A Living Lab Approach to Prepare Students to Be Confident Innovators

Une approche living lab pour construire la confiance des étudiants face à l’innovation

Ann-Louise Davidson, Ariel Harlap and Nadia Bhuiyan
Les living Labs : des espaces d'innovation sociale pour le développement économique et social des territoires et des populations

A Living Lab Approach to Prepare Students to Be Confident Innovators

Une approche living lab pour construire la confiance des étudiants face à l'innovation

Ann-Louise Davidson, Ariel Harlap and Nadia Bhuiyan
A Living Lab Approach to Prepare Students to Be Confident Innovators

**01. Introduction**

There are currently 826,500 vacant jobs (Q4 2021) in Canada, an increase from 512,760 (Q1 2020) before the onset of the pandemic (Statistics Canada, 2022). Employers who seek university graduates need more than workers with specialized knowledge—they need employees with increased soft skills, such as leadership, initiative, teamwork, collaboration, strong communication skills, professionalism, and cultural awareness (Davidson & Major, 2014). The demand for such skills is echoed in several job skills and future of work reports (Bloomberg, 2016; World Economic Forum, 2020; Pew Research Center, 2020). As the job market becomes increasingly demanding in the era of AI and the 4th Industrial Revolution (Schwab, 2017), universities must find new ways to prepare students.

Soft skills are challenging to develop in classroom settings (Murphy et al., 2014). They are difficult to evaluate because differences between skills are overshadowed by how students perceive their skills (Chamorro-Premuzic, 2010). However, experiential learning, such as internships, is known to help improve such skills (Stack & Fede, 2017) because authentic learning experiences and mentorship from industry partners help put theory into practice. Unfortunately, experiential learning activities are not available to all students. Universities need to rethink the concept of learning experiences so that intellectual exchanges can occur between students as peers and between students and extra-academic actors. This will likely bring greater relevance to students’ learning through curricula and address the skills gap.
This research note describes how the Innovation Lab, launched at Concordia University, contributes to bridging the skills gap by preparing students to develop the skills needed to become confident innovators in a living lab approach. It begins with a discussion around the theoretical underpinnings of the skills gap and discusses the reasons for rethinking learning experiences to help students become confident innovators. Next, it describes the foundations of an innovation lab and the potential of challenge-based learning and contextualizes the Concordia University Innovation Lab. Finally, it concludes with a discussion on the nuances of what it means to build soft skills while engaging in innovation, the tensions that can arise in such initiatives, and the potential of living innovation labs for the future of higher education.

## 02. Bridging the Skills Gap Through Re-Designing Learning Experiences

The government’s discourse on innovation is that Canada’s future socio-economic development relies on building a nation of innovators (Government of Canada, 2016). Five years ago, the country recognized that the path to dealing with rapid change was through innovation because it “fosters a thriving middle class and opens the country to new economic, social and environmental possibilities” (Government of Canada, 2016). From the Canadian government’s perspective (2016), innovators can propel us into global competition and translate research ideas into business opportunities along the entrepreneurship continuum of start-ups to international companies. Innovators are also much needed to help bridge the current skills gap—a mismatch between the skills employers need from employees and the skills job seekers possess.

Recent developments reveal various forms of innovation on university campuses (Alexander & Manolchev, 2020; Davidson & Bhuiyan, 2021): teaching innovation initiatives, social innovation labs, new developments in science that yield intellectual property, entrepreneurship incubators, and campus makerspaces. However, while innovation is widespread on campuses, less attention has been given to how we teach innovation to students other than through entrepreneurship which is only one domain of innovation. As Lundberg and Öberg (2021) mention, previous approaches focused on the start-up journey (La Rocca et al., 2017), the triple helix model of innovation (Etzkowitz & Leydesdorff, 2000), and open innovation (Gassmann et al., 2010) which are all focused on developing an entrepreneurship mindset. Our work in the Concordia University Innovation Lab highlights an approach to innovation that aspires for outcomes that help bridge the skills gap. This approach contrasts with what entrepreneurship education fosters when it prioritizes economic outcomes or entrepreneurship (Gaglio et al., 2019).

Indeed, recent graduates entering the job market after the COVID-19 pandemic face brutal competition (Jaberi, 2021). In a context where many people have lost their jobs, and some industries and businesses are cutting back on new hires, recent graduates are entering an incredibly competitive employment market where job loss and job search can be a traumatic experience (Crayne, 2020). Some recent graduates lack essential skills for the workplace, which prevents them from obtaining employment immediately after they complete their degrees (Kleckner & Butz, 2021). This lack of essential skills is referred to in the literature as the skills gap. The concept is far new, as scholars such as Candy and Crebert (1991) mentioned over thirty years ago that the transition from
academia to the workplace was far from easy. This skills gap is sometimes referred to as misalignments between talent’s supply and demand or skills shortage (Balwanz & Ngcwangu, 2016). The skills gap phenomenon is both a problem and an opportunity for universities because they are the institutions that prepare students to enter the workforce.

7 Educators can bridge the skills gap in a variety of ways. One way is by identifying skills that employers perceive are needed in prospective employees and addressing the satisfaction of these skills through programs (Kleckner & Butz, 2021). This approach includes finding mechanisms to help students develop confidence in these skills (Kleckner & Butz, 2021). Alternatively, the skills gap can also be bridged by identifying the perceived importance of skills by various stakeholders (employers, current students, recent graduates, and faculty members) and addressing the importance-preparedness gap—an approach adopted by Crawford and Fink (2020) for a study in agriculture and natural resources education. Understanding the difference between stakeholder groups allows institutions to gain knowledge of the discrepancies in skills perceptions and better prepare students for the workforce.

