

CURRICULUM DESIGN AND INNOVATION IN FIELD-BASED LEARNING: LESSONS FROM THE DOCTORAL PROGRAM IN LEADERSHIP AND SYSTEMIC INNOVATION IN ARGENTINA

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Abstract

Designing educational innovation in a doctoral program on Leadership and Systemic Innovation is a matter of matching form with content. The challenge to create new experiences for curriculum design becomes one of experiential integrity for learners. This requires matching curriculum content with an appropriate real-world opportunity for positive change. Classical case study methods fall short as vehicles for exploring VUCA situations — those characterized as Volatile, Uncertain, Complex, and Ambiguous. However, it is hard to find appropriate alternative methods that provide experiential learning environments for generating useful and systemically well-balanced responses to VUCA situations. This paper presents the experience of an international team of five doctoral faculty members, aided by two second year doctoral students and a social innovation expert, to design, introduce, facilitate and model a programmatic curriculum that spanned the first year (five course modules) of the ITBA (Instituto Tecnológico de Buenos Aires) Leadership and Systemic Innovation doctoral program with 22 students. Each course module focused on a distinct aspect of systemic innovation. This required the faculty to create a cross-cutting, field-based experience that interwove the learnings from one module to the next. In addition, the focus of the field-based experience was designed so as to expose students to a “wicked problem” (a VUCA situation that could not be addressed on the basis of one disciplinary perspective or approach alone) without requiring them to fix, resolve, or otherwise provide a solution to it. Instead, students were invited to explore various aspects of the situation from an empathic and holistic evolutionary perspective. As detailed in the paper, a significant challenge to what we called “the Interweave Model” was communicating exploratory methods to the students, and distinguishing this experience from what would be expected in classical case study research. The greatest challenge for students appeared to be holding a whole-systems perspective of the entire VUCA situation across five distinctly different subjects of the curriculum while generating opportunities for design responses within each subject that could be coherently combined.

Keywords: Systemic innovation, thriving education, empathy-based learning, research practicum, experiential fieldwork, evolutionary learning community.

1 INTRODUCTION

From February to November of 2017, faculty and students of the Doctoral Program in *Leadership and Systemic Innovation* at the Buenos Aires Institute of Technology (ITBA) embarked on a learning journey to explore a real-world complex adaptive socio-technical system. The lessons learned from this process may apply to educational models using action-research to create positive impact in systemic innovation initiatives.

1.1 On the nature, objectives, and relevance of systemic innovation

People need new ways of living, of creating value, and of raising not only standards of living but, more importantly, quality of life [1]. These necessities call for augmented and expanded treatments of innovation in the context of societal evolution. According to standard usage, an *innovation* is the concretization of a practical idea that augments human capability for action with societal impact, existing as an intermediate phase between the conceptual *invention* of an idea and its marketable *diffusion* in society [2]. Unfortunately, contemporary approaches to the development and implementation of advances in the application of technology tend, at best, to emphasize the synergetic relationship between human-beings, technology, society, and the environment. If we wish to curate conditions for the emergence of a world of human dignity and thriving for all, those who create socio-technical systems will need to take earnest and potent actions to rebalance the broader systemic effects.

A clearer and more well-developed appreciation of how the dynamics of socio-cultural transformation are linked to the dynamics of innovation is needed. The set of interconnected and interdependent challenges that face global civilization in the first half of the 21st century directly impact, and are impacted by, the advancement of society at local and regional levels [3]. An extrapolation of the trends that characterize the current set of challenges for humanity point toward ecological catastrophe and social disintegration. However, with a solid grounding in systems thinking and the sciences of complexity, it is possible to explain why this is happening — and to develop policies and strategies to innovate the means of emerging a future that is sustainable, desirable, and thriving. There is an urgent societal need for research, development and innovation based on the systems sciences, and in particular, on the sciences of complexity and the study of socio-technical systems [4],[5],[6].

