MESG

Mestrado em Engenharia de Serviços e Gestão

Understanding Service Innovation Approaches: Design Thinking and Service Design – An Exploratory Study

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Master Thesis

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To my grandfather Fortunato (in memoriam), an example of strength and persistence.

Abstract

Service Design and Design Thinking emerged due to the changes on the overall business landscape, wanting to increasingly focus on service innovation. Hence, the need to apply service innovation approaches has arisen and has been developed through the years. Therefore, Design Thinking and Service Design are a new field of design research where the vocabulary and paradigm are still developing. They are considered human-centered, creative and practical, to produce solutions to problems and needs.

An exploratory study using qualitative methodology was developed with the purpose of investigating Design Thinking and Service Design concept, principles, object, process and tools. Based on these results, it was developed a comparison with the existing literature to understand the major divergences and convergences between them. In order to make this comparative analysis, people who had already applied these approaches to projects of service and product innovation were interviewed, particularly professionals and students. In total, were performed 20 in-depth interviews which were recorded, transcribed and then analysed using NVivo 12.

Results suggest that Design Thinking has several similarities with Service Design, namely that Design Thinking is one of the components of Service Design. Despite the results of the study, there is lack of theoretical content on this subject. Besides, Design Thinking is considered a creative process for Service Design since it includes physical evidences which support the Service Design approach, which is not consistent with the literature. Results of this research also show that students are more aware of Design Thinking concept, principles, object, process and tools than of Service Design. Another biggest result is the gap between professionals and students concerning Service Design. Interviews show that students do not have a developed knowledge regarding this approach.

Future work about how the Design Thinking and Service Design approaches integrate among each other, is an important research to be developed. Furthermore, a study regarding Design Thinking being considered a process for Service Design may also be a topic to investigate, as well as exploring the reason why professionals and students have different levels of understanding on the subject.

Keywords: Service, Design Thinking, Service Design, Qualitative Research.

Resumo

O Service Design e o Design Thinking surgiram devido às mudanças no mundo dos negócios, pretendendo cada vez mais focar-se na inovação de serviços. Assim, surgiu a necessidade de aplicar abordagens de inovação de serviços que têm sido desenvolvidas ao longo dos anos. Desta forma, o Design Thinking e o Service Design são um novo campo de pesquisa em design onde o vocabulário e o paradigma ainda estão em desenvolvimento. É considerado que estas abordagens são centradas no utilizador, criativas e párticas, e produzem soluções para problemas e necessidades.

Desenvolveu-se um estudo exploratório através de uma metodologia qualitativa, com o objetivo de investigar o conceito, princípios, objeto, processo e ferramentas do Design Thinking e do Service Design. Baseado nos resultados, desenvolveu-se uma comparação com a literatura existente para perceber as maiores divergências e convergências entre elas. De forma a elaborar esta análise comparativa, pessoas que já tinham aplicado estas abordagens em projetos foram entrevistadas, particularmente profissionais e estudantes. No total, realizaram-se 20 entrevistas em profundidade que foram gravadas, transcitas e depois analisadas no NVivo 12.

Os resultados sugerem que o Design Thinking tem muitas similaridades com o Service Design, nomeadamente que o Design Thinking é uma das componentes do Service Design. Apesar dos resultados deste estudo, há falta de conteúdo teórico acerca deste assunto. Além disso, o Design Thinking é considerado um processo criativo do Service Design uma vez que inclui evidências físicas que suportam o processo de Service Design, o que não é consistente com a literatura. Os resultados deste estudo também mostram que os estudantes estão mais conscientes do conceito, princípios, objeto, processo e ferramentas do Design Thinking do que do Service Design. Outro grande resultado é a diferença entre os profissionais e estudantes relativamente ao Service Design. As entrevistas mostram que os estudantes não têm um conhecimento desenvolvido relativamente a esta abordagem.

Trabalho futuro acerca de como o Design Thinking e o Service Design se integram é algo importante a ser desenvolvido. Além disso, estudo relativamente ao facto do Design Thinking ser considerado um processo criativo do Service Design poderá ser também um tópico a explorar, bem como a razão da discrepância de conhecimento entre os profissionais e os estudantes.

Palavras-chave: Serviço, Design Thinking, Service Design, Pesquisa Qualitativa.

Acknowledgments

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List of Abbreviations

DT- Design Thinking

G-D- Goods Dominant

PDF- Porto Design Factory

SD- Service Design

S-D- Service- dominant

SSMED- Service Science Management Engineering and Design

TISDD – This is Service Design Doing

1 Introduction

This first chapter introduces the main topic of this master thesis. It briefly presents the project background and motivation, main research objectives as well as the project report structure.