8 Several studies have shown that soft skills, also understood as generic skills, essential skills, key skills, 21st-century skills, global skills, or innovation skills (Bourn, 2018; Cukier et al., 2015), are critical factors in bridging the skills gap. While there is no set inventory of such skills, they often include communication, collaboration, creativity, critical thinking, interpersonal skills, and strategic thinking. They are known to yield better chances of employment. Bourn mentions that “it is the direct relationship to globalization that the skills debate now needs to progress, to look specifically at how learners can be equipped for living and working in the global economy and society of today” (2018, p.83). Case in point, a study conducted in a business school in the UK concluded that social media skills that are more strategic than intuitive tend to reinforce social capital and improve chances of employability (Benson et al., 2014). Several other studies mention a gap between student perceptions of their essential skills and employer perceptions of the same skills in information technologies (Singh Dubey et al., 2021), social networking (Benson et al., 2014), communication (Kleckner & Butz, 2021), and professional writing (Moore & Morton, 2015). Again, this is an area where higher education can help students become work-ready.

9 Indeed, soft skills are more important than was once believed. Mursion (2021) conducted a recent study that revealed that 44% of human resource professionals prefer hiring someone with solid people skills to someone with strong technical skills. This has also been our experience at the university, where, through internship programs, employers constantly remind us that while technical skills are essential, they seek students who excel at soft skills. This report also highlights that teamwork and collaboration are the most critical and where most new graduates lack skills.

10 Some critics argue that the never-ending skills gap is a way of pointing the finger at higher education institutions for lagging or being unresponsive (Wedekind, 2014). Balwanz and Ngcwangu (2016) explain that this has become a discursive practice regarding the skills gap in South Africa. McLaren explains that a discursive practice is a set of “rules by which discourses are formed, rules that govern what can be said and what must remain unsaid, who can speak with authority and who must listen” (2008, p. 72). Balwanz and Ngcwangu (2016) also argue that many factors affect the skills shortage. Thinking of skills in a co-construction and partnership approach might work
better than developing specific skills through a supply and demand logic (Balwanz & Ngcwangu, 2016).

The co-construction and partnership approach is indeed a promising aspect and development. Since the beginning of the millennium, universities have become interested in incubators to foster an entrepreneurial mindset and, hopefully, propel students into jobs or promote employability skills. However, this approach does not have a one-size-fits-all solution, and pioneers face several challenges. A recent study by Suleman et al. (2021) identified several issues that create barriers to employers’ engagement with universities, including organizational goals and culture. Overcoming these barriers requires a constant and sustained effort from all stakeholders. In a study with small and medium-sized enterprises (SMEs), Lundberg and Öberg (2021) argue that universities should focus on their capacity to transfer knowledge in innovation processes rather than being producers of innovation. In other words, universities should focus on their teaching role in facilitating innovation in collaboration with industry instead of being the parties to generate new ideas through patents and start-ups (Aaboen et al., 2017; Laage-Hellman et al., 2019).

While the problem is complex to navigate, we know that Canada will thrive by building a nation of innovators. However, as mentioned above, little attention has been paid to how we teach students to be confident innovators –this is far from being a simple addition to the curriculum. However, preparing the next workforce facing a skills gap is crucial. Higher education can help build crucial essential soft skills or innovation skills needed to enter the future of work and contribute in ways that add value to the workplace. Despite the multiple explanations of the sources of the skills gap, we need new approaches in higher education that help students better prepare for or further their careers.

### 2.1. Systemic Design

To support learning to innovate, we guided students in using the Systemic Design Framework (Hunter et al., 2021). This framework aims to help designers address complex challenges by considering the systemic and interconnected nature of challenges, addressing root issues, and recognizing that “we are part of nature, not separate [from] it” (Hunter et al., 2021). In a nutshell, the Systemic Design Framework (Hunter et al., 2021) includes:

1. **Six principles to develop and adapt designs**: people and the planet-centred, zooming in and out, testing and growing ideas, inclusive and welcoming difference, collaborating and connecting, circular and regenerative.

2. **Four key roles in tackling systemic issues**: system thinker, leader, storyteller, designer and maker, connector and convener.

3. **Four types of design activities**: exploring, reframing, creating, and catalyzing, as illustrated in Figure 1.

4. **An enabling activity that gives purpose to the design process** will be used for orientation and vision setting, connections and relationships, leadership and storytelling, and continuing the journey.
The Systemic Design Framework design activities align with the challenge-based learning stages of engaging, interacting and acting as described by Nichols and Cator (2008) and Nichols et al. (2016). In addition, numerous other descriptive case studies of CBL and design methods exist, often in co-occurrence with sustainability or software design (Gallagher & Savage, 2020). However, our Innovation Lab initiative may be the first co-occurrence of a systemic design approach using CBL, described in the following sub-section.

03. Challenge-Based Learning Framework

Challenge-based learning (CBL) is a framework that can engage students in solving authentic, real-world problems in collaborative, multidisciplinary groups (Nichols & Cator, 2008; Nichols et al., 2016). Additionally, CBL can involve external stakeholders to develop in-depth knowledge of a crucial socio-technical or social topic; and it can support students in developing essential skills and sharing their ideas or solutions with the world (Nichols & Cator, 2008; Nichols et al., 2016). It stems from various origins, including the principles of progressive education, which relies on the ideas of philosophers such as Dewey's experiential learning (Dewey, 1938) and Freirian pedagogy (Freire, 1996). However, the framework called the STAR Legacy Cycle developed at Vanderbilt University in Tennessee, which includes six phases (challenge, generate ideas, multiple perspectives, research and revise, test your mettle, and go...
public; Birol et al., 2002), appears to be the earliest mention of CBL in the literature (Gallagher & Savage, 2020). The other early mention of CBL, seen at Apple with the “Classroom of Tomorrow” project that referred to a three-step cycle (engage, act, investigate), has been extensively documented in a whitepaper by Nichols and Cator (2008).

