– TOOLKIT –

INTER-DISCI-PLINE.

FOR COLLABORATION AND CO-CREATION ACROSS DISCIPLINES

iCuboUDD

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INSTITUTO DE INNOVACIÓN E INTERDISCIPLINA

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Interdiscipline, a current challenge

Interdiscipline has gained a position as a relevant element for the development of a broad disciplinary curriculum, which supports the development of skills associated with critical thinking, analytical and global vision of a complex professional context.

This type of pedagogical activities has become a pillar of UDD Futuro, a line of strategic development of the undergraduate program of Universidad del Desarrollo, wherein the Interdisciplinary Labs (Lab ID) have been positioned as activities that should develop the aforementioned skills in greater depth.

Interdiscipline being a fundamental pillar of the UDD Futuro project and a relevant aspect in the mission of the university, this component, at present, has been implemented through the creation of specific pedagogical experiences, being the Interdisciplinary Lab the most complex and relevant space for its application. However, the practical trajectory of three years of piloting Labs have highlighted the difficulties of designing and implementing effective collaborative experiences between disciplines.

The research and resource development project "Strategies and tools for collaboration and co-creation in interdiscipline" aims to continue the line of work of the responsible teacher, associated with Co-creation tools ("Co-creation Toolkit" Resource Project) from the interdisciplinary space and with the support of the Interdiscipline Vice Rector's Office. In this context, the research will focus on solving a series of questions related to the effective implementation of collaboration and co-creation among students from different disciplines in interdisciplinary pedagogical environments. To this end, a systematic review of contemporary literature will be carried out, in addition to interviews with teachers who have undertaken the design and implementation of Labs from 2018 to date, thus, generating a survey and systematization of pedagogical strategies, tools and dynamics, with the aim of designing an "Interdiscipline Toolkit" that promotes and facilitates intensive collaboration. In this way, the aim will be to provide tactical knowledge to move from multidisciplinary experiences to interdisciplinary experiences.

UDD Interdisciplinary experiences in Lab format

2018	2019	2020
Food product development (ICo+N+D) / CCP	Cardiovascular rehabilitation (Ps+K+N) / SCL	Food Design Trends (ICo+N+D) / CCP
Concepcion on two wheels (D+Pe+A) / CCP	Sustainable Technology Lab (ICv+A) / SCL	Immersion, communication and health (F+Pu+Pe) / SCL
Las Condes smart commune (D+Pe+A) / SCL	Public Innovation (D+PP) / SCL	Food product design (N+D) / SCL
Cardiovascular rehabilitation (Ps+K+N) / SCL	Food Design Trends (ICo+N+D) / CCP	Cardiovascular rehabilitation (Ps+K+N) / SCL
Athlete Integral Support Center (Ps+K+N) / SCL	Quiriquina Island (D+Pe+ICv) / SCL	Athlete Integral Support Center (Ps+K+N) / SCL
Integral Construction (A+ICv)	Effective inclusion for handicapped persons (Pu+Pe+A) / SCL	

Table 01: *List of Interdisciplinary Labs conducted during the years 2018, 2019 and 2020, informed by the Interdiscipline Vice Rector's Office. Source: self-developed based on the Universidad del Desarrollo academic records.*

[1] Nomenclatures:

A: Architecture
D: Design
F: Speech Therapy
IC: Commercial Eng.
K: Kinesiology

N: Nutrition
Pe: Journalism
PP: Public Policies
Pos: Psychology
Pu: Publicity

Project and pedagogical challenges in the implementation of interdisciplinary experiences

During the three years of piloting the interdisciplinary activities in Lab format, different approaches, dynamics and methods for their execution were developed. To a large extent, these activities are promoted by the directors of each career with the idea of implementing a specific experience, or by professors who wish to develop a specific topic and interest (either in alliance or not with other professors). The topics addressed by these experiences have been diverse and can be observed in relation to the approaches applied, the results and experiences.

Below are some conclusions regarding the challenges to project and manage interdisciplinary experiences in the context of teaching at Universidad del Desarrollo. These points of view have emerged from our own experience and from interviews with professors (5), coordinators (3) and deans (1) linked to the execution of these ID Labs.

- The design of an interdisciplinary experience is in itself an interdisciplinary project between teachers and directors, where it is necessary to have a common vision and adequate teaching profiles for its execution.
- The students participating in these experiences also need to have an adequate profile and motivation to face a change of format that sometimes can be radically opposed to the daily routine of the discipline.
- The need for an adequate preparation and conformation of ID teams, as well as ways to manage them, and facilitate their processes and crisis.
- Formulating challenges requires the identification of complex problems to motivate interdisciplinary teams to address issues relevant to complex and systemic collaborative work.
- Collaboration is a central element and key skill of the interdisciplinary process that needs to be developed in a thorough and recurrent way throughout the whole experience.
- Evaluation of the results of the interdisciplinary experience is an element to be reviewed in all planning. This evaluation cannot be limited to the traditional academic milestones, but must also address different dimensions such as teamwork, critical reflection and the process itself and not only a final product.

Conceptual Framework

In order to use a toolkit to support the interdisciplinary methodological process, it is required to integrate a vision of collaboration between disciplines, bringing together concepts related to complexity, the different interdisciplinary dialogs, the disciplinary contributions in these dialogs and the necessary skills to carry out a process of integration of views with a common objective.

