
Use of Design Thinking as Ideas Prototyping Experience in Higher Education

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ABSTRACT

This article presents a case of using Design Thinking in a course of an undergraduate degree. The Design Thinking offers an innovation in thinking, consisting of a cycle of steps comprising inspiration, ideation and implementation. Assuming that it has currently shown on the rise the term innovation together with the large number of startups and the high demand of enterprises to adapt new technologies and create competitive advantages in the environment in which they operate. As experiment we used the Design Thinking in a course of Creativity and Innovation in Undergraduate of Information Systems, running the steps of immersion, design, prototyping and validation, in order to generate non-existent or deficit services ideas that might be offered by third parties in the campus of the college. After the description of the steps of the experiment, are presented some qualitative and quantitative results and future work.

KEY-WORDS: Design thinking. Innovation. Startups.

Uso de *Design Thinking* como Experiência de Prototipação de Ideias no Ensino Superior

RESUMO

Neste artigo apresenta-se um caso de uso do *Design Thinking* em uma disciplina de curso de graduação. O *Design Thinking*, que visa proporcionar uma inovação na forma de pensar, é composto por um ciclo de etapas que compreendem inspiração, ideação e implementação. Atualmente o termo inovação tem-se mostrado em ascensão em conjunto com o grande número de *startups* e a intensa procura das empresas para adaptar-se às novas tecnologias e criar diferenciais competitivos no meio em que atuam. Como experimento, foi utilizado o *Design Thinking* na disciplina de Criatividade e Inovação, na graduação de Sistemas de Informação, sendo executados os passos de imersão, projeto, protótipo e validação, com o objetivo de gerar ideias de serviços inexistentes ou deficitários no *campus* da faculdade e que poderiam ser oferecidos por terceiros. Após a descrição das etapas do experimento, são apresentados alguns resultados qualitativos e quantitativos e previsões para trabalhos futuros.

PALAVRAS-CHAVE: *Design thinking*. Inovação. Startups.

1. INTRODUÇÃO

According to Brown (2010), companies nowadays are not accustomed to addressing new ideas, because they end up restricting them to models of existing businesses due the fact that the traditional business models are incremental, predictable and easy to be copied, on the contrary of new ideas that generate uncertainty.

With the intention to differentiate themselves and to remain competitive, companies use a variety of strategies, which in general are traditional and are already known. However, in this article the aim is to provide a new perspective by presenting the methodology *Design Thinking*.

It is verified that:

We need an approach to innovation that is powerful, effective and widely accessible, which can be integrated into all aspects of business and society and that individuals and teams can use to generate innovative ideas that are implemented and that, therefore, they make a difference. (Brown, 2010, p. 3).

In this way, the innovation is currently considered a strategic factor for businesses as the leaders look to innovation as the main source of differentiation and competitive advantage.

2. LITERATURE REVIEW

2.1. DESIGN THINKING AND ITS PROPOSAL

A 2006 study shows that some companies evaluate the design as one of the main tools for innovation (Boston Consulting Group, 2006). In this sense, considering the information about the characteristics of these companies, Franzato (2011, p.52) points out:

The processes of innovation driven by design are the processes of development of new traditional products and go in the direction of a reconsideration of the operations of the companies in the market and in society. The aim of innovation processes addressed by design is generally the definition of new scenarios for companies and other organizations. These processes are designed to meet a point of view unpublished, alternative or future on the contexts of competitive operations of the companies, and the generation of visions capable of showing the possibilities that would open up if this point of view was applied. The

ultimate goal is to identify a practicable path of innovation, allowing the coherent development of the organization.

In addition, Vianna, Vianna, Adler, Lucena and Russo (2012, p.12) point out:

As time goes by, companies began to realize that there wasn't enough just to offer technological superiority or excellence in performance as market advantage, because both the large and small companies spread around the world had already begun to adapt to this reality. In the scenario of global competition that would soon be in force, innovating would be an arduous task and often frustrating. The difficulty of obtaining differentiated market about the competition would be even greater. New ways had to be traced, not only to ensure the success of the companies, but mainly their survival.

Still, Vianna et al. (2012, p.13) complement when they mention that:

it was seeking new paths to innovation that they created what today is known as *Design Thinking*: an approach focused on the human being who sees on multidisciplinary, collaboration and tangibility of thoughts and processes, paths that lead to innovative solutions for business.

According to Brown (2009), what distinguishes an organization that applies *Design Thinking* is the number of prototypes developed from the cycle of steps available, which generates the possibility of comparison of other projects with current projects, providing this way the improvement and continuity of the project.

