generate new understandings about practice, teachers may feel encouraged to anticipate, negotiate and understand their self-assertion about their own choices; and (3) whether teachers recognize the critical and affirmative functions of dialogue as beneficial to their learning.

3. METHOD

The present corresponds to a case study of phenomenological nature. Data were collected from four different sources: (1) interviews, (2) recorded conversations (dialogues in interaction), (3) field journals, and (4) analysis of official documents. The interviews were performed to some members of the working group for the design of the xMOOC, specifically three content experts and two instructional designers. In the recorded conversations (interaction dialogues) and in the field journals (3), all the members of the MOOC design group participated, specifically, three content experts, one instructional designer, one audiovisual producer, and the educational innovation team. Two official documents analyzed were (1) presentation entitled "XMooc Energy: Sub-project: Open, interdisciplinary and collaborative innovation to train in sustainability energy through a Mooc", dated November 2016, and (2) the "Instructional Design Guide: Sub-project: Open, interdisciplinary and collaborative innovation to train in energy sustainability energy through a Mooc", dated April 2016.

Data from all sources was analyzed using the software program designed for computer-assisted qualitative and mixed methods data, text and multimedia analysis in academic or scientific institutions: MAXQDA 12. Using an inductive approach, the procedure of data analysis included the following activities: (1) encode interviews and transcribe code segments; (2) integrate codes into emerging themes and categories taking frequencies; (3) corroborate data from interviews with other sources of data obtained; and (4) prepare descriptions of the main codes and sub-codes. Support of external researchers in data analysis was sought to ensure consistency, transparency and triangulation of the findings.

4. RESULTS

Five semi-structured interviews, five field notes, and three transcripts of recorded conversations (interaction dialogues) were collected and analyzed in total. The list of all codes and sub-codes that emerged from the analysis can be consulted in Table 1. Only codes and sub-codes relevant to give answer to the research questions were selected and are presented as results of this research; namely they are: Transdisciplinary collaboration, Collaboration among peers, Communication, Tendencies of solutions and problems, and Implications in teaching and research practices (see * in Table 1). Each category is comprised of some codes or sub-codes taken from Table 1 and will be presented as a challenge associated with the transdisciplinary design of a MOOC.

Table 1. Codes

Codes and sub-codes		Frequency
Team transformation/teacher transformation*		6
	Awareness raising-empathy*	6
Audience requirements		8
	Discipline	1
	Autonomy	1
	Motivation	2
	Self-regulation	4
Recourses		4
	Technological support	2
	Impact	2
Communication*		5
	Attention to diversity	1
	Communication among disciplines*	3
	Peer communication	1
Limitations*		26
	Time	4
	Design*	4
	Transmission or construction*	10
	From presence to distance*	6
	Technological interaction	1
	Distance communication	1
Future projection (tendencies for solutions or problems)*		6
Collaboration*		56
	Transdisciplinary collaboration*	14
	Game of power*	5
	Mediators*	8
	Synergy*	6
	Professionalism*	6
	Collaboration among peers*	3
	Camaraderie*	1
	Knowledge sharing*	5
	Discussions and consensus*	5
	Diversity of strategies	3

* Relevant codes to give answers to the research questions

4.1 Challenges

4.1.1 Transdisciplinary collaboration

Although some of the participants agreed that working with different disciplines is time consuming due to the effort to end up with a consensus when discussing a topic, they also agreed that working in synergy with experts from other disciplines gives professionalism to the project that could not be obtained by working in a disciplinary manner. They recognized the added value of working with experts in technology products, such as experts in pedagogical design, graphic design and audiovisual design: "there's a lot of difference between the quality of this work that you do alone, and the work you do with people who know the subject professionally, since they are experts in things that we do not" (interview, personal communication 1).

Teamwork with people from different disciplines was defined as "uneasy", there are many tasks that accompany this objective. One of the challenges mentioned by members of the team is related to the educational content to be transmitted. It has to be agreed by the team the role of every member to avoid "power struggle" in the decision of the material to be taught (interview, personal communication 2). Here, some kind of yielding attitude, "as in marriage" (interview, personal communication 2) is needed to make agreements. Nonetheless, the team recognized that this way of working "enriches educational products and makes processes more efficient" (interview, personal communication 4).

