HOW DO WE KNOW WE TRAIN INNOVATORS EFFECTIVELY? DEVELOPING THE ASSESSMENT CRITERIA OF A NEW DESIGN THINKING MSC PROGRAM

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ABSTRACT

Some researchers have proposed that the creative industries (CI) could be a source of innovative management practices. In particular, the integration of design thinking to management education has been increasingly popular with the launch of dedicated programs. Yet, these programs' effectiveness is not measured. Based on the study of such a program, and building on a view of innovation as the transformation of ideas into social artifacts, we develop an assessment framework based on the measure of artifacts created by participants during the program. The two dimensions of measure are the complexity of the artifacts and their social dimension. We contribute to the education, innovation and design thinking literatures.

Keywords: Design Thinking, Entrepreneurship education, Innovation management, Creative Industries, Assessment.

INTRODUCTION

While innovation regularly appears at the top of CEOs agenda, it is still a challenging task for organizations. Some researchers have proposed that the creative industries (CI) could be a source of innovative management practices because the dilemmas experienced by managers in cultural industries are also to be found in a growing number of other industries where knowledge and creativity are key to sustaining competitive advantage (Lampel, Lant, & Shamsie, 2000). According to Howkins (2001), the success of creative industries reflects the growing power of ideas – and how people make money from ideas. Landry and Bianchini (1995) contend that twenty-first century industries will depend increasingly on the generation of knowledge through creativity and innovation. It is in this context that the importance of design in management develops (Brown, 2009).

Already, Simon (1969) had called for the establishment of a rigorous body of knowledge about the design process as a means of approaching managerial problems. More recently, Boland and Collopy (2004) describe the parallels between the two domains of design and management and explore the intellectual foundations for approaching managing as designing.

Management education is a way to make this link a reality because, as noted by Ackoff, 'the education system deeply affects the workplace, because of how people are taught to think, or not taught, in schools' (1993). Teaching design to managers is not new, however. It was pioneered at the London Business School in 1976, and the first program of design management at a design school was started in the 1980s at the Royal College of Art (RCA) in the UK. Results were disappointing, however (Wastell, 2014). One of the reasons is that what

was taught was design as an addition to other subjects such as marketing or strategy instead of design as a set of principles forming the foundation of an integrated curriculum (Dunne & Martin, 2006; Kao, 2009; Stevens, Moultrie, & Crilly, 2008).

To address this issue, programs combining design thinking and business thinking (so-called 'd-schools') were launched in recent years at Stanford in the US, Aalto University in Finland, Imperial College in London, and other institutions across the world. They constitute a new attempt at a holistic approach to create a management curriculum based on design from the ground up.

Yet, these "new generation" programs' ambition is not matched by a rigorous assessment framework. While significant work has been done on measuring innovation in firms (e.g. Zhuparova, 2012), pedagogical assessment is still an under-researched area in management research (Fayolle & Gailly, 2008) and more so regarding innovation programs. Without an assessment framework, we cannot know if programs based on design thinking are more effective at training innovators.

It is difficult to assess the success of education programs, and research in this area is scarce: the impact of innovation and entrepreneurship education on attitudes or perceptions of entrepreneurship has remained relatively untested (Peterman & Kennedy, 2003). Most measures are either on attitudes and intention change or post-program intentions (e.g. Rauch & Hulsink, 2014). Yet, Katz (1990) pointed out that there is only a weak relationship between intentions and behavior in the area of entrepreneurship.

Programs based on design thinking propose that an important contribution of their approach results from their practical approach of learning by doing during the curriculum. This points to a possible way of evaluating their effectiveness by measuring what is actually created during the program. It is on this basis that we develop our assessment framework.

The rest of the article is structured as follows: First, we review the theoretical background on the role that creative industries, and design thinking in particular, can play in educating innovative managers. Second, we propose an assessment framework and apply this framework on IDEA, a typical design thinking based management program. We then discuss the results and our contribution through this research.