Thus, it is disclosed the need to frequently innovate in order not to lose market space, as evidenced by the affirmation of the Apple CEO Tim Cook:

I am old enough to remember when Nokia had profit margins of 25% and there was no way it lost the leadership. I think that this is a reminder to everybody from the business world that you need to carry on innovating, and that not innovating is the same as dying (Bloomberg, 2013).

Joseph Schumpeter (1942, mentioned by Pinheiro, Alt & Pontes, 2012), based on the theory of the economic cycle, says that the economy only leaves its point of balance and goes to the expansion process with the emergence of innovations. These changes in the economy for many times were the crucial factor for the loss of value and even for the closing down of

some companies, which in turn encourage the substitution of technologies and processes for another more adapted to the reality of the market and of the people.

To keep the economy growing, it is crucial to innovate, because innovation happens when there is a change of values and the reorganization of the opens space for new forms of prosperity.

Like this, the lives of people and their work are affected at a time when the ideas are transformed into value through innovation. Therefore, "innovation is the fruit of the creativity put into practice with the aim of generating positive outcomes for the business and create positive impact for the people" (Pinheiro et al., 2012, p. 24).

The creation of innovative ideas is a complex process. Lately, the main assets of organizations are intangible, predominantly a great focus on knowledge. That is why, innovating, transforming *insights* into opportunities to generate new business can be considered a strategic point to ensure the survival of corporations today and *Design Thinking* can identify an aspect of human behavior, and then change it into benefits for the consumer, in addition to adding value to the business" (Brown, 2010, p.36).

2.2. WHAT IS DESIGN THINKING

According to Brown (2010) *Design Thinking* (thinking like a designer) can modify the way to develop products, services and processes. The approach *Design Thinking* employs the sensitivity and the methods of the designer to meet the needs of people with what is technologically feasible and creates a business strategy in the long term, providing the conversion of this necessity in customer value and market opportunity.

The term *Design Thinking* was first mentioned in 1992 in an article of the renowned professor from the University of Carnegie Mellon Richard Buchanan called "Wicked problems in Design Thinking". In this article, the author presents the potential of approach of design in four fronts, allowing it to be expanded to other subjects: *design* in visual communication, design

of products *design* applied to services and an approach in building better environments for people to live and work (Pinheiro et al., 2012, p.48).

For more than 30 years, the use of *design* has been studied in architecture, science and arts to develop solutions, however, the applications of *design* are also expanding and being applied to the branch of business. The origin of this new application is associated to the North American company of consultancy IDEO, which develops innovations based on the thought of a *designer*, having appeared hence the concept *Design Thinking*.

Nowadays the term *design* is linked to the quality and/or the aesthetic appearance of products, however the intention of the term refers to promoting the well-being of people's lives. This term has called much attention of managers, providing new ways for business innovation based on the possibilities that the *design* allows to cover:

The designer identifies as a problem everything which harms or hinders the experience (emotional, cognitive, aesthetic) and the well-being of people's lives (considering all aspects of life, such as work, leisure, Relationships, culture, etc.). Thus its main task is to identify problems and generate solutions (Vianna et al., 2012, p. 8).

Like this, the *designer* seeks to understand problems that compromise the people's well-being, using empathy, i.e., putting themselves in the place of others and seeking to better understand the context in which that person is inserted, as well as identifying the causes and consequences of the difficulties to be more assertive in pursuing solutions. Understanding the method that the designer employs for the preparation of solutions can lead to fundamental *insights* to the field of business.

The balance between the analytical thinking and intuitive is promoted during the application of the methodology *Design Thinking*, which, according to Martin (2009), allows to increase the efficiency and competitiveness by generating innovation in processes, products and services of the organizations. It still allows, companies to go from a complex environment to a simple one, through the "funnel" of knowledge in which techniques for filtering the best insights.

Still, Martin (2009) reminds that, using the abductive logics, it is possible to apply *Design Thinking*, concept originally developed by James Peirce, which allows the exploration of possibilities in the future, in parallel with the opportunities analyzed under the perspective of the past.

Brown (2009) states that the *Design Thinking* seeks the development of solutions clean aesthetically and with new features, creating new experiences, values, and above all, meaning for consumers. Thus, it is based on the ability to be intuitive, recognize patterns, develop ideas which have an emotional meaning beyond the functional.

Unlike the traditional analytical approach that encourages us to move toward more reasonable direction to resolve problems, the thought of the Design proposes that we should manage the mess first to generate options that will lead us to find a path and not first choose a path and then generate options (Pinheiro et al., 2012, p. 43).