4.1.2 Collaboration among peers

The benefits of working on the design of course content in conjunction with colleagues from the same area and from different disciplines were notable. They point out that, although the interaction is complex, the content discussions have given the course a "triple added value" (interview, personal communication 2), since content is improved with the best practices of all members:

> "The truth is, it is much more enriching to work as a team [...] we have to communicate with each other, and that generates discussions but it enriches the work a lot. You have to be aware that by the fact that you think that everything is perfect, it ends not being close to perfect when you have to consider the opinion of other minds, other points of view" (interview, personal communication 3)

They also identified that, even within the same traditions, there are differences of concepts or terms that make a difference in how to explain a concept. This problematic has generated that the sessions of work become more complex, but in turn more complete. Consensus and agreements have served to "learn different ways of teaching based on feedback from colleagues" (interview, personal communication 3); however, as in a couple relationship, teachers consider that the key to this transdisciplinary relationship is to yield not in one, but in many occasions: "on many occasions you have to give in, even if you do not think that what they propose will work. But you do not want to look stubborn. It's like in a relationship." (interview, personal communication 2).

4.1.3 Communication

Communication in the working sessions was cordial. Members participated in the construction of the contents using the dialogue as a means to generate discussions. The team agreed that "communication without respect is not communication at all" (interview, personal communication 1). According to some members, communication benefits from individual attributes that range from attitudinal issues or values, such as patience, listening skills, tolerance, and a research attitude to find the best solution or best way to deal with different challenges. Besides, to have a close communication with colleagues in the same and different areas, provides in educational institutions a "sense of camaraderie" (interview, personal communication 2) which could be beneficial, according to them, inside and outside course design sessions.

One of the topics mentioned by the team was hierarchies. According to them, having hierarchies in team work in this cases could be detrimental. They supported a horizontal relationship in which in their own words: "I am not less, I am not more, but we are working as equals, that is something that helps us a lot" (recorded dialog).

4.2 Aspects that determine the tendency of solutions and problems

Some concerns emerged during the design sessions of the MOOC. The first has to do with the very function of education and with the purpose of an online, open, and massive course. Their distress evokes the uncertainty of the main goal of education in higher education, "is it important nowadays to transmit knowledge or should we design courses to construct it? education is not about transmitting information, for that we already have the internet" (interview, personal communication 1). Some other members mentioned their worry arguing that "making a content 'beautiful' won't make the student learn better" (recorded dialog).

A second concern mentioned by the team was the use of predetermined institutional templates to design the course. According to some members, using templates "creates inflexible homologous design, causing lack of imagination and creativity" (interviews, personal communication 1, 2, 3). For some other members, templates are more than needed to organize and structure the course design.

4.3 Implications in further teaching and research practices

Having participated in the design and development of an xMOOC has had a double impact on team members. For teachers, on the one hand, it has improved teaching practices, and on the other hand it has impacted on the way in which they work with their peers. Teachers mentioned that they have been "sensitized" in terms of recognition of students' cognitive variation and recognition of their individual differences: "it transformed me to write and explain differently in a way that I was not used to [...] it is like leaving your mind and see with your student eyes" (interview, personal communication 2). On peer-to-peer work, teachers mentioned that "together they have improved" (interview, personal communication 4) in designing their classes by recognizing different forms of teaching than their own. For other team members, participating in the design of these courses meant learning from areas and methods of which they had no knowledge, "I learned a lot and what I learned will be useful not only for my professional development or for my work, but for the challenges I face in my daily life" (recorded dialog), they also mentioned that working with other disciplines have made them feel "empathy" to other members' work and contributions, as they know and "live experiences" of designing very close to them and thus recognize "the hard work they perform" (interview, personal communication 3).

5. DISCUSSION

The present study collected information from a transdisciplinary group that participated in the design of an xMOOC entitled: "Electrical Energy: Concepts and Basic Principles". In this section, the three main findings will be discussed in the light of the existing literature, then, limitations of this study will be presented, and finally, areas for additional studies will be suggested.