Base concepts to understand interdiscipline and its context in the academy

– From a specialist paradigm to a systemic paradigm

Interdiscipline provides us with a collaborative process that allows us to solve problems or challenges that are not possible to address, thoroughly and systemically, from a strictly disciplinary point of view. Therefore, the purpose of implementing interdisciplinary experiences will be associated to intervene new realities and/or generate new knowledge beyond disciplinary limits.
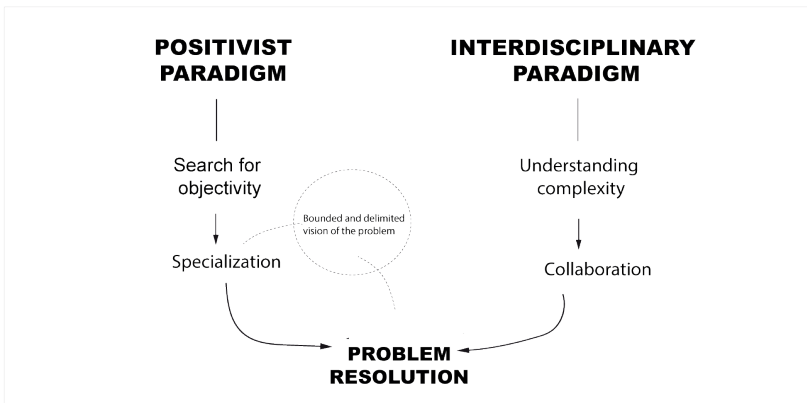
| Image01: *Distinctions between the objectives and approaches of problem solving from a cognitive point of view. Source: Own elaboration*

The positivist paradigm of disciplinary scientific development has led to a landscape of knowledge silos, in some cases unconnected with each other. Specialization has been a disciplinary objective that has resulted in an exponential increase of knowledge in diverse specific fields; however, the complexity and problems derived from systemic backgrounds are not possible to solve from that paradigm. Therefore, in the search to understand this complexity, interdiscipline emerges as a way to approach the systemic from intensive collaboration between disciplines.

Complexity

Complexity is part of the context that gives meaning to the configuration of the interdiscipline, where different disciplines dialogue and contribute to intervene in complex, wicked problems that cannot be addressed by a single discipline. These wicked problems can be understood as complex social or cultural challenges, for example, remote family and work life in pandemic times, with an unknown number of possible solutions (Rittel & Webber, 1970). These difficulties are developed at global, community and individual levels; therefore, and because there are no clear solutions for their resolution, it is necessary to address them from interdisciplinary approaches that allow establishing diverse perspectives and points of view.

The understanding of reality and its complexity requires different perspectives. Interdiscipline incorporates the competence of the global vision of a whole and its parts. This global vision cannot be possible based on the understanding of the context based on the breakdown of its parts under fragmented and unconnected perspectives (Medina, 2006). Thus, complexity feeds on the systems theory, focusing its thinking on context, emphasizing relationships, their connections and, in short, understanding reality from "a perspective of movement and in a relational way" (p.10).

As mentioned above, wicked problems possess certain characteristics that allow them to be identified, which relate to their systemic and multi-causal nature. Therefore, in order to establish an interdisciplinary challenge and consider it a wicked problem, it should meet at least the following criteria:

- The different stakeholders have diverse views (contradictory in some cases) regarding the problem, causes and possible solutions.
- The problem causes and background are systemic and complex to observe at the beginning.
- There is no clarity on how to solve the problem, and it is not possible to approach it only from a disciplinary point of view.

Disciplinary perspectives and contributions

The exercise of thinking about interdisciplinary activities requires to consider the status of each discipline and its contributions to the collaborative process in regards to the production of its knowledge and its execution.

The chart below shows a division of disciplinary areas (macro categories), where the contributions of each area are differentiated according to the nature of its knowledge

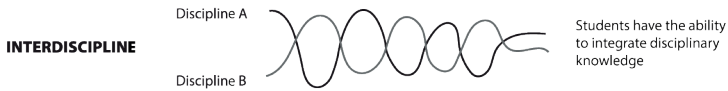| Disciplinary Areas	Nature of its knowledge (by Becher)
Natural Sciences	Accumulative; atomistic; concerned with universal criteria, quantities, simplifications - their results contribute in discoveries or explanations.
Humanities and Social Sciences	Reiterative; holistic; concerned with particularity, qualities, complexity - their results contribute to understandings or interpretations
Professions based on sciences	Task-oriented (Proposer); pragmatic; concerned with the mastery of the physical environment - their results contribute in products or techniques
Social Professions	Functional; utilitarian; concerned with the improvement of professional practice - their results contribute in protocols or procedures

Table 02: *Panel of broad disciplinary groups, with intellectual research styles and the nature of their knowledge. Source: (Trowler, 2001).*

This structure can be a guide to design disciplinary activities based on interdisciplinary objectives and the formulation of challenges where each discipline has its contribution and perspectives clear, at least from a strategic point of view.

Distinctions between multidiscipline, interdiscipline and transdiscipline

In the innovation, entrepreneurship, technological development and the arts ecosystems it is common to use some of these terms, sometimes as synonyms, that are intended to refer to the approach of projects where different disciplines must contribute with their knowledge. Collaboration and disciplinary dialogues are a central aspect in this type of disciplinary relationship, therefore, it is necessary making distinctions as to how these forms of collaborative work are configured to mobilize actions in a strategic sense and thus promote disciplinary co-creation.

Types of disciplinary dialogs.

MULTIDISCIPLINE
Discipline A
Discipline B
Students have the ability to tap into perspectives from more than one discipline

INTERDISCIPLINE
Discipline A
Discipline B
Students have the ability to integrate disciplinary knowledge

TRANSDISCIPLINE
Discipline A
Discipline B
Non-Academic Knowledge
Students have the ability to integrate disciplinary knowledge, as well as non-academic knowledge

| Image 02: *Types of disciplinary dialogs. Source: (Greef et al, 2017)*

To describe these distinctions, we will use the approach made in the teaching manual "Designing interdisciplinary education" (Greef et al, 2017) of the University of Amsterdam as a basis, wherein they make these distinctions explicit in terms of how disciplinary dialogs are carried out, i.e., how different disciplines work and collaborate in the same context. In the case of multidiscipline, this occurs when the members of a team can approach a project obtaining different perspectives to solve it, collaborating and taking care of each one's field of action, without the need to transfer knowledge or generating crossovers between disciplines. On the other hand, interdiscipline takes place when team members develop the ability to integrate disciplinary knowledge to solve a project, establishing a more intensive level of collaboration and not only a division of labor according to fields. Finally, transdiscipline occurs when they manage to integrate, in addition to disciplinary knowledge, non-academic (non-systematized) knowledge, transcending disciplinary barriers to address a complex problem and generate new knowledge.

Although there is room for opportunity in the development of a transdisciplinary paradigm of education, Interdiscipline is the approach to which Universidad del Desarrollo has committed itself as a strategic pillar of training for its undergraduate students. In the same way, the Interdiscipline allows us to establish dynamics of collaboration and transfer of knowledge in a controlled environment of resources and actors. Therefore, in this scheme it will be relevant to achieve and facilitate disciplinary dialogues that allow us to generate this type of collaboration and the results - project, cognitive and attitudinal- that entails the integration and transfer of disciplinary knowledge beyond a field of specialization.