THEORY

Creative industries and design thinking

Scholars have suggested that creative industries can be a source of innovative management practices because the dilemmas experienced by managers in cultural industries are also to be found in a growing number of other industries where knowledge and creativity are becoming key to sustaining competitive advantage (Lampel et al., 2000). Managers can learn from the approaches, practices and even techniques being developed by these benchmark organizations (Cadin & Guérin, 2006). In reviewing the different model relationships between the creative industries and the economy, Potts and Cunningham (2008) identify one model (Model 4) where the creative industries are conceptualized as a higher order system that operates on the economic system. In this model, the significance of the creative industries lies in their contribution to the process of change, and in the development and adoption of new knowledge. It is in accordance to this model that the creative industries can be a driver for change in managerial practices.

Design thinking is one way such change can happen. Design can be understood as material and conceptual innovation, realized through the integration of arts, culture, business and technology, and experienced as beauty, value and meaning. In its practice, design integrates culture and the arts, and one of the reasons why previous attempts to teach design in business

schools failed is that such attempts did not integrate this art and culture background. Design thinking, then, refers to the methods and processes for investigating ill-defined problems, acquiring information in a large scope, analyzing knowledge, and positing solutions in the design and planning fields (Brown, 2009). Design thinking combines empathy for the context of a problem, creativity in the generation of insights and solutions, and rationality to analyze, fit and test solutions to the context. Design thinking has become part of the popular lexicon in contemporary design and engineering practice, and also in business and management (Dunne & Martin, 2006).

In particular, interest from management researchers has been growing recently, as exemplified by the work of Dunne and Martin (2006), Stevens *et al.* (2008), Rylander (2009), Aminoff *et al.* (2010), Kimbell (2011), and Bjögvinsson *et al.* (2013) among others. As Kimbell (2011) notes: "Design as design *thinking* should provide more than mere design. And yet, this re-assembling of some of the approaches, knowledge and practices of professional designers, first within academic design research, and then within business schools and consultancies, has not brought a happy synthesis".

Reviewing major works on design thinking over the previous three years, Kimbell (2011) explains that one of the approaches is to view design thinking as an organizational resource (Brown, 2009; Dunne & Martin, 2006; Martin, 2009). Here, the focus is on businesses and other organizations in need of change with the purpose of innovation, and how design thinking can contribute to this change. It is this approach, in line with Lampel et al. (2000) and Potts and Cunnigham's (2008) model 4, that is of particular interest to this paper.

Benefits of design thinking for management

Design and management have contradictory cultures based on different beliefs, values and success metrics. Historically, design management was the way to address this gap as translator and negotiator between the two sides. According to Buchanan (1992), by bringing core ideas and methods of design practice into organizations, "the manager becomes a creative and innovative force, and their actually making a product themselves, the product is the organization. […] To understand good practices of design, to understand what design […] can bring, it opens up better possibilities for organizations." Yet despite repeated attempts, integrating design thinking and management is still a challenge, and education programs are still very much a work in progress.

The d.school (Hasso Plattner Institute of Design at Stanford University) is the most ambitious effort to integrate design thinking with other disciplines such as business or sciences. It is not degree granting, but offers courses and modules to the students of Stanford graduate schools (business, engineering, medicine, etc.) Students learn design thinking in a collaborative manner as a tool to inspire, ideate, and implement solutions. One of the pedagogical principles of the school is to mix students, faculty, and executives, each bringing different, and often conflicting, ways of thinking, working, and solving problems. This melting aims at breaking the silos hampering innovation in firms. Each participant leaving the program is equipped with a changed perspective and the ability to think more globally and differently in his domain.

Beyond proposing an answer to some criticisms against management education, design thinking integration enables new interactions and new perspectives in a curriculum and is of help in understanding, modeling and building systems. As such, it is one of the four foundations of system thinking as developed by Gharajedaghi (2011), but it doesn't go much beyond.

Yet most attempts at integration of design thinking in management schools did not have the effects anticipated by Dunne et al (2006). One explanation is that design thinking is often taught as a separate module, reduced to a creativity method including brainstorming and

story-telling. Such an approach neglects a key idea behind design thinking, the idea of Making. Without making, design thinking is only theoretical.