While there are various ways to mix challenge-based learning with other approaches such as problem-based learning and case-based learning, Gallagher and Savage (2020) identified seven defining features: 1) global themes, such as sustainability or war; 2) real-world challenges, which increases motivation and engagement; 3) collaboration between students, academic and industry partners; 4) technology-infused both in terms of interaction and publication of outcomes; 5) flexibility in the methodology and interpretation of the topic or approach to innovation; 6) multi-disciplinarity and openness to discipline specificity because of the close links CBL holds with STEM sciences; 7) creativity and innovation led by students and 8) challenge definition to fulfill expectations, competencies or objectives. According to these authors, their literature review provides evidence that its defining features have the particularity of helping students apply their knowledge and skills in context and improve group work, networking, and innovative thinking skills (Gallagher & Savage, 2020).

3.1. What’s a Living Innovation Lab?

We positioned our Innovation Lab as a living lab to remain faithful to both the authentic learning aspects and the defining features of CBL. Scaillardez and Tremblay (2017) described that a living lab is a co-construction approach to solving social issues that are multi-dimensional and multi-faceted. Living labs link tightly to the territories they inhabit, be it cities, regions, or university campuses. They integrate research and practice in an open innovation model, which can be utilizer-driven, enabler-driven, provider-driven, and user-driven (Leminen et al., 2012). The advantage of a living lab approach is that it allows participants and stakeholders to engage in a reflection that can have a variety of outcomes: new knowledge for product development and business development, guided strategy to enact change, new knowledge to support operations development and solutions for everyday-life problems (Leminen et al., 2012) which are always open-source or part of commons that are being developed.

A living lab is always a living innovation lab, but an innovation lab is not necessarily a living lab. For example, an innovation lab that works only on entrepreneurship or lab-to-market activities might not be a living lab if it is not user-centred, if the outcomes are not open source or if not part of a commons when possible. These are important distinctions for our innovation lab.

As per Almirall et al. (2012), there is a broad range of methodologies for living labs because of the wide spectrum of practices. As Almirall et al. (2012) highlight, living labs include the user in the early stages of the innovation process, involve users through various product or service development iterations, allow the co-construction of meaning and new understandings, and take advantage of public-private partnerships. These are common characteristics that can present a variety of adaptations, depending on the context they serve.

The contextual adaptations are essential in the initiative we will describe because one of the challenges faced by the innovation lab is to operate inside a comprehensive
university but outside formal programs. This particularity requires that we work within the university's internal functioning, such as modulating our activities within the semester structure to facilitate full student participation and including students from all four university faculties (Arts and Science, Business, Engineering, and Computer Science, and Fine Arts). Additionally, we identify challenges from authentic issues that partners face and invite mentors capable of supporting students through an innovation process.

The question then is, how can an innovation living lab help students become confident innovators who are prepared to work in various contexts and be mindful of the big crises we face? This question is opposed to the question of curriculum content as we know it in the traditional disciplines and instead opens the way to two crucial questions:

1. How do we accompany students to learn through an authentic innovation challenge involving community and industry partners?
2. How do we foster a failure-positive space for students to learn with their peers and extra-university mentors?

**04. Innovation Ecosystem at Concordia University**

The Innovation Lab we are discussing in this research note presents itself as a flagship initiative at Concordia University. However, before its creation, innovation was present in the DNA of Concordia University at various levels. The ecosystem is an important contextual factor to consider in situating the Innovation Lab’s mission and work within and outside the university.

To identify the internal innovation ecosystem (Figure 2), we conducted an environmental scan which revealed 55 instances of innovation that articulate across 11 axes: Digital Transformation, Social Transformation, Pedagogical Transformation, Technology Transformation, Urban Transformation, Artistic and Cultural Transformation, Health Transformation, Future of Work, Playing and Experimenting, Sustainability and Entrepreneurship. This map does not include specific instances of innovative research projects or specific teaching and learning innovation initiatives.
The Concordia University Innovation Lab connects to the Concordia University innovation ecosystem as a matrix. It becomes a place to establish living labs considering the academic and community dimensions as territories. The map allowed us to describe the landscape and engage in a conversation with various internal and external stakeholders to create bridges and new partnerships and engage mentors in the lab. Engaging external partners and mentors raises several notions that are articulated through the lab: how the type of pedagogical accompaniment was adopted, how we exploited the virtual territory (including Zoom, Discord, Miro, and Notion) in anticipation of a partial return to the campus, and how we attended to cultivating healthy interpersonal dynamics during the learning experience.

The section below presents the Innovation Lab experience we designed for students using a challenge-based pedagogy and the Systemic Design framework. We discuss the interactions and how we refined the experience to hone relationships between students, partners, and mentors.

### 4.1 The Concordia University (Living) Innovation Lab

The Concordia University Innovation Lab was born out of a desire to create a playground where industry and community partners can work together with students and where students can learn to become confident innovators. It began experimentally in January 2021, with the first cohort of 20 undergraduate students tackling four challenges with support from extra-academic mentors. The lab uses a hybrid challenge-based learning approach inspired by Gallagher and Savage (2020). Students explore the context of the challenge, reframe the challenge, create prototypes of actions or ideas that address the challenge, and finally share their learnings during a public presentation. Given the COVID-19 pandemic context, the first year was entirely online, using Zoom for video conferencing, Discord to chat and meet outside formal meeting times, Miro to brainstorm, and Notion as a repository.

To help students address their innovation challenges, we provided a schedule of activities (Figure 3), learning materials on using the Systemic Design Approach (Hunter et al., 2021), other research or design methods, and a list of deliverables. The schedule guides students through some of the critical activities of the Systemic Design Approach, and the deliverables guide students towards incrementally developing their final presentation.