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Interdisciplinary Skills
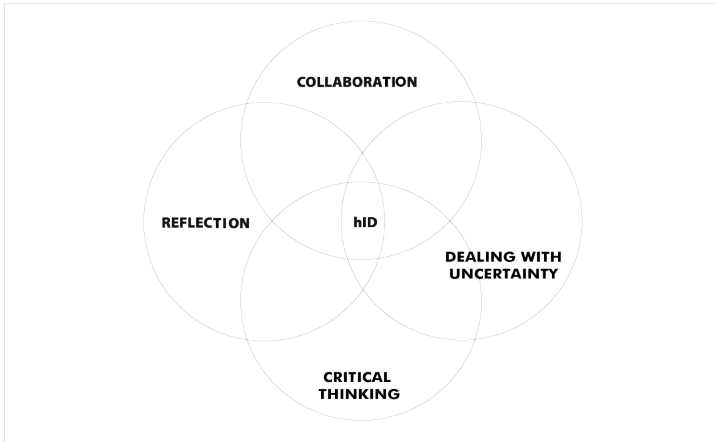
| Image 03: *Interdisciplinary thinking skills. Source: (Christoph et al, 2015)*

As noted, there are conditions to define that we are living an interdisciplinary experience, and in this process of knowledge integration there are key skills to develop in order to achieve interdisciplinary thinking.

Interdisciplinary thinking requires capabilities to identify essential skills, thinking structures and attitudinal aspects (Christoph, 2015) that will be relevant to generate effective collaboration. If we understand that collaboration is largely based on professional communication, language is a critical resource to orchestrate the processes and discourse of different disciplines in pursuit of solving a problem, addressing a topic or proposing new solutions to complex situations. In this sense, we will need to know how to "negotiate meaning, resolve differences, develop a shared understanding, and communicate progress to a wide audience" (p. 11).

Among these skills, (i) collaboration allows us to formulate common objectives in a team, give and receive feedback, be aware of the context, generate role exchanges, manage and take leadership of the process at some point in the project.

On the other hand, (ii) reflection becomes a critical skill for the creative process, as well as in exploratory moments where it is necessary to generate good questions and a deeper understanding of the context being addressed. In this skill, 'mentalization' (p. 10) is a resource that allows us to respond reflexively to other people's behavior, as well as their underlying mental states (beliefs, attitudes, desires, feelings, intentions, plans, etc.). In this way, we have the possibility of interpreting other people's way of thinking, something that we can correlate with the ability to empathize promoted by models such as design thinking, where we seek to understand the behavior of other people or groups of people and connect with meanings and patterns of behavior. Another resource of this skill is perspective taking, where we gain the ability to understand the world through the eyes of a practitioner of a different discipline, managing to assume different and alternative points of view to the ones we would take from our "lenses".

We also have (iii) critical thinking, a complex cognitive skill that allows us to approach a project from searching, identifying, understanding, critically evaluating, connecting and integrating methods and theory from different disciplines. In this way, it is possible to identify incorrect data, misinformation, and prejudices, among other background data that require the critical use of information, explaining differences and agreements, reasoning and decision making. Some resources found in this skill are the systematic and systemic analysis of a problem, the ability to explain differences and agreements, integrating knowledge from related concepts and from different disciplines, reasoning to draw conclusions and evaluate evidence; and, finally, decision making, gathering and integrating information, using judgment, identificating alternatives and selecting the best solution in a given context. (p.13)

Finally, (iv) dealing with uncertainty is an essential skill for tackling complex problems since usually there are no clear certainties, final solutions, conclusions, etc. In short, a space of exploration where it is easy to get lost and where autonomy and self-regulation will be relevant resources to lead the project towards a successful destination.

In order to support the development of the skills described above, five critical categories have been conceptualized for the configuration and use of didactic tools that allow us to effectively develop an interdisciplinary experience: (1) Initial diagnosis; (2) Collaboration and teamwork; (3) Analysis and critical thinking; (4) Recording and process; and (5) Evaluation.

Tools and strategies for the interdisciplinary journey

The following is a list of tools and strategies that support the critical dimensions for the development of an interdisciplinary experience. These tools have been designed based on the teaching / professional experience or gathered from the bibliographical review.

For this first edition of the ID Toolkit, 23 tools have been identified and/or conceptualized, five of which have been described for systematic use in the academy.

Based on the categorization previously carried out, these tools have been placed in each of these areas as appropriate. Each will be described in general and a selection of five of these will be presented in detail as a central part of this first edition of the Interdiscipline Toolkit.

Diagnosis and challenges	Collaboration and team work	Reflection and critical thinking	Recording and process	Evaluation
Wicked problem and perspectives	ID Dialogs	ID Retrospectives	Process logbook	Assessment mix for the course
Incubation of challenges	Personality and experience	ID Perspectives	Wiki	Evaluation among peers
Wicked problem construct	Team building through storytelling	Debate	One pager	Feedback
Mess map diagrams	ID team decalogue	Concept Maps	Class Instagram	
	Common Objectives	Storytelling		
	Team building through Foursight thinking			
	ID Connections			

Table 03: *List of tools according to implementation categories. Source: Own elaboration.*

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DIAGNOSIS AND ID CHALLENGES

The diagnosis of an interdisciplinary problem is a central aspect in the beginning of an interdisciplinary experience. This implies the understanding of the complexity and systemic nature of the topic that teachers and students will address. In the same way, the creation of interdisciplinary challenges should inspire the beginning of this experience from critical contemporary issues of interest to its participants.

01|01. Identification of a wicked problem and points of view

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Source: *Own elaboration. Rodrigo Gajardo (2020)*

The beginning of an interdisciplinary experience is the approach to the challenge and the search for a complex problem to be solved. We understand these wicked problems as complex social or cultural challenges, with an unknown number of possible solutions (Rittel & Webber, 1970). These problems develop at the global, community and individual levels. Therefore, and due to the fact that there are no clear solutions to these problems, it is necessary to approach these challenges from interdisciplinary approaches that allow establishing diverse points of view for their approach.