Problems with evaluation

A closer look at this growing offer claiming to integrate design thinking and creative industries reveals a lack of definition in the performance objectives and measurement criteria of these programs. For example, the fact that the d.school, the emblematic representation of these pedagogic practices, is not degree granting is quite symtomatic of the difficulty to evaluate the performances of such programs. While significant work has been done on measuring innovation in firms (Zhuparova 2012, Sawang 2012), pedagogical evaluation is still an under-researched area in management research, and particularly in innovation and entrepreneurship (Fayolle & Gailly, 2008). Without evaluation criteria, we cannot know if programs based on design thinking are more effective at training innovators.

The question of evaluation is somehow an echo of the older question about the measurement of effectiveness of design and design thinking (Carmel-Gilfilen & Portillo, 2010; D'Ippolito, 2014). As such, this research lies at the intersection of the three fields of pedagogy, innovation and design thinking by asking how we can develop evaluation criteria to know whether the teaching of design thinking can make business students more innovative.

METHOD

Measurement: Artifacts and social interactions

In the case of education programs, there is specific difficulty of measuring effectiveness of education programs because their effect happens after program completion, which poses methodological problems such as causal ambiguity. Accordingly, in the entrepreneurship field which is closest to our interest here, most measures are either on attitudes and intention change or post-program intentions (e.g. Rauch & Hulsink, 2014). Yet, Katz (1990) pointed out that there is only a weak relationship between intentions and actual behavior in the area of entrepreneurship.

The fact that a key elements of design thinking is learning by doing, however, provides us with a methodological opportunity to develop an assessment framework by basing it on what is actually done, or produced, by students.

To develop it, we need to rely on a clear definition of innovation. For Schumpeter (1934), innovation is a novel combinations of resources carried out in practice, i.e. subject to attempts at commercialization. Behind this definition lie the idea of newness, and the idea that this newness is socialized through the process of diffusion and/or adoption (Callon, 1986; Rogers, 2003). Building on this and based on Sarasvahty (2001), we define innovation as *the successful transformation of ideas into social artifacts* such as products, firms or markets. Hence measuring the production of social artifacts is a good proxy to evaluate the innovativeness of a process. This suggests two important dimensions of output to measure: the degree of complexity of the artifact created, and the degree to which this artifact is socially embedded (Callon, 1986).

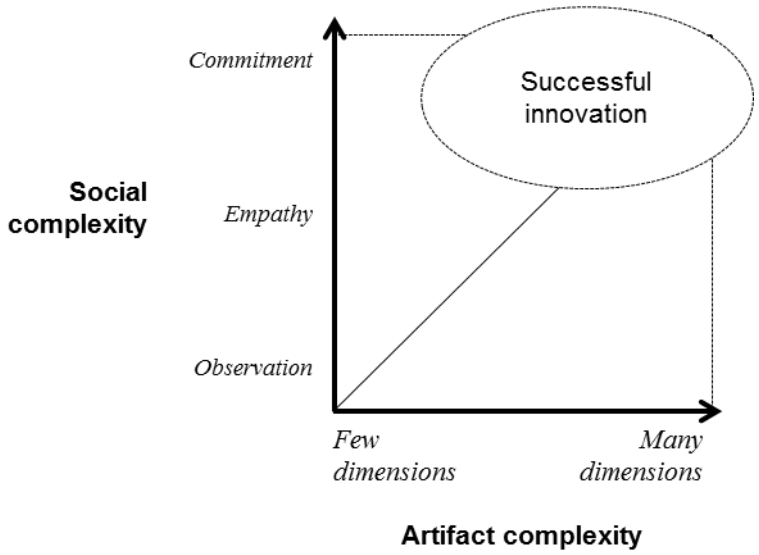
The degree of complexity of an artifact, in the context of design thinking, is the number of dimensions introduced into it. It can range from a simple product that is redesigned, such and eyeglass frame, to a software application and to a firm. At its most complex, an artifact includes the three dimensions of design thinking: feasibility, desirability and viability (Brown, 2009).

