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ORIGINAL ARTICLE

Prototyping the future of learning: reflections after seven iterations of Challenge-Based Innovation (2014-2020)

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ABSTRACT

This article presents the reflections of a multidisciplinary team working on CERN's Challenge-Based Innovation (CBI) since 2014. These reflections on pedagogy and innovation are positioned at the intersection of experiential learning, design thinking and challenge-driven education. Drawing from seven editions of what has become "CBI Fusion Point," we present our story as an ongoing journey of experimentation with various formats and methods in response to broader shifts in education. Our article contributes to a better understanding of the characteristics and challenges that CBI-like programs pose and the infrastructure and support that they require.

Keywords: Challenge-driven education; experiential learning; design thinking; future of teaching creativity; innovation and entrepreneurship.

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INTRODUCTION

Higher education appears to be at a tipping point concerning its purpose, structure and content. Although scholars have long been raising concerns about the efficacy of college degrees in preparing graduates for the needs of the job market, there has been a significant increase in the volume and sense of urgency to increase the impact and relevance of academic institutions. There are several models and initiatives that suggest changes needed in educational paradigms for schools and universities to be more creative (Robinson & Aronica 2015), innovative (Christensen & Eyring 2011) and entrepreneurial (Etzkowitz, 2003).

There is a general understanding of what education should look like, but how to make this happen is less clear. While there is a plethora of toolkits with methods and techniques for teaching and enhancing innovation (see for example IDEO, Stanford D-school and NESTA), limited attention has been given to their repurposing for learning within higher education organizations (Beckman & Barry 2007). Relatedly, the infrastructural support and cultural changes needed for the successful implementation of initiatives such as "CBI Fusion Point" (CBI-FP) are rarely discussed.

Fusion Point is a collaboration between ESADE Business School, Istituto Europeo di Design (IED)-Barcelona and Universitat Politécnica de Catalunya (UPC) that started in 2014. Bringing together the fields of business and management, technology and engineering, and design, these three schools based in Barcelona gave birth to an experimental context for educational innovation. Together we have delivered seven iterations of the CBI program so far.

In a nutshell, CBI-FP is a 12-credit course that runs from September to mid-December. Approximately 40 students work in small multidisciplinary teams (5-6 people) and meet on a weekly basis in workshops, seminars and coaching sessions. Each team has three coaches, one from each school. The students travel together to CERN three times during the course for a total of 15 days (first two trips are 3 days long and the last one slightly longer; see Figure 1 for an overview). The student profiles are:

- ESADE: full time MBAs;
- UPC: Telecom engineering & computer science (majority 4th year bachelor level from the Telecom School);
- IED-Barcelona: Different design programs (majority 4th year bachelor level)

CBI-FP has been described by our students as a life changing experience. In addition to giving them the opportunity to visit and interact with CERN, which is undoubtedly a major attraction for students in CBI, it also allows them to experience the process of innovation from start to finish, deal with high levels of uncertainty and frustration, learn to interact and work with people with different backgrounds, and engage with actual users and other stakeholders in real-life contexts.

CBI has also been a life-changing experience for the academic team, equally uncertain and frustrating but also enriching. Among the many challenges we have had to face over the years, perhaps the most difficult has been

explaining what exactly happens in CBI-like courses and describing the effort they require for making them possible. This article presents the reflections of a multidisciplinary team of teachers and researchers involved in CBI-FP in different roles since 2014[i] and tackles the following questions: What are the key characteristics of CBI-FP that are unique and effective, but also challenging? What infrastructural support and cultural changes do CBI-like programs necessitate?

THEORETICAL BACKGROUND

To better understand our CBI experience, we draw from literatures on design thinking, challenge-driven education, and experiential learning. The links between CBI-FP and design thinking and challenge-driven education are perhaps self-explanatory, as these elements were embedded in the original CBI designed by CERN's IdeaSquare team. Our attention to the experiential learning literature, which is the oldest and most theoretically advanced body of work of the three, came about as we began thinking about some of the challenges we observed in CBI-FP. More specifically, we realized that for CBI-FP was for our students not only an opportunity to learn about innovation, more importantly perhaps, it was an experiential learning journey.

Experiential learning is positioned as a synthesis of the works of various well-known scholars "who gave experience a central role in their theories of human learning and development" (Kolb & Kolb 2017, p.8). These scholars include William James, John Dewey, Kurt Lewin, Jean Piaget, Carl Jung, Mary Parker Follett to name a few. According to one of the latest articles by David Kolb (ibid.), the author of the 1984 ground-breaking and very influential book "Experiential Learning," many of the non-traditional educational innovations of the past few decades, such as competency-based and professional education, are linked to experiential learning. For educators, Kolb & Kolb state (2017, p.7),

> "the magic of experiential learning lies in the unique relationship that is created between the teacher, the learner, and the subject matter under study. The experiential approach places the subject to be learned in the center to be experienced both by the educator and the learner."