Some of the characteristics of wicked problems can be found in the text Dilemmas in a general theory of planning (1970) by Rittel and Webber, where they established their properties from the absence of a formulation and solution to the absence of a solution to the problem. formulation and solution of these problems. Solutions cannot be evaluated on the basis of true or false classifications, but rather from conditioning criteria, e.g., appropriate or inappropriate. These problems are unique, each attempt to solve these problems is significant and provides experience and background to advance further in their resolution, something that we could relate to the processes of prototyping and testing. A complex problem to be analyzed could be a symptom of another deeper problem and there will always be more than one explanation for them, these vary according to the perspective of each stakeholder.

Therefore, identifying a wicked problem will require addressing three central elements of analysis:

[1] . Disciplinary areas: where the problem or issue to be addressed is observed from.

[2] . Points of view: the different stakeholders have diverse (and in some cases contradictory) visions of the problem, causes and possible solutions.

[3] . The causes and background of the problem are systemic and complex to observe initially. Addressing these causes will help us to go deeper into a more relevant complex problem from an interdisciplinary point of view.
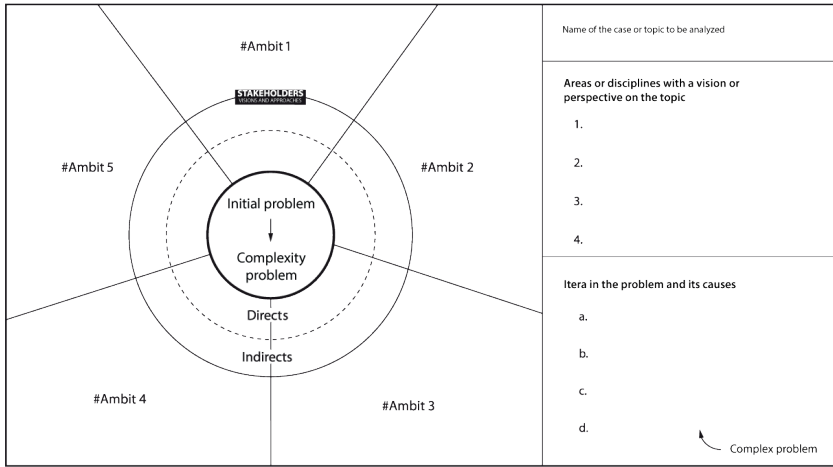
Recognizing a wicked problem implies moving towards a deep understanding of the causes and consequences of the phenomenon, as well as the various effects from different disciplines and disciplinary fields. The map of wicked/complex problems and perspectives is a tool that will support us in this analysis, reflection and discussion about an interdisciplinary problem. Its elaboration is based on the understanding that these are complex social, cultural, personal and interpersonal challenges, their causes and background are systemic with an unknown number of possible solutions. On the other hand, these challenges can be considered a complex problem if the different stakeholders have diverse (sometimes contradictory) visions of the problem, its causes and possible solutions.

Steps:

Reflect and discuss in interdisciplinary teams:

- Establish the initial topic, challenge or problem to be analyzed.
- Analyze the topic from disciplinary points of view (What do the experts say? Users? Other relevant actors in the topic?)
- Identify actors and their points of view on the topic.
- Organize the points of view in different areas (social, cultural, economic, medical, etc.)
- Reflect on the problem and its causes: is there a deeper and more relevant cause?
- Change the central issue to a deeper and more systemic problem.

01|02. Incubation of Interdisciplinary challenges

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Source: *Own elaboration. Rodrigo Gajardo (2020)*

The creation of interdisciplinary activities requires the vision and coordination of different views towards common learning objectives. In this context, the challenge is a key element for the strategic design of an interdisciplinary experience, highlighting, organizing and selecting themes that will inspire the processes of intensive collaboration between disciplines.

The objective of this activity of incubation of interdisciplinary challenges is to address a first stage, defining guiding axes and potential disciplinary links from an activity consisting of three steps: (1) defining the macro context (through a brainstorming of topics and trends selected in a disciplinary manner), (2) the convergence of visions, and (3) the formulation of the interdisciplinary challenge.

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| Tool 01/02-1: *Definition of the macro context*

Steps:
From a disciplinary executive work:

- Identify contingent and disciplinary interesting issues, strategies, objectives and/ or trends. These may come from regional development strategies, public policies, sustainable development goals (UN) or trend reports.
- Select one of these topics according to its relevance to disciplinary development and the potential for extra disciplinary collaboration that it may trigger.

Discipline A

Discipline B

Discipline C

Topic name

Topic description
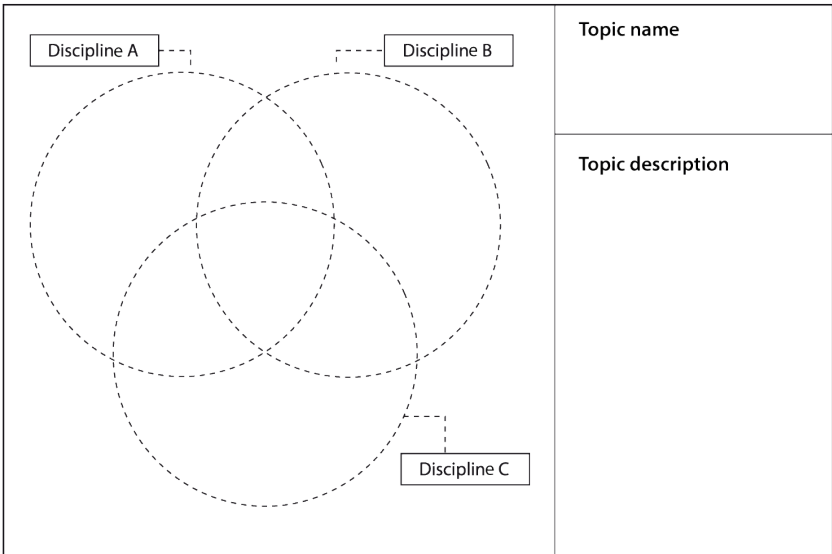
Steps:

From an interdisciplinary executive work:

- Summarize previously established disciplinary definitions.
- Discuss and share topics and trends of interest. Argue the relevance of these issues for disciplinary development.
- Agree on common ground, incorporate aspects of all the topics discussed into your own analysis.
- Define a common theme, name it and describe what it is about.