An important characteristic of systemic innovation is its fusion of scientific and ethical knowledge. For innovation to be efficient, efficacious and effective, as well as ethical, aesthetic, empathetic and humane, no single individual can be responsible for creating what relies on collective intelligence. Systemic responses to the complexity of contemporary global and local challenges – personal, societal, planetary – require expanded perspectives: ways of recognizing interconnections, of perceiving wholes and parts, of acknowledging processes and structures, of blending apparent opposites. Most importantly, people who practice systemic innovation require collaboration and an appreciation of reciprocity. Individual solutions and breakthrough ideas are necessary but not sufficient. Real opportunity to affect change arises from the systemic synergies that we create together. The leaders and designers of systemic innovation are able to draw on contemporary insights from the sciences of complexity, computational and life sciences, and an embracing spirituality that re-instills a sense of integrity and ethical purpose.

The Club of Rome coined the term “global problematique” [7] to describe the complex entanglement of the collective challenges humanity faces at any point in time. The leaders of systemic innovation of today and for tomorrow seek to create “solutionatiques” – systems of shared solutions that arise from the connected intelligence of many. Innovating socio-technical solutionatiques that embody social values, technological creativity, economic opportunity, and environmental integrity requires immersive research, and collaborative development. As Janine Benyus noted, *life creates conditions conducive to life* [8]. Systemic innovation provides a path to connect life with life and to re-imbue our relationships with all other living organisms, together with past and future generations, in service of thriving futures.

1.2 Framing the learning experience

The ITBA doctoral cohort of 2017 studied the real-world VUCA situation and associated systemic innovation challenge of the Matanza-Riachuelo River Basin (MRB). This is a grossly polluted geographic area in which generations of impoverished people suffer severely negative health consequences. The environmental challenges are exacerbated by chronic violence, poor education, lack of economic opportunities, and political paralysis in the face of urgently needed infrastructural improvements. The choice of this situation as the study focus resonated deeply with the cohort; as one student noted, “if we were to carry out a consultation/survey of five complex issues in Argentina that require urgent attention

and solution, the MRB case could take first place. Ever since I was a child I have heard about it, and everyone around me sees it as something stagnant, unresolved and wickedly complex.”

The design challenge for the first-year doctoral students in the *Leadership and Systemic Innovation* program was to gain a better understanding and a more meaningful perspective of this “wicked problem” situation (one which cannot be addressed through a mono-disciplinary perspective or approach) by familiarizing themselves with a variety of tools and methods used in systemic innovation. Accordingly, they were guided through activities that addressed the following learning objectives:

- To richly describe the complex systems that embed and surround the situation.
- To map the complexity of the context and stakeholders who experience and reciprocally influence the situation.
- To plan ways of researching the situational dependencies involved.
- To establish an empathetic approach to action-research.
- To use a design thinking process for addressing the challenge of creating a positive impact while minimizing unintended consequences.
- To explore the short- and long-term benefits of socio-technical interventions such that actions would be more likely to create healthy and self-sustaining dynamics than destructive ones.

A cadre of international faculty (all of whom are co-authors on this article) co-created the Interweave Model which was comprised of five course modules during the first year of studies in the ITBA doctoral program. The intended outcomes of the interweave curriculum design were: a) a single, multifaceted study focus for the first year learning experience centered on a real-world VUCA situation; b) a first approximation of the complex problematique in its systemic context based on an action-research approach; c) a vision for a possible solutionatique that takes into account potential secondary, indirect, and time-displaced impacts in the system under study; d) a practical design outcome that models potential directions for systemic innovations using rapid foresight and prototyping; e) a basic ability to apply biomimicry for enabling an expanded scope of potential innovation applications; and f) an understanding of how the systemic innovation prototype could be further refined and scaled through the engagement of both connective and collective intelligence.

Two consecutive cohorts, three administrators, five faculty members and an external social innovation expert were involved in the project with the intent to foster co-learning across multiple levels and functions. Two volunteer project managers from the previous cohort served as teaching assistants who helped lead the effort of engaging stakeholders and their representatives as well as charting the path for the learning experience with the 2017 cohort of doctoral students. Rich learning outcomes were derived from both the process experiences of working in a VUCA situation and the content understanding of the multifaceted and entangled set of issues that comprised the associated problematique. As described in the Results section and further emphasized in the Conclusions, the first iteration of this engagement yielded opportunities for improvement that will be applied to the design and implementation of future iterations of this action-research study approach.