Design thinking has been described as an active learning method where students experience different phases of the learning process through feedback and reflection. Design thinking is more dynamic than the typical classroom methodology where the goal is to help students understand predefined material and master certain techniques. By contrast, students learning through design thinking are asked to leave their chairs and classrooms and go out in the real world to observe and take notes (Beckman & Barry 2007; Glen et al. 2014). According to Micheli and colleagues (Micheli et al. 2019), definitions of design thinking link the term to processes and personal characteristics (thinking or sensing) with the aim to create viable business. In general, design thinking is often used in parallel to human-centred design and innovation and is widely regarded as an effective approach to creating new products or solutions that address specific user needs.

Challenge-driven education is considered to be a recent strand that positions students against real-life challenges and ask them to address them by working in teams, drawing on different disciplines and collaborating with organisations and stakeholders beyond the walls of their institution (Mulgan et al. 2016). Challenge-driven learning is regarded as complementary to mastering a specific field of study because it provides an opportunity for students to apply their knowledge in practice. As Mulgan et al (ibid) note, challenge-based learning echoes ancient traditions of learning that start with challenging questions and which can be traced back to Socrates. Arguably, the essence of design thinking is also not new, yet it has cast a new light on the importance of empathizing with the people whose needs or desires your ideas, products and solutions aim to address.

While this literature sheds light on several characteristics and constitutional elements of CBI-FP, it does not consider the challenges of implementing such programs. Our study, therefore, aims to contribute to this body of work, by making explicit the realities of the teaching experience of delivering learning programs that are experiential, challenge-driven and apply innovation processes neatly captured by design thinking.

METHOD AND DATA

Our article draws on qualitative research methodologies grounded in ethnography. There is a long trajectory of ethnographic research in anthropology (Clifford & Marcus 1986; Geertz 1977; Malinowski 1922) and there has been a growing interest and application of its core methods in innovation and product development (Otto & Smith 2013; Suchman 2011). Although definitions of ethnography may vary, there is a broad consensus about its principal characteristics, namely: a) data-generating practice that is built on fieldwork, participant observation and interviews; b) an analytic framework that is aligned with pragmatism and grounded theory; and c) a practice of representation and writing that relies on the writer's descriptions of practices observed, usually presented in a narrative and storytelling manner (Van Maanen 2011; Watson 2011).

The data informing our research was collected over a period of eight years through our complete immersion, active participation, and direct observation of CBI-FP. We adopted an iterative and recursive research process typical in anthropology where data collection and analysis are simultaneous, and research is adjusted according to

the information or challenge at hand (Fairfield & Charman 2019; Srivastava & Hopwood 2009). The analysis of our data, therefore, is also spread over the eight years during which we designed and implemented CBI-FP. It primarily took place through a reflexive process designed to generate insights and develop solutions or ways to incorporate the lessons learned from our data into the subsequent editions of CBI.

More specifically, throughout each academic year, the academic team involved in CBI meet on several occasions to share information and discuss observations (see figure 2). The academic team has weekly reunions while the course is running and three annual meetings outside of the course months, resulting in an average 11 meetings each year. Furthermore, this team convenes at the end of each edition to reflect on the main challenges and lessons learned. It also comes together annually to plan the subsequent edition of CBI, putting in place all the new elements for experimentation. All reflections and decisions of the academic team meetings have been documented, and some joint publications presenting our observations and learnings have already been published (Charosky et al., 2018a, 2018b; Hassi et al., 2016). The first author, who is trained in anthropology, has extensive fieldnotes of all our CBI iterations, including records of the numerous conversations and reflections about format, content, methodologies and outcomes.

Additional data informing our article has been generated through the Fusion Point Research Workshop Series, which in the past two years has provided a platform for reflection and tackling of specific topics and challenges endemic to CBI with other internal and external interlocutors. Finally, through Fusion Point's participation in the Erasmus+ Knowledge Alliance project VISION "Envisioning the Future of Teaching and Training for Creativity, Innovation and Entrepreneurship" (vision-project.org), we draw from the 130 interviews with relevant experts around the world whose insights help us to better understand the critical shifts underway in the learning landscape within which CBI is grounded.