**Figure 3. Diagram of the student learning experience**
4.2 The student learning experience

The Systemic Design Approach (Hunter et al., 2021), represented in a linear schedule of activities in Figure 3, provides a framework for students to build knowledge through various interpersonal interactions (Figure 4). Students and Innovation Lab staff decided upon joint meeting agreements during the first meeting, clarified expectations, and later student teams finalized their team agreements. Through these activities, students were given agency and supported by creating a positive learning environment and team dynamic. Students began exploring the challenge in the subsequent several weeks by working with their mentors, networking, speaking with experts, and researching popular and academic literature. Innovation Lab staff encouraged students to talk with stakeholders, faculty at the university, or organizations working in their challenge area and attend events or webinars that might be relevant. In many cases, mentors facilitated student connections with other experts, and students mentioned speaking to family and friends to learn more about their challenge topic. Following the exploration phase, students spent two weeks reframing the challenge by clearly identifying the gap between the current challenge situation and the ideal future or by creating a visual depiction of the essential elements of their challenge, thus concluding the first half of the challenge term.

Figure 4. Student interactions as a team and as individuals

Students first expanded a set of potential ideas into action, product, or service that adequately addressed the reframe during the second half of the term. Then, using consensus-based decision-making, each student team decided what to create and prototype. In some cases, students had access to prototyping spaces such as a makerspace; during a challenge on mask effectiveness, students had access to an aerosol filtration lab. After that, students tested, gathered feedback, and synthesized the results of creating their prototype. In some cases, particularly with systemic and social challenges, prototyping may influence the system or begin to catalyze change, and students were encouraged to observe and record these effects. Finally, students prepared, practiced and performed a public presentation documenting their
experiences and learning on the challenge topic. Finally, students had to wrap up their
documentation and share it with the Innovation Lab and their mentors to facilitate
future student teams to continue the challenge. The final presentations of Winter 2021,
Summer 2021, Fall 2021, and Winter 2022 are available online (4TH SPACE Concordia
University, 2021a, 2021b, 2021c, 2022).

05. Student interactions and learning from others

Students learned from various individuals within and outside the university (Figure 4).
The density and frequency of these interactions had different objectives. Weekly
interactions with Innovation Lab staff encouraged students, acted as a sounding board,
provided feedback on their progress, clarified expectations or goals, facilitated
connections, provided coaching in navigating team or mentor dynamics, shared
relevant learning resources, and facilitated collective discussions. Occasionally,
individual students engaged staff in conversation via in-person meetings or
asynchronous messaging around personal or interpersonal challenges. In an
anonymous program improvement exit survey, several students reported an
appreciation for the care and timely support received from staff, suggesting that the
one-on-one interactions were significant for building student confidence and success.

Mentors typically met with students weekly to provide their expertise or domain
knowledge, and their approach to supporting students varied considerably –some were
more comfortable directing. In contrast, others acted as listeners, coaches, or
connectors to other stakeholders or experts. As many mentors were new to this role,
we shared a guide on good practices emphasizing curiosity, openness, and respect for
the mentoring relationship. The mentors did not employ students, and the tone was set
for students to learn with the mentor, prioritize tasks as a team, and consult with
mentors.

The teams had considerable freedom to self-organize, determine roles, distribute tasks,
and even form subgroups or work as a whole. This freedom was at times overwhelming
and sometimes empowering. Team members led in areas of their expertise or used this
as an opportunity to develop expertise in new skills or knowledge domains. Given the
interdisciplinary nature of the challenge and the student recruitment strategy, it was
not uncommon for students to reorganize halfway through into subgroups tackling
complementary elements of the challenge. One undergraduate student shared how the
interdisciplinary nature of the team composition was beneficial both to her learning
and to improving the team’s presentation:

“I remember [my teammates] had to explain a lot of the more scientific things to
me, especially with the results [...]. I hoped it helped in the making of the
presentation because you have to pass it by my brain to make sure I got it before
[finalizing the presentation]. For me, that was helpful, and they were very open and
explained things quite well.” (4TH SPACE Concordia University, 2021a)

At times, students within a team agreed upon distinct roles and had to develop a
successful approach to communicating their progress and maintaining alignment
towards the shared goals. For example, some teams relied more heavily on
synchronous weekly meetings; others used messaging platforms or collaborative
documentation software. The limited time and interdisciplinarity meant that students
also had to learn to develop trust for others to lead specific tasks, share the workload,
develop different expertise, and share results from their exploration or testing in a
meaningful way.

06. Preparing and fine-tuning the learning environment

Multiple iterations were essential to crafting a fun, motivating, and supportive learning environment for students. The evolution of the lab (Table 1) included consideration of the framework and activities used to scaffold how students learned to address the challenge. Additionally, because of the breadth and ill-defined nature of the challenges, students were given increasingly specific documentation and suggestions on the deliverables to incrementally prepare a final presentation and any required administrative tasks. We often reminded students that proposed deliverables and sample work were provided only as suggestions and that they were welcome to break the “rules.”

Although the lab operated virtually, we attempted to encourage student community building beyond their participation in a single challenge. After the winter 2021 term, we invited a few previous lab participants to take on occasional leadership roles for teams or tasks for lab activities. These lab alumni could help teams with occasional questions or peer feedback. However, ultimately the opportunities for building connections were perhaps too limited to contribute to forming a community of students which persisted beyond a term. Meanwhile, the number of staff, participating students, and external mentors supporting student teams did not change meaningfully between iterations (Table 1).