2 METHODOLOGY

This section presents the Interweave Model as it came into being in the Doctoral Program in *Leadership and Systemic Innovation* at ITBA. Section 2.1 presents an overview of the Interweave Model, explaining the faculty’s design and intentions to flow from one module to the next, during which the students developed their understanding of the Matanza-Riachuelo River Basin as a project. Section 2.2 presents each individual learning module in the words of the respective leading faculty member and teaching assistant, who will be referred to in this paper by their given names. The faculty (in the order in which the modules were taught) are: Alexander Laszlo, Dino Karabeg, Nina Serpiello, Regina Rowland, and Pavel Luksha. The second-year doctoral students who were the teaching assistants throughout this process are: Sara Castiglioni and Rosana Zambon.

2.1 Overall process and flow of the five Interweave learning modules

The idea for this interweave project originally emerged from the need to streamline a learning process for students. The curriculum design in the first year of the doctoral program operation had required students to learn about several system perspectives without the benefit of a “red thread” to connect the theories and principles to their own projects. In addition, the two Design Thinking modules – respectively focused on human-centered innovation and living systems inspired innovation – required a real-world

context to effectively teach how to design, facilitate, and participate in the innovation process using an action-research approach.

Together, the faculty designed and proposed a field research project with a sponsor organization to connect the five ITBA program course modules with one research focus: to design potential ways of improving the severe environmental and social degradation that had befallen the Matanza-Riachuelo River Basin (MRB).

The faculty designed the project as a thematic through-weave of the principal systemic innovation learning frames covered in the first year courses. As a teaching team, they set a focus to serve as a common fieldwork domain for each of their respective courses and teaching modules. They devised a *leitmotif* to serve as the attractor for the archetypes that underlay the individual and collective learning objectives. The result was a learning, experiencing, designing and formulating flow that accorded with the following plan:

Alexander launched the incoming students along their doctoral learning path with a general orientation to the program through the course on *Systems Thinking and Collective Intelligence* that he co-taught with Pavel. Students learned to apply various systems thinking frameworks to identify key systemic leverage points and systemic nurturance spaces in the Matanza-Riachuelo field study. They were asked to gain perspective on the VUCA situation using Bela H. Banathy's Three Lens perspective (System, Function and Process); Russell Ackoff's approach to Formulating the Mess; and Peter Checkland's Rich Picture framework [9],[10],[11]. By bringing to bear the combined understanding from these distinct but related systems thinking traditions, students explored the intra-personal, inter-personal, trans-generational and trans-species dimensions of the MRB situation.

Dino taught the next learning module on *Systemic Innovation: From the 20th to the 21st Century* in which he presented his praxis of Polyscopy 2.0. Dino lead the students on an exploration of the emergence of systemic innovation at the frontier of 21st Century science. Students applied lessons from Dino's class to the field study and built on the systemic perspectives that they developed in the first learning module. In their teams, students analysed and identified the potentials for systemic innovation that could be bootstrapped from within the MRB community.

This lead into the first module of the *Design Thinking* course under Nina's guidance. Students applied design thinking principles to their understanding of the dynamics and leverage points of the MRB field study. By focusing on *human centered innovation*, her course invited students to consider the people living in community and their collective creative potential as a means for transformative change using systemic innovation.

Regina moved the students into the second module of the *Design Thinking* course. After becoming familiar with the intra-systemic workings of the field study, Regina lead the class through an exploration of Biomimicry as an ecosystem of socio-ecological dynamics. Students considered how the MRB systemic innovation study could be enriched by *living systems inspired innovation* with an expanded participatory domain of stakeholders (including the more-than-human world, i.e., the trans-species domain of nature) to inform their understanding of systemic innovation potentials.

In the final module of the *Systems Thinking and Collective Intelligence* course, Pavel brought the students down the homestretch of this collective through-threaded learning journey. Building on the cumulative lessons since the opening of the VUCA field study in the first half of this course with Alexander, students were challenged to design a normative framework and/or model to address the transformative potential within the MRB systems. They used Rapid Foresight methodology to draw out the collective intelligence present at the four systemic levels of intra-personal, inter-personal, trans-species and trans-generational stakeholders. In the final exercise, students ran a group-facilitated collective vision building exercise that produced a "map of the future" for MRB. Their objective was to indicate emerging trends that could shape the future of the MRB area (in the near, medium, and long term), identify opportunities and threats for various stakeholders, and suggest a variety of systemic innovations that would help address the identified challenges.