RESULTS

CBI-FP has seven characteristics that are important and impactful, but at the same time challenging to organize for. We describe each of them below together with their organizational implications and summarize these in Figure 3.

CBI-FP offers a *challenge-driven* learning context. Students learn by applying knowledge in practice to address real-life challenges that are open-ended and complex, requiring the ability to learn across multiple subject areas. To create such contexts, the educational organization needs to be able to establish a network of experts and key stakeholders of the challenge to define the challenges as well as inform and support the work of the students. This is key in facilitating the work of student teams operating within a strict time frame, as well as supporting the potential continuation and implementation of the project after the course itself. This calls for the role of an ecosystem architect, to build and manage the network of various current and potential future collaborators.

Teams need to form collaborations with third parties in an agile manner, and to have access to off-campus locations for project work. In CBI-FP, learning takes place in a *hybrid-environment*, not established within the boundaries of any single organization or context. Students work in various environments: in flexible working spaces and workshops on different campuses, as well as in real world (off-campus) locations to carry out field research and interact with the target population and stakeholders. This implies moving away from a strict campus-focused model for the learning environment to a model where learning is more closely integrated with existing real societal processes and context.

The scope of learning transcends disciplinary boundaries, as both student and faculty involved represent various disciplinary areas. Due to its *multidisciplinary* nature, course delivery does not depend on a single faculty member, but on a well-coordinated team of faculty. This has at least two direct implications. First, to create such a context, collaboration either across departments of a single organization or with schools representing other disciplines is required. Secondly, to lead a coordinated effort of the multidisciplinary faculty team in the service of designing the overarching learning experience, the role of an academic coordinator is required.

The *process* in CBI-FP is not a linear one. Student teams follow a user-centric design process, that is based on iterative knowledge creation. The outcome is not definable at the outset, but emerges during a journey that is iterative, exploratory and experimental. As a result, the needs of the projects and the students are not fully predictable at the outset. Relately, the required program content and hours for faculty involvement cannot be fully predetermined as faculty must be able to adapt to emerging needs as they arise. This calls for a model for course planning, which accepts some improvisation and flexibility in content and hours while the course is running.

Learning happens through teamwork in heterogenous groups of students, faculty, industry partners, target users etc., forming a large community of co-learners in the process of addressing a challenge. To support this collaborative learning, there is a need to organize and facilitate regular feedback and reflection sessions between the different parties, as well as ad-hoc sessions as the need arises. This poses a significant change to the role of the teacher. Rather than the role of an expert sharing discipline-specific knowledge, faculty members provide the main learning support to the students through *the role of open-minded coaches*, trained in innovation and capable of integratating several areas of knowledge. Due to the exploratory nature of the projects, students' needs

for coaching cannot be entirely predicted. This is true both in terms of time required and content expertise needed. Faculty need to prepare to be flexible in terms of availability, as well as to know how to reach beyond their own expertise area to fill necessary knowledge gaps.

The aim of the program is to direct the individual learning effort to create a *positive impact on society* in the form of new or improved products, services, and processes, either as new start-ups or as projects within existing organizations. Learning does not happen solely as an intellectual exercise but has a concrete impact beyond the individual. The educational institutions face the need to encourage and facilitate the jump from academic learning activity to the creation and scaling of new solutions. A structure to bridge the gap between academia and the society is needed: a program and resources to support the maturing of very early-stage projects, with the objective of improving the rate of student-developed solutions reaching the market