We created documentation using the collaborative, online knowledge management software Notion, supplemented with diagrams in Miro, and the primary means of communication used the messaging platform Discord. These tools permitted the flexibility to update the documentation rapidly, both by staff and students, and effortlessly invite collaboration from extra-academic actors, which would otherwise have been challenging with the university’s sanctioned communication technology and learning management software.
Table 1. Evolution of the materials and people supporting student learning in the Innovation Lab

| Deliverables and tasks | Winter 2021 | Summer 2021 | Fall 2021 |
|------------------------|-------------|-------------|-----------|
| Weekly deliverables or task are described briefly in the schedule. | List of weekly task in the schedule. | List of weekly tasks in the schedule. | Page with the description of deliverables every two or three weeks plus a placeholder for teams to add links to created materials. |
| The final deliverable is a live, online team presentation. | Page with the description of deliverables every two or three weeks plus a placeholder for teams to add links to created materials. | Samples of past deliverables, explanatory paragraph for almost every deliverable. | Deliverables are predominantly an incremental production of their final live, online presentation. |
|Weekly learning log. | The final deliverable is a live, online team presentation. | Weekly learning log. | Weekly learning log, with additional questions on mood. |

| Stakeholders involved | Winter 2021 | Summer 2021 | Fall 2021 |
|-----------------------|-------------|-------------|-----------|
| 1.5 full-time equivalent staff. | 1.5 full-time equivalent staff. | 1.5 full-time equivalent staff. | |
| 4 teams: 8 full-time students and 9 part-time students. | 1 part-time contract support staff. | 1 part-time contract support staff. | |
| 8 mentors. | 4 part-time lab alumni supporting student teams. | 4 teams: 19 part-time student. | |
| | 3 teams: 19 part-time students. | 7 mentors. | |
| | 5 mentors. | | |

| Supplementary documentation | Winter 2021 | Summer 2021 | Fall 2021 |
|-----------------------------|-------------|-------------|-----------|
| Description of expectations towards student participation. | Description of expectations towards student participation. | Description of expectations towards student participation. | |
| Frequently-asked questions pages. | Frequently-asked questions page. | Frequently-asked questions page. | |
| | Guide for partner mentors on mentorship at the Innovation Lab. | Guide for partner mentors on mentorship at the Innovation Lab. | |
| | Team-forming discussion guide for student teams. | Team-forming discussion guide for student teams. | |
| | Collective agenda for weekly lab meetings. | Collective agenda for weekly lab meetings. | |
During each iteration, areas that created frustration, friction, or repeated questioning led to the creation of new documentation. The first of these was adding as much clarity as possible to the application process and the initial orientation materials by addition of supplementary documentation (Table 1). These clarifications better-aligned student expectations with the intended approach of the lab – most participating students had no prior experience with challenge-based learning, and few had experience with systems thinking or design methods. Another significant addition was the team-forming discussion guide (Concordia Innovation Lab, 2021) to support teams in structuring a discussion to clarify a shared vision, agree on consensus decision-making, as well as agree upon habits, scheduling, roles, task distribution, individual preferences for feedback, and proactive conflict resolution strategies. Finally, individualized learning logs or journals, which were only viewable by the student and Innovation Lab staff, were added to support students in various ways: reflecting on and indicating when they might be stuck, sitting with unanswered questions, experiencing interpersonal tensions, or perhaps being overwhelmed by other academic workloads or personal circumstances.

07. Discussion and Conclusion

One of the questions that drove our motivation to write this research note relates to the accompaniment of students to learn through an authentic innovation challenge involving community and industry partners. We aimed to use challenge-based learning (CBL) because the functioning of the Innovation Lab is consistent with aspects of real-world problems and involves working in multidisciplinary groups, two criteria of CBL emphasized by Nichols and Cator (2008). The learning experience we offer is also consistent with many of the defining features of CBL, as identified by Gallagher and Savage (2020). Some challenges, though not all, addressed global themes, but all challenges had a link with real-world challenges. All challenges involved collaboration between students and academic and industry partners. The collaboration was not always balanced as equals because of how some partners prefer to work with students, whether it was a side project, a contributory project, or a critical project that was key to the development of a company (or a new section of a company), a mandate or an initiative. All projects were highly technologically-infused because of working virtual during the COVID-19 pandemic and because the deliverables were all digital. We can anticipate that future initiatives will keep the online documentation aspect but will proceed in some form of a hybrid model, which can create new dynamics.

Perhaps the most significant challenges emerged from the flexibility of the approach, the teamwork, and approaches to supporting student creativity. These misalignments stem from various systems interfacing with different aims and objectives. For example, using the Systemic Design framework from the Design Council (Hunter et al., 2021) gave us enough flexibility to bring students through a creative process. However, this was less useful for task-based and tightly-defined challenges or when mentors were more directive. In those cases, we had conversations with some partners to ensure that challenges remained open enough for students to have the freedom to develop creative solutions while developing innovation skills.

Living innovation labs need flexible approaches to allow various designs and prototypes to yield socio-technical solutions. Meanwhile, they must also stay true to
living labs by including user-driven, open-source solutions that can enact change in processes and everyday life, as per Leminen (2012). This flexibility aligns with Almirall et al.’s (2012) stance on the importance of adopting a wide range of methodologies in living labs. Similarly, we had to be flexible in our workshop offerings at the Innovation Lab because we included students from all four faculties, and students from different programs had different skill gaps.

While there is no consensus on defining and assessing soft skills/innovation skills in the literature (Chamorro-Premuzic et al., 2010), there is an agreement that they can propel students to gain significant employment post-graduation (Government of Canada, 2016). Soft skills/innovation skills help bridge the skills gap, primarily when taught in rich, authentic experiential learning contexts (Stack & Fede, 2017) created in partnership with industry to avoid the discursive biases around supply and demand (Balwanz & Ngcwangu, 2016). As we did in the Innovation Lab, finding rich and authentic challenges with community and industry partners is an efficient mechanism to help students develop their confidence in such skills, which Kleckner and Butz (2021) also documented.

We work in close collaboration with mentors to offer guidance in accompanying students. We also worked tightly with students to prepare them to receive feedback from mentors and community and industry partners. This approach is consistent with Lundberg and Öberg’s (2021) suggestion that universities focus on their capacity to transfer knowledge in innovation processes. Similarly, Aaboen et al. (2017) and Laage-Hellman et al. (2019) suggest that universities focus on facilitating innovation and collaboration with industry partners rather than working in silos to generate new ideas and patents.