The fist topic to discuss in this paper is collaboration. Collaboration is generally defined as working together; typically, collaborators share power and contribute with knowledge and skills. This research as [7], demonstrated that teamwork with different disciplines is not an easy goal to accomplish, in other words, getting along or communicating information with each other is not the essence of collaboration, but the common understanding that evolves through dialogue, discussion and the formation of agreements or consensus. Although one can assure that the work load seems to be divided, this research, like [34], concludes that in many cases it is more difficult and time consuming when there is no clarity in the roles, when there is overlap or hierarchy inside the team, when there are differences in terminology, models or domains, or when there is a lack of dialog and agreements.

A second concept to discuss is transdisciplinarity. The consequence of the close coexistence of work of multiple disciplines in a related project provokes the absence of individualism, which generates opportunities for joint revision and reflection, intellectual discussions and tolerance, thus achieving what Nicolescu called the unity of knowledge [17]. Working in a transdisciplinarity way also had synergistic effects with which it was possible to have more efficient processes, fostered mutual support, and transformed and

improved educational practices. This was consistent with [18] research regarding the reflexive methods of the teaching-learning process that are obtained in working with peers. Phrases such as " it transformed me", "I am more sensitive to the diversity of students" "I feel empathy with my team" "you no longer think of yourself but the students and their needs," "it is like leaving your mind and see with your student eyes", were mentioned by team members. Empathy is an important value to pursue in every organization, this concept is worth further research.

Although results revealed a sense certain hierarchy in the team relationships, with the use of dialogue, construction of agreements, empathy, understanding, listening, and acceptance of other's point of view, it can be concluded that in the design work sessions a real collaborative process took place.

This research supports the findings of [8] with regard of the importance of the role of an instructional designer in the development of courses. Climate is built to some extent by this figure, who in this case demonstrated the ability to communicate effectively with all members of his team, provided advice on design models, teaching strategies and tools, and had problem-solving skills. It is possible to infer that the work of an instructional designer is full of challenges along the way of designing a MOOC, because in addition to acting as an instructional designer, this figure becomes in itself knowledgeable of the content that he or she designs. This topic could be interesting to expand in further research.

In this study it is recognized that there is no qualitative or quantitative method to ensure the objectivity of knowledge about social processes, since it is not possible to exhaust all dimensions of reality in a study [24]. One limitation of this research was the use of the qualitative interview as a technique of data collection. The interview provided richness to the research by integrating the experiences, feelings and interpretations of the people interviewed, but at the same time, due to its unique character, the discoveries cannot always be generalizable [28]. A second limitation was the use of participant observation to generate the field journals. This study recognizes that the occasional encounter, week by week, implies an emotional relationship with the observed agents that can prevent to see what actually exists, or not, in a case. To overcome these limitations, validity was carried out through data triangulation, in which four sources of information were used to identify the diversity of perceptions and the different realities.

One strength of this case study was the insertion of the researcher into the work sessions for a long time, this allowed an empirical study of human activity. The field journals allowed to generate a mixture of descriptions, interpretations, opinions and mixed feelings. Another strength of this study was the establishment of rapport [24], which was fundamental for a better observation and compilation of information. In this case study it was possible to have sympathy and openness of the informants to cooperate in the study, since they were taken as subjects producing valuable knowledge.

Any collaborative project between disciplines - multi, inter, or transdisciplinary - adds value by providing access to a broad knowledge base. For projects in higher education, an additional advantage is that it reproduces more closely the real world of students' current needs, as compared to individual disciplinary models.

It is important to reflect on the anguish of teachers and professionals towards this new teaching and learning environments. Their concern in understandable when visualizing a future with little people interaction and little theoretical or practical depth. It is also understandable when it is noticed that the true value of any educational work lies in the feedback, the personalized follow-up, and the motivational stimulus provided by the close interaction with people, not the content that doubles and changes easily; that content lacks or has very little value.

For now, the generation of knowledge lies in the understanding of our relationships with others. This project promoted a natural movement of a transdisciplinary working group, with the intention of sharing the possibilities and challenges of the transdisciplinary course design projects, and its echo in the complex reality of the current educational practice.

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