The social dimension ranges from simple interaction (market research) to getting user insights (design thinking and empathy) to complete embeddedness through social commitments. By social commitment, we mean the active involvement of a stakeholder in the

project evidenced by the provision of resources (tangible or intangible) to the innovator. Examples of commitments include acceptance into an incubator, involvement of a partner to develop a prototype, a pre-order by a customer, etc. Only when a project has secured significant social commitments can it become a viable innovation and, thus, evidence of success of the pedagogical process in this research.

Hence we can assess the production of an artifact along two axes: 1) The complexity of the artifact in terms of design thinking dimensions; and 2) The social complexity of the artifact, ranging from user observation (brainstorming) to interaction and empathy (market study, ethnography) to actual third-party commitments such as investment, incubation or a first sale.

Figure 1:Two dimensions to measure the artifacts created by students



Empirical setting

In our attempt to develop a measurement framework, we study a two-year graduate degree called IDEA (Innovation, Design, Entrepreneurship and Arts), jointly created by an engineering school and a business school. With IDEA, design as a set of principles forms the foundation of the whole curriculum in an integrated way.

The objective of the program is to train future managers by breaking the existing silos between design, the arts, technology and business as per Dunne and Martin (2006). The program aims at educating students able to create new firms or to manage innovation departments in existing firms.

The program's model takes its roots in the triad developed by Brown (2009). According to Brown, innovation is the conjunction of three elements: feasibility, viability, and desirability. Feasibility is covered by courses delivered by the engineering school. Viability is covered by courses given by the business school. Desirability, which includes design, and creative and cultural aspects, is covered by a diverse, ad-hoc faculty from both schools and external lecturers.

As such, IDEA is representative of the new generation innovation programs based on design thinking aimed at future managers and entrepreneurs, and can thus be considered an exemplary case (Yin, 2009). An important difference with existing programs, however, is the emphasis that the program places on the actual production of artifacts early in the process.

In line with the principles of design thinking, real life projects form the cornerstone of the curriculum. Design thinking seen as project management integrates both with Problem-Based Learning and Project Based Learning. Problem-Based Learning is an instructional learner-

centered approach that gives students responsibility for problem definition, research conduct and theory and practice integration. Each phase of the design thinking as project management offers by itself a natural problem-based learning situation. Problem-Based Learning uses design and project experiences to transfer and integrate learning, thus amplifying the experiential learning as described by Kolb (1984). Hence the approach can be described as small "project-oriented studies" gradually switching to "project-oriented curriculum" (Heitman, 1996) to implement the principles of design thinking.

Accordingly, and while there is learning in the traditional sense of the term during the program, we focus our assessment framework on the students' outputs during the program.

RESULTS

In this section, we review the artifacts created during the IDEA program and propose evaluation criteria for each of them.

First year

The first year of the program is articulated around four projects, P0 to P3.

Project P0 is the first step of the project-based learning methodology. Students are given a precise brief for a deliverable that is academic in nature. During this project, students learn how to use the fablab, how to sketch and are initiated to the design thinking approach. A typical project is to 'rethink' glasses: the object, its identity that integrates its user profile, its form, and its materials. With P0, the artifact is not complex (eyeglass frames) and the social dimension is limited to understanding human needs and aspirations with regards to glasses (as a tool, as a fashion accessory, as a symbol, etc.).

Project P1 is also based on a brief by the teaching team but broader in scope. This is in line with one of the key elements in design thinking that the formulation of the problem inherent to all project where problem is initially ill-defined (Buchanan, 1992). Students have to develop an interactive exhibition[1] around a given theme for the annual Festival of Lights in Lyon, France[2] (which has millions of visitors). With this project students have two objectives: 1) integrate arts and creativity to create aesthetic and interactive artifacts telling a story to the public; and 2) create, prototype and manufacture the artifacts they have imagined. Compared with project P0, the artifact is therefore more complex as new dimensions are added (aesthetics, storification, etc.) and students go beyond the prototyping stage to the product stage with full meaning. The solidification of the design thinking approach is focused on this project on establishing a meaningful product through a broad (arts, culture, literature and technology) state of the art exploration. Interaction with the public visiting the exhibition is introduced, providing an increased social dimension.