Teamwork is often a contentious issue in higher education. Everybody knows it causes tensions; very few people talk about it, but it is one of the most sought-after skills by employers, as per a recent report written by Mursion (2021). In the Innovation Lab, teamwork-related tensions arose due to uneven participation, personality conflicts, and conflicting ambitions. To minimize tensions, we created a team-forming discussion guide and a worksheet on team agreements and integrated team building as an essential starting and ongoing lab activity. Of course, this did not eliminate the issues. However, it contained them because we had proactive and retroactive mechanisms to manage and better attenuate interpersonal conflict.

In the ideal world, students might only have value-based constraints and could freely follow their creative insights. Additionally, this openness would be more consistent with CBL and its open inquiry process (Gallagher & Savage, 2020). It is also the distinction between being creative without boundaries and being creative in an innovation framework with external partners where new ideas have to add value. In the case of the Innovation Lab, we work with external partners and mentors, so the innovations must have meaning for the contexts in which they work.

In facilitating the learning experience, fostering a failure-positive space for students was essential. Multiple students noted how refreshing and novel this was for them, as exemplified by two undergraduate student testimonials from the Winter 2021 cohort:

“It was nice to be able to share ideas and brainstorm and prototype and have [...] a feeling of [a] community instead of [feeling that] I’m being graded, or [that] everyone is judging me.” (4TH SPACE Concordia University, 2021a).

Another student added that the most important thing they learned was that,
“Making mistakes is OK, which was very weird to me. And, you learn a lot more just from making mistakes and learning from there. However, when you present something in university, you always think it has to be perfect –but that’s not the case.” (4TH SPACE Concordia University, 2021a).

This environment was facilitated by giving students control and ample support, allowing for great flexibility and role-modelling how the staff handled mistakes. Students were trusted to self-organize tasks and roles and participated as equals in deciding what to discuss during weekly lab meetings. They were also entrusted to make up for missed sessions, choose how and where to put their efforts, and honour the initial participation agreements. When students did not fulfill their agreements, we approached this with curiosity and conversation rather than assumption or judgment. Furthermore, we empowered students to find alternative ways of honouring the terms of the agreement that worked for their situation. Teams had multiple opportunities to share and receive feedback from their peers. Periodic feedback was essential to clarify how to prepare, ask for feedback, receive feedback with curiosity, and give feedback to others. In preparatory discussions with mentors, it was essential to set realistic expectations of what students might produce and consider aligning challenge topics with side-projects to avoid unnecessary pressure from mentors. Other elements which supported the failure-positive environment were the flexibility of the schedule to allow time for failed attempts or unfruitful explorations and the lack of grading in this extra-curricular experience.

This article contributes to the literature in describing in detail solutions to the challenges we encountered while attempting to empower students to become confident innovators and in adopting a CBL approach. For example, whereas Gallagher and Savage (2020) noted the difficulty in the need for flexibility when working with extra-academic actors, the Systemic Design framework effectively provided both structure and flexibility—we recommend it as a complement to CBL. In addition, we attended to numerous difficulties commonly noted in CBL: meeting student’s needs for support (Malmqvist et al., 2015) through a web of frequent interactions, reducing the discomfort of the high level of uncertainty (Gallagher & Savage, 2020) by scaffolding tasks towards a final team presentation, and attending to teamwork challenges in a flat hierarchy (Gallagher & Savage, 2020) with a team-forming discussion guide and rapidly checking in with students when they reported interpersonal tensions. These strategies may also serve other highly collaborative problem-focused learning approaches such as grand challenges (Nowell et al., 2020), collaborative learning (Davidson & Major, 2014), and collaborative problem-based learning (Mott et al., 2019).

Future initiatives might focus on broadening the scope of innovation beyond the dominant discourses of entrepreneurship, disruption, and novelty. To create appropriate measures of success, we need new tools to identify which innovative skills are crucial according to employers and how to assess these skills meaningfully for both students and employers. In universities, it can also be helpful to prepare undergraduate students to be confident innovators instead of waiting to open such possibilities during their master’s or doctoral degrees. Another element to explore is empowering students to build knowledge networks and partnerships around the challenges, as one of the essential elements to innovating in which they rarely get to participate before graduating.
BIBLIOGRAPHY

4TH SPACE Concordia University. (2021a, April 26). Winter 2021 innovation challenges [Video]. YouTube. https://www.youtube.com/watch?v=xa4dJ2KzPqg

4TH SPACE Concordia University. (2021b, July 8). Summer 2021 innovation challenges [Video]. YouTube. https://www.youtube.com/watch?v=yzNtbPPWKDM

4TH SPACE Concordia University. (2021c, November 25). Fall 2021 innovation challenges [Video]. YouTube. https://www.youtube.com/watch?v=pfjzS8Uh4RU

4TH SPACE Concordia University. (2022, April 8). Winter 2022 innovation challenges [Video]. YouTube. https://www.youtube.com/watch?v=M8-k_N_7w5A

Aaboen, L., La Rocca, A., Lind, F., Perna, A. & Shih, T., Eds. (2017). Starting up in Business Networks: Why Relationships Matter in Entrepreneurship. London. Palgrave.

Alexander, A., & Manolchev, C. (2020). The future of university or universities of the future: A paradox for uncertain times. International Journal of Educational Management, 34(7), 1143–1153. https://doi.org/10.1108/ijem-01-2020-0018

Almirall, E., M. Lee, & Wareham, J. (2012). Mapping living labs in the landscape of innovation methodologies. Technology Innovation Management Review, September 2012, 12–18.

Balwanz, D., & Ngcwangu, S. (2016). Seven problems with the scarce skills discourse in South Africa. South African Journal of Higher Education, 30(2), 31–52. https://doi.org/10.20853/30-2-608

Benson, V., Morgan, S., & Filippaios, F. (2014). Social career management: Social media and employability skills gap. Computers in Human Behavior, 30, 519–525. https://doi.org/10.1016/j.chb.2013.06.015

Birol, G., McKenna, A. F., Smith, H. D., Giorgio, T. D., & Brophy, S. P. (2002). Integration of the "how people learn" framework into educational module development and implementation in biotechnology. Proceedings of the Second Joint 24th Annual Conference and the Annual Fall Meeting of the Biomedical Engineering Society] [Engineering in Medicine and Biology. https://doi.org/10.1109/iembs.2002.1053468

Bloomberg. (n.d.). Bloomberg.com. Retrieved May 9, 2022, from https://www.bloomberg.com/graphics/2016-job-skills-report/

Bourn, D. (2018). Understanding Global Skills For 21st Century Professions. Palgrave, MacMillan.