2.2 Individual course module descriptions

In this section, each instructor presents the course module for which they were responsible, highlighting the learning objectives as they relate to the overall epistemological landscape of systemic innovation and the specific ontological action-research involved in the VUCA field study.

2.2.1 *Systems Thinking and Collective Intelligence – Part 1: Systems Thinking*

This first course module provided an advanced introduction to systems thinking in action, exploring the methodological aspects of innovation in and by social systems with special focus on the conceptual tools of the social change agent. The course began with a broad overview of general evolution theory, took a deep dive into social systems design methodology, and emerged with the application of theory and methodology applied to understanding and systemically framing a real-world VUCA situation.

The course was structured to meet three primary learning objectives:

1. To gain an understanding of the broader dynamics of change of which human beings and societies are a part (KNOWLEDGE).
2. To gain proficiency in the language, theory, and methodology of systems thinking and social systems design (METHOD).
3. To gain competence in the use of the conceptual tools of systemic innovation in the proactive creation of desirable and sustainable futures for socio-technical systems (CRAFT).

As the introductory module in the VUCA interweave course series, a key objective was to set the stage for the following modules. The introductory module was split between the first and last learning module, effectively serving as the andragogic “bookend” of the entire interweave study. For this first course module, students were assigned the following:

Each student was to keep their own Living Case Journal in a format that could be shared with peers and instructors, and were asked to document everything! They conducted a first interview with representatives of FARN (Foundation for Environment and Natural Resources) to gather data on the systemic dimensionality of the situation. They worked with Sara and Rosana from Cohort’16 as guides to set up the interview. The specific learning that involved the preparation of team reports required them to draw upon several of the systems thinking and design approaches covered in this module, including:

- Using Ackoff’s framework to “formulate the mess” of the Matanza-Riachuelo field study.
- Creating a Rich Picture of the VUCA system using Checkland’s framework.
- Drawing on Banathy’s Three Systems Lenses to describe the systemic aspects of the study.
- Using Causal Loop Diagrams (CLD) to make explicit the feedback loops of the “wicked problem” aspects of the case using System Dynamics.

The principle input from this module to the proceeding one was a Rich Picture of the VUCA situation relating to the Matanza-Riachuelo River Basin. In doing so, the students managed to get a conceptual handle on the complexities involved in the field study, which served as a reference frame for a real-world VUCA situation. Subsequently, students were able to explore the objectives and approaches of systemic innovation as it emerged in the late 20th Century and is now taking shape as a field of praxis.

2.2.2 *The Challenge of Systemic Innovation from the 20th to the 21st Century*

In this learning module, students were introduced to the need for scaling innovation to include basic institutions such as academic research and communication, education, public informing and governance, or more generally socio-technical systems; and to basic techniques for such innovation as they developed historically. They learned about how Norbert Wiener, Erich Jantsch and other systems scientists a half century ago observed that the resolution to urgent contemporary issues will need to include systemic innovation. They explored how, in parallel to such prescient insights, network-interconnected digital media technology was developed by Douglas Engelbart and others to enable the development of systems that make us “collectively intelligent” and hence more capable of handling complex and urgent issues. Students explored how to develop themselves as institutional leaders, equipped with skills and insights to realize systemic innovation in practice, or as academic leaders, with access to the methods and means of advancing the essential knowledge and academic praxis required to evolve the field of systemic innovation.

To complete their assignment for this second module of the Interweave Model, students were asked to engage in the following learning activities. First, they were to read all of the other team reports from the previous course module and to enrich their understanding of the VUCA situation by considering:

- What had the other teams learned that they had not noticed in their own team?
- What were the connection points between each of the team reports?
- What new questions emerged in this process?

This combined assessment of the VUCA situation provided critical input for the necessary stakeholder analysis for the next module on human-centered design with Nina. By working closely with Sara and Rosana, they arranged for a meeting with an expert on the development challenges of the MRB. They also worked with Alexander to specify the framing and orientation for the next two sets of interviews they conducted: one with representatives of the *Instituto de la Vivienda* (the Housing Institute) and the other with representative of ACUMAR (the inter-jurisdictional Matanza-Riachuelo River Basin Authority).