OTRAS HERRAMIENTAS PARA EL DIAGNÓSTICO Y DESAFÍOS ID

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| **Tool 01/02-3:** *Formulating the challenge*

Name of the challenge	Description of the challenge	Learning objectives to be pursued
Exploration questions	Expected results	Participating disciplines

Steps:

From an interdisciplinary executive work:

- Agree on the name of the challenge. You can use the format of How might we...?
- Describe the challenge, providing context and general data to understand the systemic characteristics of it.
- Define learning objectives to be developed in this experience, integrating expected disciplinary skills as well as interdisciplinary skills.
- Establish exploration questions that motivate and inspire the beginning of the interdisciplinary work of teachers and students.
- Define expected results at the end of the experience (a product, an activity, a document, etc.).
- Agree on the disciplines/careers involved in the experience.

01|03. **Mess map diagrams**

Source: *Horn, R. & Weber (2007)*

Mess Mapping is a set of structured methods for sharing, organizing and evaluating information about Wicked Problems. This diagram represents a common mental model of the problem at hand, showing the important "chunks" of information and their relationships to other "chunks".

01|04. **Wicked problem construct**

Source: *Yawson, Robert (2013)*

The construct of a complex problem makes it possible for us to obtain an instrumental model with which organizations or interdisciplinary teams can guide the analysis and definition of the problem with these characteristics. To use this tool, we must understand that a wicked problem cannot be analyzed in a linear way, but from iterative observation processes, interpreting this problem from different perspectives and intervening for its "domestication".
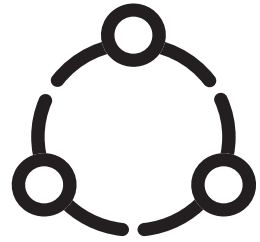
This model proposes that a complex problem has three stages of approach: observation (from the identification of the complex problem), interpretation (from the analysis of different perspectives) and domestication (as a form of intervention).

02

COLLABORATION AND TEAM WORK

Collaboration is a strategic skill in interdisciplinary thinking, since its process requires dialogs and the formulation of common objectives as well as conducting an effective work process in a set of diverse personalities, languages and histories. Likewise, co-creation between disciplines helps to activate complex thinking through a process of learning from the context and role exchange.

02|01. Interdisciplinary Dialogs

Source: *Own elaboration. Rodrigo Gajardo (2020)*

Collaborative work and co-creation between different disciplines is a complex space to develop. Interdiscipline differs from multidiscipline in the way they interact, permeate and transfer their knowledge to solve a problem. However, in practical experience it is possible to notice that the transfer of knowledge is not as idealized as we might think; a lawyer will hardly be able to acquire specific knowledge of nursing in a few weeks to apply it to a problem ad hoc to both disciplines.

It is in this context where generating instances of interdisciplinary dialogs becomes critical to facilitate this intensive collaboration between disciplines, where an ID team can go from simply dividing the work in a specific situation -and according to their knowledge- to grow and feed -collectively and individually- from the existing knowledge, practices and expertise existing in the work core.

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Language is a valuable resource to empower and articulate interdisciplinary work. It is probably one of the most tangible results after an interdisciplinary experience, where students are able to incorporate knowledge through language. Although they will not be specialists in a field of the other discipline with which they were working, they will be competent in a topic, they will have acquired language and skills that allow them to relate better in new scenarios outside or at the edges of the disciplinary tradition.

An exercise to promote interdisciplinary dialogs should allow students to reflect on their discipline, their knowledge, their way of working and the products they can contribute. To this end, it is suggested that an activity be proposed where students should first analyze a topic in a disciplinary way and then in an interdisciplinary way:

1. Analysis of the topic in disciplinary groups
2. Interpretation of the topic in interdisciplinary groups (there must be at least one from each discipline)
3. Final ID reflection

| **Tool 02/01-1**: *Analysis of the subject in disciplinary groups*

Causes and antecedents	**Associated disciplinary concepts**
What antecedents and causes do we have on the subject, from a disciplinary point of view?	Which concepts arise from our discipline and which are related to the subject?
Possible solutions What possible solution ideas arise from our discipline?	

Steps:

Participants are assembled in disciplinary teams. If there is only one member of the discipline, it will be done individually:

- Analyze the causes and background of the issue addressed, which arise from the disciplinary perspective to respond or provide a view.
- Formulate ideas for a solution that emerge from the discipline, whether existing or not, but that propose a way to address it from the current state of the art.
- Record and briefly develop the theoretical and technical concepts that emerge from the discipline and that are part of the analysis of causes and background data. These may be founded theories, dimensions of analysis, methodologies, techniques, tools, etc.

Topic addressed Describe the topic in general according to the points of view of each discipline	Concepts and ID language
	Share, define concepts and disciplinary language (of all the disciplines involved) relevant associated with the subject.
Perspective A	
Perspective B	
Perspective C	

Steps:

Participants get together in interdisciplinary teams:

- Describe the topic you are analyzing from each of the disciplinary points of view. Identify differences and distinctions between each perspective.
- Record and bring together all the concepts you have identified in a disciplinary manner. Share them, discuss them and clarify those that are not clear.

| **Tool 02/01-3**: *Final ID reflection*

	What do we know about the subject?	How do we think about the subject?	What products and results can we contribute to the topic?
Discipline A			
Discipline B			
Discipline C			

Steps:

Reflect and discuss in interdisciplinary teams:

- Agree on what they you about the topic, according to each discipline and as a whole.
- Identify the predominant way of thinking from which you observe the topic (Nature of your disciplinary knowledge).
- Define and agree on which products and results you will be able to contribute from your own disciplines (diagnoses, experiments, methodologies, prototypes, etc.).

Once this tool is completed, the teams will obtain a set of definitions, concepts, methods, roles and responsibilities that will allow them to establish a starting point and a working route to manage the interdisciplinary project.

02|02. **Personality and experience**

Source: *Buckley et al (2015)*

In order to understand the circumstances and trajectories of interdisciplinary projects, it is necessary to analyze how the personalities of those involved make possible an enriching amalgam, so that the project is given continuity and has a successful interdisciplinary result.