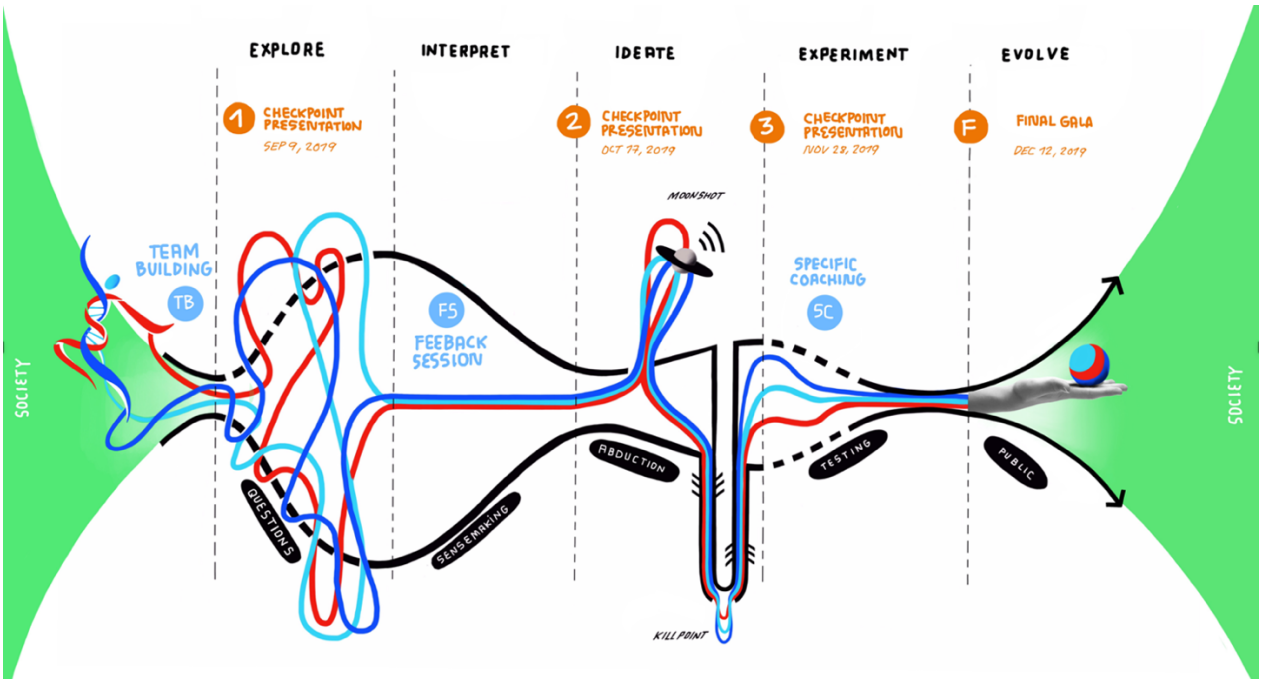

Fig. 1. CBI Fusion Point Journey Itinerary, concrete example from 2019. The blue, light blue and red colours represent the Fusion Point partners' core areas of expertise. The three trips to CERN take place right after the checkpoint presentations.

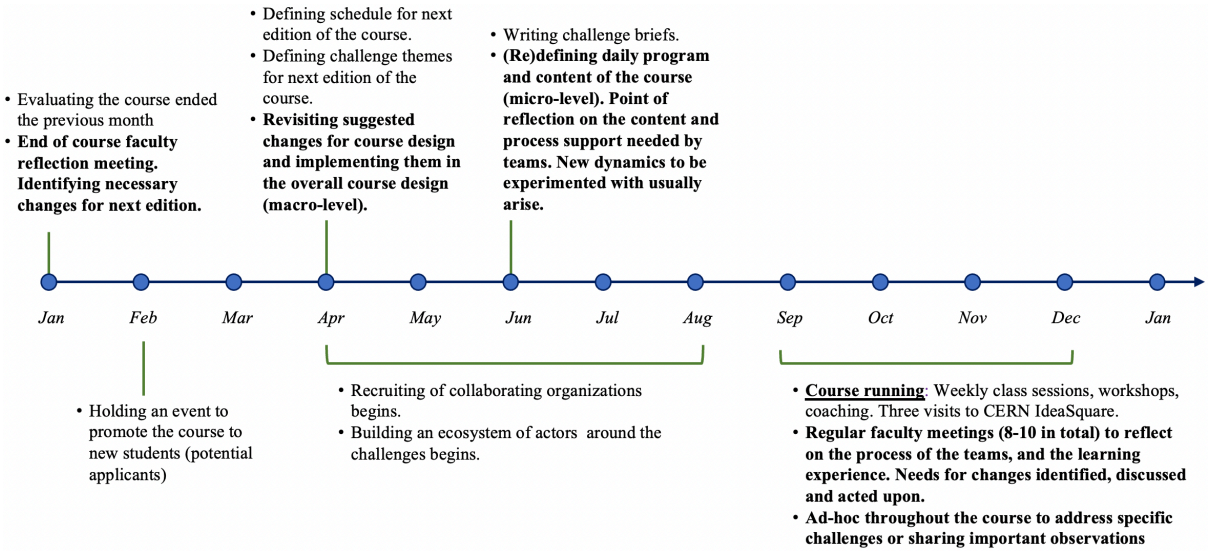

Fig. 2. The annual activity of the CBI-FP faculty team. Data collection points in **bold**.