Project P2 is a full proposition that could be issued to any design agency. With P2, students experience the whole design thinking process (including problem definition) and address Brown's (2009) three elements of design: feasibility, viability, and desirability. In 2013, the brief was to *"Imagine a product or service that takes inspiration from bees as a society and as dissemination vectors in the context of Big Data and Urban Mobility"* and the event concluding the project was held in conjunction with Biennale Internationale Design Saint-Étienne and received 15,000 visitors. Six out of seven projects were viable enough to eventually be exposed, and two of them moved to startup phase. Design thinking is fully apprehended since it is the first time that students will manipulate all the dimension of the methodology and experiment all of its freedom dimension aspects. Whereas in project P1, the

[1] http://programme-idea-lumieres2013.tumblr.com/
[2] http://www.fetedeslumieres.lyon.fr/EN_2013

end-user had ‘‘only’’ to understand the sense of the exhibition, with P2 the end-user (visitor of the public exhibition) is a potential adopter of the product or service designed. Hence, the social commitment dimension is higher and deeper with project P2. Desirability is integrated through usage observation but also user involvement and field observations. Feasibility is here broadened since the artifact has to be defined and created by the students. P2 is also the first project where viability is introduced as a dimension as students are given a budget for their project: it is an initiation to the entrepreneurial dimension even if students can develop this aspect and then the social commitment dimension of their project by the integration of sponsoring or external support.

Project P3 has a different nature. It is an internship abroad in an NGO designed to develop students' intercultural awareness. There is no formal artifact involved at this stage besides the result of students' action and the end report. Yet, the social dimension of the project is more developed as it is the first time that students have to deliver on a brief given by a real end-user (as opposed to the pedagogic team) with a real issue to address. A typical project involved teaching uneducated women in Vietnam how to read. The lack of formal artifact, however, makes the assessment difficult beyond a qualitative evaluation of their contribution during the project and, possibly, the measurement of the intentions expressed by students to become involved in social entrepreneurship projects.

Second year

The second year of the program focuses on the viability of the design thinking triad with a strong emphasis of entrepreneurship, i.e. social commitments and value creation. The project begins in Project-Based Learning mode from September to January before becoming either an internship within an existing company or a startup within the associated incubator of IDEA for the following six months. The aim is to significantly increase the ambition of the project along the two dimensions of social and artifact complexity.

Mini-IDEA project

Students first work on a pre-project called “mini-IDEA”, which is then converted into the Grand-IDEA, either as a startup project or in a project within a host company as an internship. During this period, each student must review the state of the art of their internship subject that they consider as a brief to be interrogated through the design thinking approach. With regards to the artifact, few new dimensions are explored except the entrepreneurial dimension. In terms of social dimension, the objective is to move from interaction to commitments, by integrating the socio-economic context as expressed by the various stakeholders, such as institutional sponsors and early customers, whose commitment is sought.

Accordingly, the following metrics can be used for evaluating the mini-IDEA phase: how many projects are proposed by the students (as opposed to by the teaching team), how many are validated, how many get converted into Grand-IDEA after completion, and out of these, how many are accepted by the school's incubator through a separate selection process.

Grand IDEA

The Grand IDEA project is the cornerstone of the program. The project can be conducted in two modes: either as a startup project or as an in-company project.

Startup project: In the case of a startup project, there is obviously an artifact, the project itself. Beyond the creation of the project itself, traditional metrics of entrepreneurship, such as jobs, revenue, etc. can not necessarily be applied so early (Delmar, Davidsson, & Gartner, 2003). However, the tracking of the progress of the project in such an early phase can be made in terms of stakeholders acquisition and artifact progress: product, market, firm, etc.