Getting to know the team, their personalities, work histories and projects will be very useful for the configuration of new interdisciplinary teams.

02|03. **Team building trough storytelling**

Source: *Greef et al (2017)*

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This activity seeks to promote team building, breaking down barriers, prejudices, insecurities and hierarchies. To this end, it is recommended to create three stories to form a team. All these stories will be focused on change: The story of me, the story of us, and the story of now. (Greef et al, 2017, p.102).

02|04. **ID Team Decalogue**

Source: *Own elaboration. Rodrigo Gajardo (2020)*

During the process of forming interdisciplinary teams, it will be important for the members to establish certain rules of coexistence and collaboration, drawing up a decalogue (a list of 10 points) and individually defining what I expect and need (to receive) and what I am willing to deliver (to give). What am I interested in from other disciplines? What do I know? What can I deliver, teach, offer?

02|05. **Common Objectives**

Source: *Own elaboration. Rodrigo Gajardo (2020*

The objective of developing interdisciplinary activities in the academic environment is to develop learning outcomes and skills to be produced. For this purpose, it is relevant to establish what the objective pursued by each discipline is and how the resources, processes and experiences will help to CONNECT and DEVELOP these outcomes.

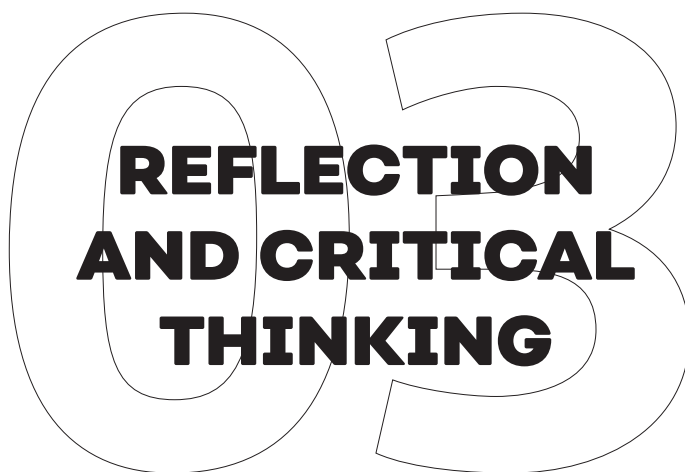## 02|06. **Foursight thinking**

Source: *Puccio (2002)*

FourSight is a tool that allows us to facilitate the conformation of work teams for innovation and creative thinking processes. It proposes a framework (theoretical framework) based on four stages (Clarify, Conceive, Develop and Implement) based on which the members of a future work team declare where they feel more apt or comfortable to assume a given role. By means of an assessment, each person is given a certain role and this makes it possible to organize the interdisciplinary teams that will tackle a complex problem.
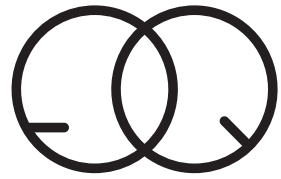
02|07. **ID Connections**

Source: *Own elaboration. Rodrigo Gajardo (2020)*

The start of an interdisciplinary project or challenge involves asking ourselves what our networks are, mapping opportunities for work and collaboration to achieve our objectives.

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REFLECTION AND CRITICAL THINKING

Reflection is another relevant skill for the creative process (be it problem solving or higher understanding of it). It is not enough to follow a linear process or method to solve an interdisciplinary project, it is necessary to conduct these processes from a critical point of view, making use of the different disciplinary perspectives present in order to obtain a deeper understanding of the context and complexity of the scenario that they have to analyze and intervene.

This involves both the project processes as well as the social processes of teamwork that make it possible for them to move forward and achieve an expected result. Therefore, developing critical thinking will be an essential skill to achieve other sub-skills, establishing distinctions, complex reasoning and integrating knowledge and language from all participating disciplines.

03|01. **Interdisciplinary Retrospectives**
03|02. Conceptual Maps
03|03. Debate
03|04. Storytelling
03|05. Interdisciplinary Perspectives

03|01. Interdisciplinary Retrospectives

In the interdisciplinary process and experience we will have different types of closing milestones that will allow us to establish pauses in the ID teams and observe the process carried out from a critical point of view. Recognize how the requested task has been executed, how and what each of the members and disciplines have contributed.

The retrospective of the interdisciplinary process is a reflective exercise about the process carried out in a given lapse of time or a developed task/work. Therefore, it is suggested to conduct it after the closing of a cycle (a unit, work, project, contest, exam, etc.), in order to cause a reflection of the ID team about their personal process, lessons learned, explanation of the mistakes made and revealing the problems of coexistence, among other components of the learning process.

Similarly, a retrospective can be accompanied or supported by a peer evaluation or self-evaluation which guides the conversation and reflection of the team members to generate a discussion about their process.

A retrospective activity can be conducted by bringing together the ID teams, performing an exercise after the milestone closure or as part of the deliverable of said milestone closure. As a group and/or individually, they should respond to and discuss the following topics:

1. Individual lessons learned
2. My own and my colleagues' / mates' contributions
3. Team work

Learnings

What have we learned and obtained from this process?

Disciplinary contributions

What has been my contribution in the process? What has been the contribution of my colleagues?

Teamwork

How could we have carried out our teamwork better?   ?

Steps:

Reflect and discuss in interdisciplinary teams:

• Identify the lessons learned during the process you have undertaken. These can be individual and group.

• Discuss and establish what contributions you have made individually to your project. In the same way, each one should indicate the contribution that your peers have made.

• Reflect and agree on lessons learned on how to improve your performance as a team and make decisions about best practices to be applied.

This activity can be implemented as a formative self-evaluation exercise, providing corresponding feedback in the presentations of each team. It can also be part of the summative co-evaluation of the closing milestone, giving it a certain weight in the weighting of the final grade.

03|02. **Interdiscliplinary Perspectives**

Source: *Own elaboration. Rodrigo Gajardo (2020)*

The perspectives of the interdisciplinary process are a reflective and projective exercise regarding the process carried out in a given period of time or a developed task/work. Like the ID Retrospective, this technique allows the work team to clarify and gain insight regarding their experience, but in this case, projecting the possible learning and skills obtained in their collaborative process.