Still according to Brown (2010) *Design Thinking* is understood as a system of overlapping of different spaces of an ordered sequence of steps. According to the author, this system is divided into three stages of innovation": inspiration, when *insights* of all types are collected; ideation, step in which the *insights* are translated into ideas; and implementation, in which the best ideas are developed in the action plan.

Contrary to popular opinion, you don't need weird shoes or a black turtleneck to be a design thinker. Nor are design thinkers necessarily created only by design schools, even though most professionals have had some kind of design training. My experience is that many people outside professional design have a natural aptitude for design thinking, which the right development and experiences can unlock (Brown, 2008, p. 87).

In free translation of the text above, in accordance with Brown (2010), we can observe that not necessarily a design *thinker* is graduated in a *design school* or has to be considered a professional in *design* to be able to develop innovations, because people have a natural aptitude protected, requiring only to unlock this ability of creation through practice and the making of experiences.

However, it is emphasized that the principle of empathy, of thought focused on people, facilitates the creation of relevant desirable solutions and that meet the needs, but not everybody is prepared to apply these insights and create innovative solutions. For this reason, juxtaposing an integrated vision focused on analytical processes in order to identify all

relevant aspects in a problem trying to develop new solutions is considered another characteristic that a *design thinker* must possess.

In addition, sharing optimism is critical to assume that no matter the degree of difficulty of a problem, but, yes, what is the most favorable possible solution to improvements than the existing options. However, expressive innovations are not created from incremental adjustments, since the experimentation assists in the preparation of questions to understand the issue and explore creative restrictions, resulting in new meaningful solutions.

Another special feature observed in the profile of a *design thinker* arises from the principle that lonely creator is a myth, since it is increasingly difficult to create genuine solutions that reflect the reality and the enthusiasm of the benefited by this solution. Thus, the collaboration of other areas, in addition to the principal, makes all the difference in the process of creating innovative solutions.

Thus, characteristics such as empathy, integrated thinking, optimism, experimentation and collaboration, observed in the *design thinkers*, are seen by Brown (2010) as a determinant.

However, this methodology puts important tools in strategic contexts different in the hands of people who are not necessarily graduated *designers* but they need to think and apply them to a large variety of problems to create sustainable and innovating solutions for the company (Brown, 2010).

2.3. STAGES OF DESIGN THINKING

Brown (2009) mentions that the design projects have some restrictions, which affect the layout and the acceptance that comprise the steps of *Design Thinking*. Some restrictions described are linked to three criteria: practicality (which in the near future it is possible to be functional), viability (which fits into the business model of organization) and desirability (which arises the interest and makes sense to people), making it ideal to seek a balance between the restrictions.

In this way, it is sought through empathy to envision the solution based on the principle of multiple perspectives designed by the vision of each one involved in the project. By addressing the people as the main focus of the project, the designers or architects imagine solutions that are a priority, desirable and which envisage the identified or appointed needs

2.3.1. Inspiration

The first stage in the process of Design Thinking is called inspiration or immersion. At this moment the project team is closer to the context of the problem, both from the point of view of the company as the end user - the client. (Vianna et al., 2012, p. 21).

In this step insights are identified, and collected that can be considered opportunities generated from a personal observation, from the moment that we put in place of another person, i.e., when assuming an empathic posture. This process helps to understand the business before the eyes of consumers by establishing a valuable proposition:

The preliminary Immersion, therefore, aims to define the scope of the project and its borders, as well as to identify the users' profiles and other key actors that should be addressed. In this phase, it is also possible to raise the areas of interest to be exploited in order to provide inputs for the development of the themes that will be investigated in the immersion in depth (Vianna et al., 2012, p. 22).

Usually the team is unaware of the theme, and the preliminary immersion is responsible for assisting in the knowledge of the problem, aiming to bring together the individuals linked to the project, the problem to be worked, which provides new perspectives through the initial understanding of users, the identification of the profiles of the main people involved, among others.

To this end, after understanding the problem, the next step is to know the users and profiles of the main people involved. At this stage, you should seek to deepen the theme through an immersion in depth, which aims to identify behaviors and to map patterns and needs:

This research consists of a diving in the context of life of the actors and the subject worked. Generally, the aim is to focus on the human being with the goal of raising information of four types: What do people talk?

How do they act? What do they think? How do they feel? (Vianna et al., 2012, p. 36).

Thus, the steps of preliminary immersion and immersion in depth are crucial in the process of analysis and synthesis of information, since the data collected by means of the *insights* generated in the step of inspiration help to better understand the problem.