In conducting this field research, students were asked to apply what they had learned in this course module to develop their perspective of the systemic innovation opportunities present in the MRB. They were urged not to solve, resolve or dissolve what might be the “problem situation”, but rather to focus on the systemic opportunities it represented. To prepare students for the next learning module, faculty encouraged students to describe the VUCA situation from two perspectives: the encompassing system (society/environment) as well as some of the sub-systems involved (families or special interest groups).

2.2.3 *Design Thinking – Part 1: Human-Centered Innovation*

The Human-Centered Innovation module of the *Design Thinking* course introduced students to a research-based, iterative design process [12]. Students would now deeply consider the systemic opportunities generated in the previous two learning modules. The overall course of study was essentially a creative learning process involving investigative research with contextual information gathering to achieve the following learning objectives: identifying stakeholder needs, mapping the system dynamics in order to generate deeper understanding, synthesizing various inputs, brainstorming and creative visualization, prototyping and testing, storytelling based on empathy, and presenting their learning outcomes. Essential to the overall Interweave Model was insistence that course content and learning experience reinforce each other.

Students continued their work in teams in order to investigate the MRB situation and the needs of the people living there. This research formed the basis of a specific action-research focus for prototyping that would be used in the subsequent module. The teams were tasked with further elaborating their Rich Picture portrait of the MRB VUCA situation on which they had been working since the very first course module. Through emphasis on individual and collective learning dynamics, the various teams became learning communities. The teams pooled information to form shared understandings from which all teams could rapidly respond to relevant new information.

By now students had developed a high level of cohesiveness and social bonding, which helped the teams transition from research to idea generation. Working with raw ideas through collaborative conversations, the teams built prototypes with a logical story of value. The teams were required to document their assumptions and critique their thinking. Given that the focus of this module was on Human-Centered Innovation, emphasis was placed on intra- and inter-team dynamics that fostered empathy and positive communications. Students had to contribute comments with sensitivity and vulnerability and accept critical feedback with open-mindedness.

The mission in this third learning module was to converge on one design challenge that could be expressed as a systemic function that in some way characterized the MRB situation. This design challenge set the stage for the fourth learning module.

Due to the nature of the marginalized communities living in the MRB area, the sponsor organization (FARN) was very clear that the situation was sensitive and could be dangerous were students to visit or otherwise seek to engage with MRB residents. This was a frustrating research limitation. Nevertheless, they were able to develop a sense of agency and a set of tools to bring diverse thinking and surprising opportunities to seemingly entrenched situations.

2.2.4 *Design Thinking – Part 2: Living Systems Inspired Innovation*

The Living Systems Inspired Innovation module focused on the *Biomimicry Thinking Design Process* originally developed at the Biomimicry 3.8 Institute [13]. Students learned about Biomimicry as a theory and a practice for applying nature’s strategies for survival to address challenges faced by human systems — from viability, to survival, to sustainability, and eventually to thrival (where thrival is defined as the ability to flourish in the midst of challenging circumstances - cf. <http://www.thrival.com/what-is-thrival>). While the previous module focused on human-centered innovation, this module built on and expanded the design frame that nature has within it the solutions for complex human problems. Students were introduced to the Biomimicry framework, including 26 life principles that represents a sustainability benchmark, and an innovation process comprised of four distinct phases: scoping, discovering, creating, and evaluating.

During the scoping phase, students were challenged to research and describe the dynamic context of the system being studied; to identify a clear function that can be fulfilled through systemic innovation and, significantly; to create a list of design criteria and essential life principles to inform the intended innovation. In the discovering phase, students “biologized” their research question into a function of the system. Working in teams, they researched strategies that organisms use to fulfill this desired function, and communicated their conclusions as design principles with essential criteria.

Students applied the design principles to guide idea generation activities and develop concepts with 2D and 3D renderings towards prototypes. During the evaluating phase, students worked with their prototypes to meet the sustainability mandate of the 26 life principles. The challenge here was to work with the process in an iterative manner, often backtracking to previous phases to revisit and improve upon earlier decisions. A key learning from this process was understanding the recursive and non-linear nature of these steps — as with all creative processes.