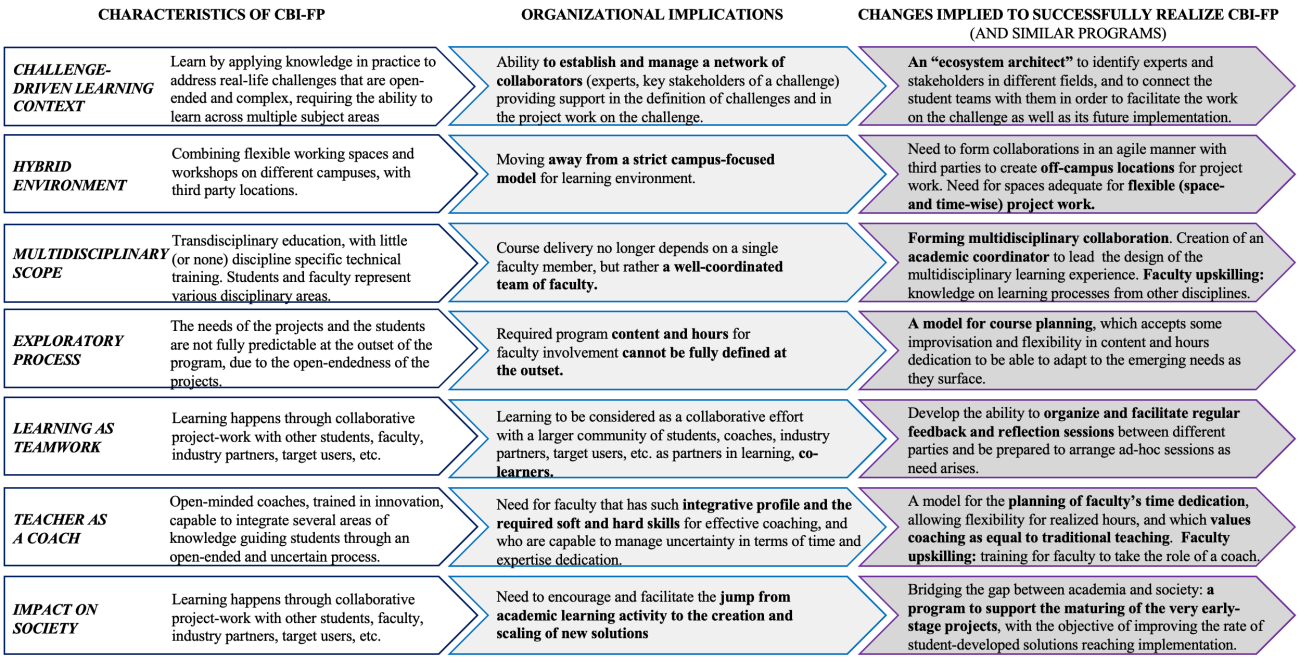

Fig. 3. Main characteristics of CBI-FP, their organizational implications and changes they require for their successful implementation.

DISCUSSION AND CONCLUSION

Our observations and reflections from the seven iterations of CBI-FP point to a set of characteristics that pose unique challenges to the established infrastructures in higher education that have been built around lecture-based and subject-specific learning. For the successful implementation of programs like CBI, which are experiential and challenge-driven, we suggest several broader organizational changes need to take place, such as the creation of new academic and administrative positions (such as an "ecosystem architect" or an "academic coordinator"). These changes, we also argue, have important implications at the policy level, as they are particularly pertinent for all organizations that aim at enhancing their students' and employees' creativity, innovation, and entrepreneurship (Papageorgiou & Kokshagina nd; see EU & OECD HEInnovate initiative https://heinnovate.eu/en).

Here we would like to highlight four shifts in the learning landscape, the effects of which are critical for the successful realization of CBI-like initiatives:

- From disciplinary-centred knowledge transmission to problem-based learning and challenge-driven innovation;
- From learning alone to learning collaboratively
- From traditional classrooms and lecture halls to flexible spaces and the real world;
- From lecturers to coaches, facilitators, experiential learning designers and beyond.

The latter shift is important to emphasize because it presses against one of the core pillars of modern higher education – the lecture-based tenure faculty model. CBI has enlisted educators for various backgrounds and positions who have had to switch from standing in front a classroom and delivering lectures to taking an active role in the students' learning jouneys as mentors and coaches, providing different types of support and guidance depending on the different phases of the course. Beyond the changing roles of faculty, CBI has demanded that we also become learners and practitioners of educational innovation. Further research is needed to better understand the novel faculty and administrative roles, course formats and methodologies for experiential learning that effectively respond to broader shifts in higher education. As we continue moving forward using the "license to dream" that we received from CERN, we realize more than ever that the success of CBI-like projects is dependent on dedicated support, strategic investment in new learning infrastructures and cultural change.

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