Candy, P. C., & Crebert, R. G. (1991). Ivory tower to concrete jungle: The difficult transition from the academy to the workplace as Learning Environments. The Journal of Higher Education, 62(5), 570. https://doi.org/10.2307/1982209

Chamorro-Premuzic, T, Arteche, A., Bremner, A.J., Greven, C., Furnham, A. (2010). Soft skills in higher education: importance and improvement ratings as a function of individual differences and academic performance, Educational Psychology, 30:2, 221–241.

Concordia Innovation Lab. (2021). Sample learning log. OER Commons. Retrieved November 10, 2021 from https://www.dropbox.com/s/822ahgpmenbl14j/Sample-Learning-Log.pdf?dl=0

Crawford, P., & Fink, W. (2020). Critical Growth Areas for Students Today. APLU Series on Employability Skills in Agriculture & Natural Resources. Association of Public and Land-Grant Universities.
Crayne, M. P. (2020). The traumatic impact of job loss and job search in the aftermath of COVID-19. *Psychological Trauma: Theory, Research, Practice, and Policy, 12*(S1). [https://doi.org/10.1037/tra0000852](https://doi.org/10.1037/tra0000852)

Cukier, W., Hodson, J., & Omar, A. (2015, November). "Soft" skills are hard: A review of the literature. Toronto: Ryerson University. Retrieved November 10, 2021 from [https://www.ryerson.ca/content/dam/diversity/reports/KSG2015_SoftSkills_FullReport.pdf](https://www.ryerson.ca/content/dam/diversity/reports/KSG2015_SoftSkills_FullReport.pdf).

Davidson, A.-L., & Bhuiyan, N. (2021). The time for innovation in higher education is now. The Hill Times, Briefing Policy on Innovation. Retrieved Feb 20, 2021 from [https://www.hilltimes.com/2021/02/17/the-time-for-innovation-in-higher-education-is-now/283717](https://www.hilltimes.com/2021/02/17/the-time-for-innovation-in-higher-education-is-now/283717).

Davidson, N., & Major, C. H. (2014). Boundary crossings: Cooperative learning, collaborative learning, and problem-based learning. *Journal on Excellence in College Teaching, 25*(3 & 4), 7–55.

Davidson, P. (2014). What do employers want from Canadian higher education? Global and Mail. Retrieved April 25, 2022 from [https://www.theglobeandmail.com/partners/advtopcanadianuniversities0614/what-do-employers-want-from-canadian-higher-education/article19195787/](https://www.theglobeandmail.com/partners/advtopcanadianuniversities0614/what-do-employers-want-from-canadian-higher-education/article19195787/)

Dewey, J. (1938). *Experience and education*. Touchstone.

Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: From national systems and "mode 2" to a triple helix of university-industry-government relations. *Research Policy, 29*(2), 109–123. [https://doi.org/10.1016/s0048-7333(99)00055-4](https://doi.org/10.1016/s0048-7333(99)00055-4)

Freire, P. (1996). *Pedagogy of the Oppressed*. Continuum.

Gallagher, S. E., & Savage, T. (2020). Challenge-based learning in higher education: an exploratory literature review. *Teaching in Higher Education*. [https://doi.org/10.1080/13562517.2020.186354](https://doi.org/10.1080/13562517.2020.186354)

Gaglio, G., Godin, B., & Pfotenhauer, S. (2019). X-innovation: Re-inventing innovation again and again. *Novation: Critical Studies of Innovation, (1), 1–16.*

Gassmann, O., Enkel, E., & Chesbrough, H.W. (2010). The future of open innovation. *R&D Management, 40*(3), 213–221.

Government of Canada. (2016). *Building a nation of innovators*. Innovation, science and economic development, Canada. [https://www.ic.gc.ca/eic/site/062.nsf/eng/h_00105.html](https://www.ic.gc.ca/eic/site/062.nsf/eng/h_00105.html)

Hunter, N., Drew, C., Johnson, J., Chadha, S., Carlisle, C., Burnett, A., & Davies, E. (2021). Beyond net zero: A systemic design approach. Design Council.

Jaberì, S. (2021). Entering the workforce during the pandemic. *Design Management Review, 32*(1), 17–18. [https://doi.org/10.1111/drev.12252](https://doi.org/10.1111/drev.12252)

Kleckner, M. J., & Butz, N. (2020). Addressing undergraduate skill gaps in higher education: Revisiting communication in the major course outcomes. *Journal of Education for Business, 96*(7), 411–423. [https://doi.org/10.1080/08832323.2020.1844119](https://doi.org/10.1080/08832323.2020.1844119)

Laage-Hellman, J., Lind, F., Öberg, C., & Shih, T. (2020). Interactions between university spin-offs and academia: A dynamic perspective. *Journal of Business & Industrial Marketing, 35*(12), 1941–1955. [https://doi.org/10.1108/jbim-08-2019-0380](https://doi.org/10.1108/jbim-08-2019-0380)

Leinen, S., Westerlund, M., & Nyström, A.-G. (2012). Living Labs as open-innovation networks. *Technology Innovation Management Review, 2*(9), 6–11. [https://doi.org/10.22215/timreview/602](https://doi.org/10.22215/timreview/602)
Lundberg, H., & Öberg, C. (2021). Teachers, researchers, but not innovators? Rethinking university-industry collaboration. Journal of Business & Industrial Marketing, 36(13), 161–173. https://doi.org/10.1108/jbim-03-2020-0126

Malmqvist, J., Kohn Rådberg, K., & Lundqvist, U. (2015). Comparative analysis of challenge-based learning experiences. 11th International CDIO Conference, Chengdu University of Information Technology, 87–94.