By the end of this module, students had gained an introductory understanding of the Biomimicry Design Thinking Process for living systems-inspired innovation. Students began to address the MRB problematique by emulating and integrating strategies from specific organisms and/or aspects of ecosystems as core concepts for potential prototypes. This learning became an entry point for the subsequent learning module on collective intelligence.

2.2.5 Systems Thinking and Collective Intelligence – Part 2: Collective Intelligence

The purpose of this final learning module in the Interweave Model was to provide a general framework for *collective intelligence* as a new paradigm for initiating and catalyzing systemic innovation through co-creation and curated emergence within complex and evolving systems. To this end, Pavel focused on the acquisition of practical skills and methods to apply collective intelligence to complex real-world challenges, including the following approaches:

- General methods of group facilitation that served to promote collective intelligence.
- The use of online tools (specifically, those relevant to social media) for collective problem analysis — and also as a way to enrich the “content space” in offline interactions.
- The World Café™ structured conversation approach as a basic format to optimize collective intelligence in group work.
- Rapid Foresight™ as a comprehensive methodology for augmenting collective intelligence in group work with a specific focus on the co-creation of a collective vision of the future states of the system.

As part of the final exercise of the Interweave Model, students were invited to map the future of the MRB area onto an extrapolatory timeline using Rapid Foresight™ methodology and integrate results from the previous learning modules. Each team issued a report aiming at different targets of the VUCA situation using a systemic approach: one focused on issues of the application systemic frames, another on the aspects of systemic operation, a third on incentives for systemic change, and the fourth on strategies for the future. Students consolidated their work into a joint report representing the progress of the entire cohort.

To demonstrate the power of collective intelligence, students created an interactive, exploratory website of “maps of the future” of the MRB as the final presentation. This work synthesized and summarized previous courses modules, allowing a sub-group of students to make a final presentation to members of the sponsor organization, the FARN Foundation. FARN representatives agreed with the students’ diagnosis of the need to co-create a more high-resolution image of the MRB using the systems thinking and design methodologies exhibited and taught in the Interweave Model detailed in this paper.

3 RESULTS

This multi-course interweave project focused on a real-world VUCA situation with open-ended outcome potentials. Projects of this sort tend to defy the normal categorization as a “case study”. Rather, it is more useful to think of them as:

- A practical experience or “research practicum”
- A practice-framed focus area
- A dynamic living study
- An unbounded field study
- A sandbox for exploring, experimenting, and learning

- A “wicked problem” study focus
- A holistic, multi-perspectival exploration of systemic innovation
- A socio-technical, eco-political, and bio-physical systemic innovation challenge
- NOT a problem/situation/case to be solved, resolved, determined, or decided upon

Another important quality of VUCA situations is that they cannot be framed as “problems to be solved”; they always represent complex multi-faceted situations that are best experienced and addressed in their “wholeness”. Studying VUCA situations demands multiple ways of description and thinking about potential technological and social innovations — some individual and some collective, some human-centered and others nature-informed — to address certain challenges generated by the system. As such, a VUCA situation serves as a situational frame in which to interweave academic knowledge about complex systems.

Students formed and remained in multidisciplinary research teams throughout the academic year and held each other accountable for shared learning and documentation. The teams provided a consistent structure to bridge new course content with thematic throughput from the VUCA study. Each team was responsible for a particular aspect of the VUCA situation upon which to focus. This enabled the teams to add to the collective knowledge generated by the class. For the most part, students developed strong working relationships and team affiliation from this structure. When given the opportunity to change team members, most students stayed with their original team configurations.