Metrics to evaluate here the effectiveness of the innovators are inherited from incubators metrics (Center for Strategy and Evaluation Services, 2002), entrepreneurship education metrics (Küttim, Kallaste, Venesaar, & Kiis, 2014) and incubation pedagogy metrics (currently developed in IDEA program).

In-company project: the artifact here is more difficult to measure due to the intricate aspect of the situation of the student in a group or a firm. Raw results are difficult to obtain since filtered by the firm and by the fact that application of the design thinking methodology can be distorted by the enterprise culture. Sometimes students find it difficult to apply their methodology in a real corporate context. Thus, the evaluation is a more qualitative assessment. Company satisfaction at the end of the internship is one element, but does not necessarily assess innovation. The ability of the students to promote change and innovation within company as well as the ability to create a coalition within the company to promote the project can also be assessed, but it is an approximation at best.

The last measurements that have to be integrated are the impact of the students after graduation. Such measurement poses obvious methodological problems, however, and is not well addressed in the literature. One should measure how many of business units focused on innovation are created inside companies and managed by the graduated and how many companies have been created and the ratio of which that are still alive. The IDEA program being in its second year of existence, this information is not yet available.

The results are summarized in Table 1.

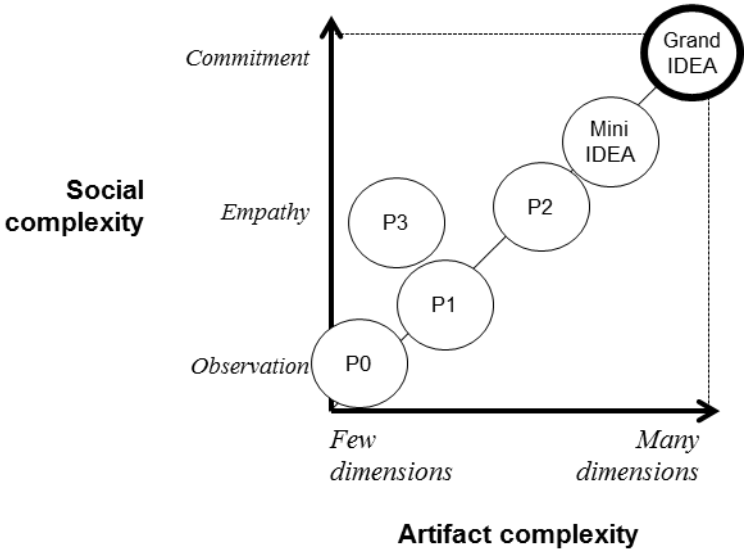
Table 1: Projects and assessment criteria

	Social complexity	**Artifact complexity**	**Output**	**Assessment**
Project P0	Minimal (internal project)	Simple product, few dimensions	Internal report	Purely academic
Project P1	Users' feedback post process through a public mediation	Product with meaning, Prototyping ability, sense-making	Artifact-based public exhibition	Numbers of visitors, reviews, satisfaction of the organization committee, quality of the mediation, etc.
Project P2	User integration (survey, observational research), users feedbacks, empathy	From wicked problem (Buchanan, 1992) to well defined problems, axis development identification, prototyping, solution proposition	Full product (prototype) or service concept presented to potential users	Numbers of visitors, reviews, quality of the mediation, transformation in start-ups, number and quality of the industrial contacts, social commitments
Project P3	Medium: Interculturality integration, empathy, embeddedness	Limited. Application of design thinking methodology to real life without a proximity mentoring	Internal report	None / Social entrepreneurship vocation creation.
Mini IDEA In-company	User integration and enterprise culture appropriation	From wicked problem (Buchanan, 1992) to well defined problems, axis development identification	Internship proposition rewriting, state of the art	Quality of the rewriting of the initial proposition, number of proposition of internship
Grand IDEA In-company	Fully embedded: Enterprise's workers or clients engagement	Ability to deploy DT methods in established enterprises or start-ups.	Fulfillment of the mission	Difficult quantitatively: Mission achievement, satisfaction of the enterprise, employment proposition, stakeholder commitments.
Mini IDEA startup	User integration, stakeholders research	From wicked problem (Buchanan, 1992) to well defined problems, axis development	Admission to incubator	Quality of the admission file in incubator, quality of the actors network[3] established
Grand IDEA startup	Stakeholders integration	Integration of the entrepreneurship dimension to design thinking methodology	Firm creation	Conventional incubator metrics: business model, business plan, actor network, number and quality of stakeholders.
Post graduation	Real life without mentoring		Employment or enterprise creation	Ratio of employment in innovation field of a batch, delay to find a job since graduation, numbers of firms created