McLaren, P. (2008). Critical pedagogy: A look at the major concepts. In A. Darder, M. Baltodano and R. Torres (Eds.), The critical pedagogy reader (pp. 61–83). New York. Routledge.

Mott, B. W., Taylor, R. G., Lee, S. Y., Rowe, J. P., Saleh, A., Glazewski, K. D., Hmelo-Silver, C. E., & Lester, J. C. (2019). Designing and developing interactive narratives for collaborative problem-based learning. Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 11869 LNCS, 86–100. https://doi.org/10.1007/978-3-030-33894-7_10

Moore, T., & Morton, J. (2015). The myth of job readiness? Written communication, employability, and the ‘skills gap’ in higher education. Studies in Higher Education, 42(3), 591–609. https://doi.org/10.1080/03075079.2015.1067602

Murphy, S. E., Putter, S., & Johnson, S. K. (2014). Soft skills training: Best practices in industry and higher education. In R. E. Riggio & S. J. Tan (Eds.), Leader interpersonal and influence skills: The soft skills of leadership (pp. 5844–6499). New York, NY: Routledge.

Mursion. (2021, May). From skill to instinct: How higher education can bridge the gap between classroom and career. Mursion.com. https://info.mursion.com/from-skill-to-instinct

Nichols, M. H., & Cator, K. (2008). Challenge based learning white paper. Cupertino, California: Apple, Inc.

Nichols, M., Cator, K., & Torres, M. (2016). Challenge based learner user guide. Redwood City, CA: Digital Promise.

Nowell, L., Dhingra, S., Andrews, K., Gospodinov, J., Liu, C., & Alix Hayden, K. (2020). Grand challenges as educational innovations in higher education: A scoping review of the literature. Education Research International, 2020, 1–39. https://doi.org/10.1155/2020/6653575

Pew Research Center. (2020). Women Make Gains in the Workplace Amid a Rising Demand for Skilled workers. https://www.pewresearch.org/social-trends/2020/01/30/women-make-gains-in-the-workplace-amid-a-rising-demand-for-skilled-workers/

Rocca A.L., Öberg C., Hoholm T. (2017) 4 when start-ups shift network: Notes on start-up journey. In L. Aaboën, A. La Rocca, F. Lind, A. Pern, T. Shih (Eds.), Starting up in business networks. Palgrave Macmillan, London. https://doi.org/10.1057/978-1-137-52719-6_5

Scaillez, A., & Tremblay, D.-G. (2017). Coworking, fab labs et living labs: État des connaissances sur les tiers lieux. Territoire En Mouvement, (34). https://doi.org/10.4000/term.4200

Schwab, K. (2017). The Fourth Industrial Revolution. Portfolio Penguin.

Singh Dubey, R., Paul, J., & Tewari, V. (2021). The soft skills gap: A bottleneck in the talent supply in emerging economies. The International Journal of Human Resource Management, 1–32. https://doi.org/10.1080/09585192.2020.1871399

Stack, K., & Fede, J. (2017). Internships as a pedagogical approach to soft-skill development. NACE Journal, (August). Retrieved from http://www.naceweb.org/career-readiness/internships/internships-as-a-pedagogicalapproach-to-soft-skill-development/
ABSTRACT

This article examines the development of a living innovation lab to support university students in becoming confident innovators. Given the effervescence of the Quebec innovation field and the Canadian ambitions to develop a nation of innovators, universities must teach innovation approaches and bridge the gap between the skills developed in university and those expected by the job market. Accordingly, we have created an Innovation Lab at Concordia University, including student interdisciplinarity, mentors, and partners. We have adopted challenge-based learning and a systemic design approach to help students develop innovation skills. We describe the Innovation Lab initiative and share reflections on the essential elements, including the need for flexibility, creating a failure-positive environment for students, proactively attending to teamwork, and contextual limits on creativity.

RÉSUMÉ

Cet article se penche sur le développement d’un living lab d’innovation pour accompagner les étudiants universitaires dans le développement de leur confiance face à l’innovation. Avec l’effervescence du domaine de l’innovation au Québec, ainsi que les ambitions canadiennes de développer une nation d’innovateurs, il est essentiel que les universités deviennent des lieux de formation à l’innovation pour combler l’écart entre les compétences développées lors de la formation et celles attendues par le marché du travail. Nous avons créé un laboratoire d’innovation à l’Université Concordia, dans lequel nous avons adopté l’apprentissage par défis et un modèle de design systémique pour aider aux étudiants à développer des compétences d’innovation. Ce laboratoire implique la participation d’étudiants de toutes les disciplines, des mentors et des partenaires externes. Nous décrivons l’initiative du laboratoire d’innovation et nous offrons une réflexion quant aux enjeux les plus importants, incluant le besoin de souplesse dans un environnement où les étudiants doivent pouvoir prendre des risques, le travail d’équipe et des contraintes contextuelles de la créativité.

INDEX

Keywords: Innovation skills, skills gap, higher education, systemic design, living labs, challenge-based learning

Mots-clés: Compétences d'innovation, écart de compétences, enseignement supérieur, design systémique, living labs, apprentissage par défis
AUTHORS

ANN-LOUISE DAVIDSON
Associate Professor, Department of Education; Director, Innovation Lab, Concordia University, Canada, ann-louise.davidson@concordia.ca

ARIEL HARLAP
M.Sc.; M.A. student, Educational Technology; Coordinator, Innovation Lab, Concordia University, Canada, ariel.harlap@concordia.ca

NADIA BHUIYAN
Vice Provost, Partnerships and Experiential Learning; Professor, Mechanical, Industrial and Aerospace Engineering, Concordia University, Canada, nadia.bhuiyan@concordia.ca