2.3.2. Ideation

In the ideation, all opportunities observed in step of inspiration are worked through the synthesis of information, which aims to refine the opportunities and generate ideas for the project. From the discovery of needs, identified in the first step, we seek to explore possibilities for improving the concept of idea through techniques of co creation, preferably worked in conjunction with the users:

Brainstorming is a technique to encourage the generation of a large number of ideas in a short space of time. Typically performed in group, it is a creative process conducted by a moderator, responsible for letting the participants at ease and encourage creativity without letting the team to lose the focus (Vianna et al., 2012, p. 101).

Another technique used in the validation of ideas generated consists in the tool of strategic analysis matrix of positioning, which aims to support the decision-making process through understanding more efficiently the benefits and challenges of each solution. In this way, the ideas with higher potential are selected to be developed a prototype of this solution.

The *design thinker*, therefore, gives shape to a thought that contributes to the process of divergent thinking, creating distinct alternatives. However, Brown (2010) mentions that only accumulating alternatives is nothing but an exercise, being necessary that, in the stage of ideation, the best ideas be selected and converted into something tangible, passing from generation to the resolution of ideas, until the stage of prototyping.

2.3.3. Implementation

The Design Thinking works tirelessly to create opportunities, or better, hypotheses, which are the result of sessions of creativity that create and recycle the knowledge generated by the prototype. The prototypes developed are intended to go beyond the assumptions that block effective and really innovative solutions (Bonini & Endo, 2010, p. 4).

Creation and development of prototypes of the project are part of the implementation stage, in which, from the ideas generated in the ideation, actions are put into practice to make them tangible and shape the idea. Most of the DT projects fail at implementation time. They may not be viable from the technological point of view nor financially viable or because the company cannot take them to market successfully (Nakagawa, 2014, p. 3).

According to Bonini and Endo (2010), unlike traditional models in which the prototypes are designed to make minimal risks and the classification of the potential profitability, these prototypes approached help to adapt and improve the ideas quickly and without the need for large investments, seeking fast learning about the strengths and weaknesses of the idea, beyond the identification of new directions and reducing the chances of failure:

Experimentation is, for us, an inseparable part of the process of reasoning construction. It allows us to express ideas so they can be absorbed and complemented by other people while they are designed. So, we build and think together. The ability of the people to submit what they think in a rich and immersive way is a fundamental catalyst of the innovation process. And the prototypes are the means that allow this to happen in a tangible manner and with less loss of meaning possible between what was imagined and what is being communicated (Pinheiro and al., 2012, p. 115).

In this way, the prototypes, through the implementation and experimentation of *Design Thinking*, are eligible to fail early and learn valuable lessons from the mistakes, allowing improvement of the proposal and continuous improvement of the solution until the final release.

A more experimenter model is not only more intelligent but also less risky. It represents the only way a business can adapt with relevance to the speed that the market varies in these days. On the other hand, some companies are still reluctant to face the constant experimentation as part of their development strategy. On the other hand, many competitors of these companies have already embraced this culture of value that has as its main result the constant injection of innovations of high impact on the market (Pinheiro et al., 2012, p. 117).

It is highlighted that the prototypes have as a goal to test and validate hypotheses, but so that a prototype works, it should be considered the possibility of failure. Unlike what many people believe, failing does not mean losing but, yes, a way of correcting errors as early as possible and adapting the prototype, which in many cases is the crucial factor that leads the solution to success.

3. METHODOLOGY USED

In order to validate the Design Thinking as an approach to generate ideas and innovative business, the methodology was used in the subject of creativity and innovation of a course of Bachelor of Information Systems, with 24 students aged between 22 and 31 years. The college in which the course is inserted has ten undergraduate courses, two master's degrees and 36 lato sensu graduate courses, with a total of five thousand students enrolled.

In spite of creativity and innovation to be a subject of Information Systems, out of the total of students, ten of them were Administration students and 14 was Information Systems, because the subject is offered with mixed courses. Out of this total, 13 students were women and 11 men, and the groups were constructed in a random manner, without the chance of choice for students.

We used four meetings of the subject with the theme of the research, as it is shown in Figure 1, with the purpose of: (a) submitting the DT; b) immersing the students for analysis of needs not met yet on the facilities of the College; c) designing a solution to the need; d) prototyping and validating with the real users.