[3] As per Actor Network Theory (Latour, 1987)

In summary, the different projects are represented along the two dimensions of social and artifact complexity in Figure 2 below.

Figure 2: The IDEA projects along the two dimensions of artifact and social complexity



Actual results

The program was launched only in September, 2012, so the first batch of students will only graduate in September, 2014. With regards to the artifacts, we observe that two of the six projects for P2 led to the creation of startups, which joined an incubator in January 2014. More generally, regarding the Mini-IDEA project, 10 students out of 31 applied for entrepreneurship and 6 projects (for 8 students including the two previously mentioned) integrated the incubator in January 2014. The progression in terms of artifact complexity, from simple objects with few dimensions involved to complex service or product offering, is evidenced.

Produced objects have a form related to material or immaterial objects, services or organizations. In line with design thinking, the notion of form is the visible expression of the artifact of any complex project. This expression consists of semantic components, functional components, and emotional components that act as mediators of intrinsic values. This mediation uses little but measurable components, determinants in the success of a project. Building on the social and human sciences, the dimensions of meaning, sense-making, and semantics have been introduced in the artifacts, while design thinking served to build a conscious and controlled form, in relation to the project's objectives (value creation). The learning-by-doing posture allowed a concrete and rapid application development of real artifacts, hence closing the loop of innovation, entrepreneurship, design and art that drives the curriculum.

DISCUSSION AND CONCLUSION

We started with the observation that the creative industries could be a source of innovative management practices. In particular, the integration of design thinking to management education has been increasingly popular with the launch of dedicated programs. Yet, these programs' effectiveness is not measured. Based on the study of IDEA, a typical design

thinking program that was launched recently, we developed an assessment framework based on the measure of artifacts created by participants during the program. The two dimensions of measure for these artifacts that we proposed are the complexity of the artifacts and their social dimension. As such, this research lies at the intersection of the three fields of pedagogy, innovation and design thinking by asking how we can develop evaluation criteria to know whether the teaching of design thinking can make business students more innovative.

With regards to pedagogy, the research contributes to a better assessment of innovation education programs based on design thinking. Most measures proposed in the literature which are mostly centered on intentions (Fayolle & Liñán, 2014) and planned behavior (Ajzen, 1991), i.e. the measures apply to what may happen *after* the program is completed. Because learning by doing is a key notion of design thinking, a program based on design thinking necessarily integrates the creation of artifacts and thus offers a possibility to measure outcomes *during* the program. This reduces the causal ambiguity between a curriculum and its outcomes, and therefore facilitates the evaluation of the curriculum and its improvement.

With regards to innovation, we contribute to the literature on innovation measurement. While significant work has been done on measuring innovation in firms (e.g. Zhuparova, 2012), it is still inconclusive. Studying the evolution of social artifacts along several dimensions is a way to improve such measurement and constitutes an area of further research.

Finally, with regards to design thinking, we contribute to the development of a measurement system for the effectiveness of design and design thinking, which so far has remained an open issue (Carmel-Gilfilen & Portillo, 2010; D'Ippolito, 2014). While our measurement is developed in the specific context of pedagogy, much can be applied in the broader context of industry innovation.

Clearly the assessment framework we propose only covers some aspects of the impact of an education program, that of the creation of social artifacts, and other dimensions of the program must also be assessed. As such, measuring social artifacts can only be one part of a more general assessment framework in innovation education programs. Further research should aim at refining the dimensions of artifacts we assess and better integrate with other variables that influence the impact of the program, such as work team, emotions, etc.

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