An ID Perspectives exercise can help develop an action plan to address new challenges or resolve issues not addressed or addressed erroneously by the team. In the same way, this exercise can contribute to build a disciplinary identity of the students from an interdisciplinary point of view, finding new (and interesting) topics, areas or disciplinary spaces for their professional development.

03|03. **Debate**

Source: *Several authors. Described by Rodrigo Gajardo (2020)*

Debate is a learning strategy that helps to implement active learning methodologies, as well as interdiscipline. This structured conversation, where two or more opinions are confronted according to a topic under discussion, allows us to develop various skills in students, such as: the appropriate use of language, effective communication, the transmission of ideas and opinions, and active listening, among others, that make it possible for us to shape the analytical vision, reflection and critical thinking.

In the context of the nterdiscipline, it is interesting to use this resource as a way of showing different views about the same complex problem, views that will be evidently influenced by the disciplinary background of each student, his/her concerns and particular language. This aspect will be very useful in the first moments of the interdisciplinary experience, when students should be able to develop systemic views about the topic addressed and the disciplines that will be involved in its development.

03|04. **Conceptual Maps**

Source: *Several authors. Described by Rodrigo Gajardo (2020)*

Conceptual maps are a tool that allows us to better understand the data we have on a topic, challenge or problem to be analyzed. The objective is to collect the most relevant concepts and visualize the relationships between them, managing to represent a set of meanings and connections between theoretical concepts, previous knowledge or data collected from first source (Garcia-Huidobro, Gutiérrez & Condermarin, 2000). In general, a conceptual map starts from the establishment of a main concept through which we hierarchize the rest of the concepts derived from it. The connectors between concepts must be defined, whether they all mean the same or each of them mean something different.

03|05. **Storytelling**

Source: *Several authors. Described by Rodrigo Gajardo (2020)*

Storytelling is a technique widely used in the marketing area, with the understanding that a good story becomes impregnated in the memory of the audience. In interdisciplinary experiences, we can use the storytelling resource to give meaning to an investigative or immersive process carried out by the teams (when they empathize with a problem). In this sense, the construction and conceptualization of a story, the definition of meanings and reflection on the types of emotions that we want to provoke (or that the collected material evokes) are elements that allow us to articulate and develop skills related to analytical vision: (1) identify components of a problem, (2) disaggregate and organize these components in a rational way, (3) organize the information and (4) think critically.

Story construction is excellent for simplifying abstract concepts, transforming complex problems into meaningful narratives. A good story connects ideas and people, which makes it possible to articulate actions to solve a given problem or context from inspiration and making sense with an interdisciplinary challenge.

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PROCESS RECORD

04
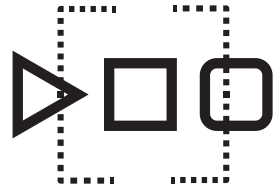
The path we follow to achieve a given result or product is as important as its closure to understand or evaluate the achievement of a skill. In the case of interdisciplinary experiences -many of them conducted from a project approach- this is even more critical, since a bad result could have had a valuable and consistent learning process (although with bad final decisions).

Considering the process as one more element in the production of learning also requires tools that allow students and teachers to manage the interdisciplinary experience and its results beyond the final product.

04|01. **Process logbook**
04|02. Wiki
04|03. One pager
04|04. Class Instagram

04|01. Process logbook

Source: *dLab UDD. Described by Rodrigo Gajardo (2020)*

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In project-based learning experiences, the process is as important as the final result. However, many times we make the mistake of focusing the attention (and evaluation) on the deliverable or the resulting product. It is not uncommon for an ID team to have a great process throughout the course; however, in the final stretch and due to a bad decision, they end up with a poor product that is not a true reflection of the road they have traveled.

The logbook is a tool for recording this learning process and project development. In essence, the logbook is a simple publication system focused on the generation of evidence of the stages, experiments, ideas, proposals and learning. To carry out these records, texts, drawings, sketches and any other resource developed during the project can be used, as well as any other resource developed during our process or to raise awareness of the process we have conducted.

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The objective of the individual process logbook will be to obtain a record document for each student and in thus, obtain evidence of the personal processes in contrast to the results of the team.

This document can be in an open format or in pre-established formats that the students can use. A common logbook structure can be:
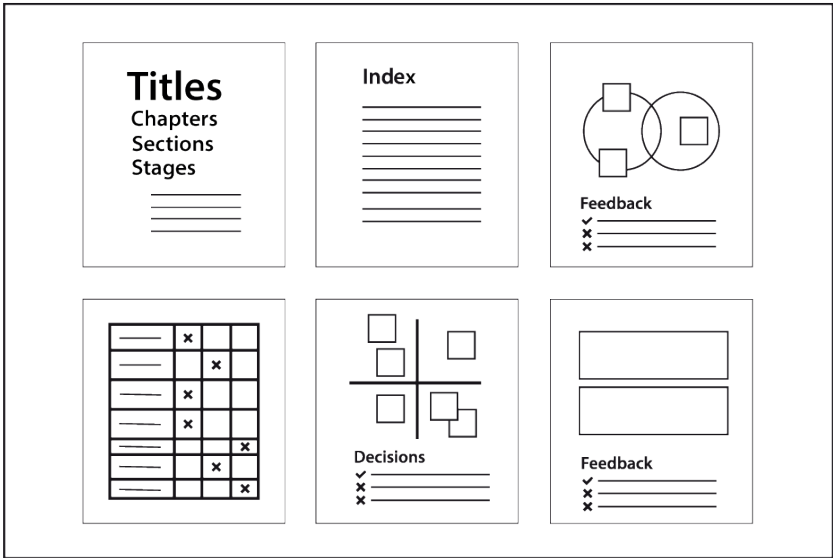
- Cover
- Table of contents (index)
- Cover page of subtopics or chapters of the logbook (e.g., according to unit or stage of the course/project)
- Record of completed tools and their iterations (editable formats of delivered tools, with space for comments and revisions)
- Logging of feedback obtained (according to date and stage)
- Systematization of collected data (tables, matrices)

We can use this tool as a formative evaluation - providing corresponding feedback at specific milestones - or integrate it into the set of summative assessments of the course, helping to counterbalance a final grade.