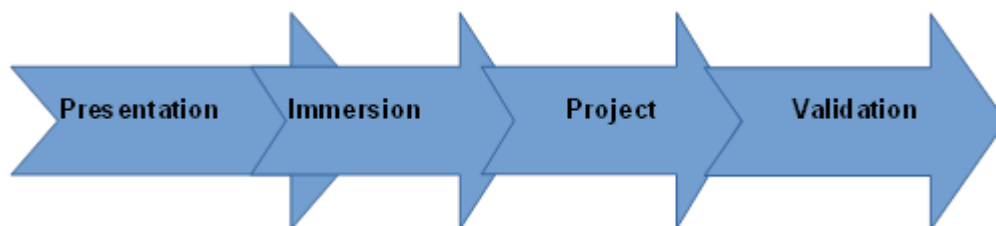


Figure 1: Stages of Design *Thinking* used in research

a) Presentation *Design Thinking*: in this first meeting it was presented the basic bibliography of *Design Thinking*, mentioned in the theoretical framework of this study. After the explanation, all of them took part in a storytelling to mobilize members to think creatively. At the end of the meeting, four groups were formed of six members challenged to walk on *campus* looking for a students' need - product or innovating service - still no fulfilled. They should return with the theme chosen at the following meeting.

b) Immersion for Analysis of the Needs: In this second meeting, students should bring chosen and discussed the real need of students on *campus* not fulfilled yet. The group A brought ideas regarding the Xerox; group B, improvements in the library; and the groups C and D thought on improvements in the central canteen. At that meeting, they should immerse themselves *in loco* in the provision of services, identifying bottlenecks and seeking *insights* for improving or creating new services, noting everything in documents of observations record, which were presented and discussed later, generating collective analysis of the large group. After that, it was generated a questionnaire with six questions closed and two open, about the current state and suggestions for improvements, seeking to identify bottlenecks or opportunities. Each questionnaire was completed during the week for 30 target individuals in the study, and became a compilation to be presented at the following meeting.

c) Solution project: in this third meeting, the students showed the compilation of the questionnaire and, based on this, designed the improvement or new product/service based on the needs collected and individual analyzes of each state, the small group of six people and the large group of 24. The Project was designed using the *Business Model Canvas*, and at the end the projects were validated by a large group, under the aspect of relevance of the solution and technical and economic feasibility.

d) Prototyping and validation of the Solution: in this fourth meeting, students used the project developed in the model Canvas, and with it they created scenarios of use or service improvement. At

that time, it was made the prototyping, in that they staged as the new product or service would be delivered to students, moment when the large group made stops, discussion and *feedback*. After the improvements or registered bottlenecks, each group has updated its project and validated on the *in loco* with the real customers of the services, where the products/services were used, generating the last validation process. In the end, the projects were presented in their final version and opened up discussion for processing of activities and the experiment of the subject.

4. DISCUSSION AND CONCLUSIONS

The mobilization generated by the application of Design Thinking in this subject can connect the educational and academic content with business reality, since the projects presented here are in the process of pre-incubation of the technological incubator of the institution, and may participate in the incubation banking.

As qualitative results, the remaining undergraduate courses of the College were interested in running the workshops, becoming more and more real the possibility of forming a network of research in entrepreneurship and innovation. It was also possible to identify a greater engagement of students in the subject, in which the tool used as practice for the processes of ideation and prototyping that before were only shown in theory.

With a pragmatic and functional focus, the Design Thinking contemplates all the innovation process, since the view of insight from the use of empathy, until the view of potential opportunities that add value to the user. In addition, it involves the filtering and the generation of ideas based on the insights and the development of ideas with prototypes.

This approach has an optimistic, constructive and experimental view, focused on solving users' needs with respect to products and services. Still, it contributes, especially, with the way it is approached the problem, using tools that allow grouping the needs which will guide the procedure of

creating opportunities desirable to users, mercadologically viable and technically feasible to be developed.

In the final debate, students elucidated that what drew their attention was the fact that at the Design Thinking, the user plays a fundamental role in the process, and the thinker seeks to create hypotheses and use their knowledge to create effective solutions. They understood still that the rapid prototyping and the transformation of the idea into something more tangible favors a learning environment and implementation, as well as favors the selection of solutions that cause more impact and that fulfill the expected needs.

Still, as quantitative results, the 24 students, two are business owners and 14 working in IT companies or sectors of the administration, and proposed to bring the methodology for their businesses, as a tool for innovation. Due to the fact of the experiment be recent, it was still not possible to assess the impact on companies or in the careers of the students.

As future works, for a second edition in 2015-1, the time will be expanded, including a theoretical step for construction of the research with users, the research desk and the questionnaire, and will be offered methodologies more refined of analysis and compilation of data, in order to reduce the deduction staff and the assertiveness of the projects.

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