Students reported confusion regarding how best to incorporate new knowledge from classwork into the VUCA study activities that took place between each face-to-face class session from one module to the next. Some of the concepts were difficult to apply when the students could not experience a true immersion in the system. The students were requested not to visit the area because of the physical dangers within the Matanza-Riachuelo River Basin. Other barriers to action-research included the enormity and complexity of the political impasse surrounding the MRB situation. It quickly became clear that responsibility for corrective social action lay everywhere and as such could not be effectively addressed by the students. Nevertheless, students gained much from the experience as expressed in the opening sentence of the conclusion to their collective final report:

“The lack of a shared vision of the future image of the Matanza-Riachuelo Basin is one of the elements that, together with the absence of leadership, in a context where there is a vast variety and diversity of stakeholders, are, in our opinion, the main causes of the little advance in a clear and consistent direction in aspects of environmental contamination and standard of living of the inhabitants of the basin.” They went on to affirm that “Methodologies such as Rapid Foresight would be a great contribution in the Matanza-Riachuelo Basin, to start a solid and sustainable path that contains the needs and desires of all the participants, and to establish consensus and define priorities that result in concrete improvements in the quality of life of its inhabitants, many of them without voice and without possibilities or resources to make progress.” Finally, they suggested that “Annual updates of the map of the future of the Basin are key for large system management.”

4 CONCLUSIONS

The Interweave Model detailed in this paper was designed to engage faculty and students in a deep dive research project that spanned the topic material of the first-year introductory courses in the doctoral program on *Leadership and Systemic Innovation* at the Buenos Aires Institute of Technology (ITBA). It was structured around a specific real-world VUCA focus, in this case, the Matanza-Riachuelo River Basin (MRB) of the greater Buenos Aires metropolitan region. The nature of this situation could not be addressed from one disciplinary vantage point but required a systemic perspective and the engagement of collective intelligence competencies.

The intent of the model was to provide an exploratory sandbox with a relevant challenge for students to apply and connect the concepts across five learning modules. Classes were designed as three day intensives to present concepts, methods and approaches for each subject. Students spent the remainder of the month working independently or with their teams to apply the new material to the MRB situation with assignments and continue field research activities. As a result, the class time experience remained fairly disconnected from the MRB field study experience.

Even though the assignments served to address the MRB focus and provide a meaningful learning path based on action-research, students had to shift focus between the changing topics of each class and their efforts to apply those foci to the continuous study of the MRB situation. Subsequent iterations of

the interweave framework will require closer collaboration among the faculty to fully integrate shared fieldwork with the classwork of each learning module.

Future versions of the Interweave Model will incorporate more empathy-based learning approaches. It is in human nature to empathise with those in need and try to help. Students clearly wanted to “do something” about the MRB situation, and it was an emotional burden to remain within the frame of “not solving the problem”. In the future, it will be important to manage the emotional aspects of situations in which people face VUCA challenges.

Another significant challenge derived from the fact that students were required to remain distanced and disconnected from the actual “situation holders” — the people who lived and worked in the MRB area. We must consider how extreme VUCA situations like the MRB may perpetuate an “ivory tower” stance that the doctoral program Interweave Model is actually meant to overcome.

The Interweave Model covered only the first three introductory courses, comprising five learning modules at the beginning of the doctoral program, and the formal study of the MRB situation was complete. Many topics related to in-depth considerations of social innovation could not be considered during the short interweave period. However, students continued to explore the theme of leadership and systemic innovation throughout their four-year course of studies. Subsequent courses provide substantial learning opportunities to identify, stimulate, accompany, and evaluate the impact of social innovations, allowing students to contribute to the social dimension of economic, environmental, and socio-technical change and transformation. Several of the students continued developing their results on the MRB project by connecting and working with key stakeholder organizations. Continuing the legacy started by Sara and Rosana, a sub-group of student volunteers will serve as the teaching assistants and guides through the interweave for the next student cohort. In this way, the students continue to build and strengthen the ITBA learning community.

The outcomes of this experience were open-ended by design: all that was expected of the doctoral students was to learn how to get a conceptual handle on a given VUCA situation and find or create systemic leverage points for socio-technical change agency. In order to meet the combined learning objectives of the interweave courses, their primary objective was to render, model, and prototype a representation of the system and its dynamics over time — including possible and desirable futures states of the system — in a form that was useful to the key stakeholder organization with whom they worked. To do this successfully, they had to generate an actionable framework for the MRB socio-technical, eco-political, and bio-physical system that encompassed the VUCA nature of the situation. The result of this experiential learning process was a real-world engagement that explored how given initial conditions could lead to multifinal viable outcomes, defined and delimited by the participants and stakeholders.

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