04|02. **Wiki**

Source: *Several authors. Described by Rodrigo Gajardo (2020)*

A wiki is an information creation and revision system for web environments that was made popular by Wikipedia. Its main relevance lies in the ease of building a space and content database in a collaborative way among different people with a common goal. In a wiki we can upload all kinds of content (text, images, videos, audios, etc.), subscribe to updates via RSS, link pages and review previous versions of editions.

With all these features, a wiki can be a good platform to record the process of an interdisciplinary activity and generate common knowledge bases according to projects, among other dynamics of collaboration and co-creation between disciplines.

04|03. **One pager**

Source: *dLab UDD. Described by Rodrigo Gajardo (2020*

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The One-pager tool is a resource that allows us to summarize a topic, knowledge or project (or phase thereof) addressed in a 'one-page' visualization. This visualization make it possible for us to obtain an adequate summary of the process carried out by the ID team, as well as to provide students with a learning path in order to define and make decisions regarding the knowledge obtained and to establish the most relevant findings.

To work a one-pager it is necessary to rely on graphic visualization skills and technologies for conceptual synthesis. These aspects can be solved through the leadership of the corresponding discipline, as well as with the diversity of applications available on the web for this type of tasks.

04|04. Class Instagram

Source: *Several authors. Described by Rodrigo Gajardo (2020)*

The use of social networks can help the visibility of an interdisciplinary process in real time, where the results obtained at each stage are synthesized in a post through basic resources of text, photography, audio, video, hashtags and hyperlinks, among others.

Due to its popularity, simplicity and access, Instagram has become a useful tool for these purposes, where a complete course can generate material and interact with it (e.g. formative peer evaluations) through reactions and comments.

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05 EVALUATION

The evaluation of interdisciplinary processes and results will be a central element to configure or provide a relevant experience to the involved students and professionals. In accordance with the approach that states that the learning process is as relevant as the results or products obtained from it, these aspects of the interdisciplinary experience must be evaluated using the different resources offered by active learning methodologies.

In this context, it is relevant to consider the use of different types of evaluations - qualitative and quantitative - allowing teachers, students and collaborators to participate in the evaluation process, promoting co-evaluations as a recurrent element in the process and milestones.

05|01.   **Evaluations Mix**
05|02.   Peer Evaluation
05|03.   Feedback

05|01. Evaluations Mix

Source: *Greef et al (2017)*

The evaluation of interdisciplinary processes is a relevant point to develop and improve for an ID experience from students to teachers.

This assessment mix is presented by The Thinking Academy and seeks to incorporate in a holistic way the various processes that result in interdisciplinary learning outcomes.

| Tool 05/01: *Evaluation Mix*

Learning outcomes	Research report	Interview	Presentation	Blog	Reflection
Prepare and conduct an interdisciplinary research project, being presented to a diverse target group.	X		X		X
Compare and evaluate the methodology and way of thinking in various disciplines.					X
Apply some philosophy of science topics to your own discipline.		X			X
Work together on an interdisciplinary group project.	X		X		X
Critically reflect on interdiscipline.	X		X		X

Van der Tuin has established criteria to measure learning outcomes in an interdisciplinary project. These are:
- Prepare and conduct an interdisciplinary research project, presenting it to a diverse target group.
- Compare and evaluate the methodology and thinking of various disciplines.
- Apply some topics from the philosophy of science to your own discipline.

- Work together in an interdisciplinary group project.
- Reflect critically on the interdiscipline

On the other hand, Spelt divides interdisciplinary thinking into the following sub-skills:Tener conocimiento de disciplinas.

- Having knowledge of disciplines.
- Having knowledge of interdisciplinary paradigms.
- Having knowledge of interdisciplinarity.
- Having higher order cognitive skills.
- Having communication skills.

Criteria for rubric construction:

- The student is able to answer open-ended questions to understand the reasoning involved in the disciplines.
- The student is able to draw a table or figure to show the relevance of disciplinary knowledge for a particular research purpose.
- The student is able to explain the disciplinary perspectives that are used to interpret the elements of knowledge.
- The student is able to make a meaningful and creative connection between relevant disciplinary perception and produce a more holistic understanding or solution.
- The student is able to communicate the progress of his/her project in understanding disciplinary and interdisciplinary aspects.
- The student is able to communicate how knowledge connections were established, as well as their benefits and shortcomings.

Evaluation of the interdisciplinary writing:Sentido de propósito.

- Sense of purpose.
- Disciplinary field.
- Interdisciplinary integration.
- Critical conscience.

05|02. **Peer evaluation**

Source: *Several authors. Described by Rodrigo Gajardo (2020)*

"Peer evaluation" is a tool for the measurement or assessment of the learning process carried out by the ID teams, where the perception of the peers is key to generate an evaluation of a specific result. These evaluations can be summative and/or formative, obtaining feedback from each member and generating meta-learning of the process.

This type of evaluations is conducted by the members of the ID team, appreciating the work of their peers according to instructions and a previously established guideline.

In interdisciplinary experiences, where the work is carried out by a team of people, the use of this type of evaluation will provide important information to visualize the contribution and individual performance of the team members through the eyes of those who lived the experience.

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This dynamic allows students to internalize the correction criteria used during the course, which should be explicit in the instructions. On the other hand, students can develop their critical thinking and create habits of reflection on their learning, laying the foundations of their autonomy.

05|03. **Feedback**

Feedback on student performance is a relevant evaluation strategy for the interdisciplinary experience, especially in those processes based on the development of projects that contain formative evaluation milestones or "reviewers" prior to a summative evaluation.

We can classify feedback into three main focal points: (1) On the product, informing how well the specific work or task was achieved, receiving comments on its content and final outcome; (2) On the process, informing how the journey towards task resolution was carried out; (3) On self-regulation, evaluating students' ability to conduct their learning process and conflict resolution (Hattie y Timperley, 2007).

Ongoing feedback allows students to improve their performance, correct and quickly validate a course of action regarding the project or problem addressed.

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CONCLUSIONS

Interdiscipline is a fertile field of academic and professional development for persons who seek new challenges beyond their disciplinary fields in collaboration with others who think, mean and dialogue differently. This is why it is relevant to contribute with spaces, knowledge and tools that help us in this transition towards the complexity and systemic vision of our context.

We hope that this toolkit will be a relevant support in this process and that it will motivate others to collaborate, co-create and co-design from a convergence of perspectives.

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