1.1 Project Background and Motivation

Consumers habits have been changing over the past decades. The purchase of goods and services is nowadays an easy and simple task, as it can be done from anywhere at anytime. New trends are continuously emerging, and consumers are adapting to them, while they became more aware of the products and services they use and buy. That way, businesses need to adapt to the changes, improving marketing and innovation strategies in order to become more competitive. Companies have been transforming into service-oriented companies which involves some challenges regarding for example, the business ecosystem and processes (Cherbakov, Galambos, Harishankar, Kalyana, & Rackham, 2010).

The rise of service-based business models as transformed the way world works, becoming the services sector, the dominant economic activity in most advanced industrial economies. Services industries have expanded fast in the past decades and now have more than 70% of total value added in the Organization for Economic Cooperation and Development (OECD) countries (Sheehan, 2006). However, despite this domination, there is lack of scientific understanding of modern services (Chesbrough & Spohrer, 2006). It was only on the twenty-first century that the research about services arose, with IBM and the Service Science Management Engineering and Design (SSMED) which is defined as the application of scientific, management, engineering and design on tasks that a person, organization or system perform with another person, organization or system. It was here that the research of services, especially the study about service innovation began and thus attracted the attention of the academic community (Spohrer & Kwan, 2009).

Service innovation refers to the creation of new and/or enhanced service offerings, service processes, and service business models (Ostrom et al., 2010). Innovations can be driven by a detailed understanding of people's needs and their preferences. Hence, with the change of the overall business landscape, human-centered, creative, iterative and practical approaches are required to produce innovative ideas and solutions to problems so that companies gain competitive advantage (Brown, 2008; Evenson & Dubberly, 2010).

Service Design (SD) is an interdisciplinary, creative and holistic approach which is becoming commonly used to improve and create services. This approach considers the customer or user as the starting point for launching a new service or improve an existing one (Holmlid & Evenson, 2008). Therefore, the focus of this approach is to provide a holistic and well-planned customer experience, always taking into consideration the customer problems and needs (Stickdorn & Scheinder, 2011).

Design Thinking (DT) is a human-centered approach to innovation based on design tools to integrate the needs of people, the potential technologies and the requirements in order for businesses to have success (Brown, 2008). It is useful for any type of organization, as it allows to work with open and complex problems (Dorst, 2010).

SD and DT are a new field of design investigation where the vocabulary and paradigm are still developing. Both are human-centered and can be applied regarding problem framing, information gathering and interpretation, solution ideation and evaluation in the development of an existing service or designing a new service solution. SD and DT are involved in the called

Human-Centered Design which captures insights and produces innovative solutions that reflect the needs of the consumers (Brown, 2008).

There are a variety of different process models in literature and on companies' websites regarding the SD and DT process and these process models vary according to the number of steps or the precision identified in each phase. In general, first there is an identification and discovery phase, where there is a study about the service context and the user, as well as the business environment of the client. The next phases, which are building, conceptualizing and creation phases are about visualizing, co-creating, participatory design, prototyping and testing. The principal objective in comparing the service concepts is to discovery the profitability and value of the service to the customer (Patrício & Fisk, 2013; Plattner, 2015).

During the creation of services, user involvement is essential. The user's role can vary from a more proactive participation where they contribute for building the challenges, to an inactive role where the data is interpreted with direct contact to the user (Keinonen, 2009).

1.2   Problem Description

Companies are increasingly providing services. Studies have shown that companies generate, on average, one-third of their revenue from services. However, besides this predominance, companies have struggle when transiting from product-centric to service-centric business. Delivering services requires several specific operating processes, capabilities, platforms and resources. Service strategies help organizations to overtake the problem of growth maintenance (Kindström & Kowalkowski, 2015).

Hence, it has become increasingly necessary to study these approaches, as they are present in today's businesses in which everything is a service. However, beyond the growing body of literature concentrating on service innovation, exploratory research focusing on service innovation approaches remains scarce. Even though there is a mass of contributions discussing the concept and the process of DT and SD, there is lack of clarification regarding each approach. In addition, there is lack of research about how these two approaches relate with each other and how they can be used in practice, thereby constituting the main challenge of this study.

In order to fill these gaps, this research integrates people who had already applied DT and SD to projects of service and product innovation were interviewed, namely students and professionals.

Porto Design Factory (PDF) was the chosen institution to develop this research, since it welcomes several students to develop service innovation projects using human-centered approaches and working directly with business organizations. Besides, it has also assisting teachers who were part of the study, too. Other professionals working directly with the design of solutions outside PDF were also part of the study in order to diversify the sample.

1.3   Research Questions

The existing gaps in literature allow some questions to be formed regarding DT and SD. Therefore, the research questions of this study were based on the questions that arose when reading literature about DT and SD, which are the following:

- How are Design Thinking and Service Design approaches seen in the literature and used in practice?

- To what extent are Design Thinking and Service Design different and complementary?

The study was developed always in accordance with the research questions, which means that the data collection was structured to answer to these questions. Figure 1 illustrates the objectives of this study.

The first question regards the understanding of DT and SD both in the available theoretical materials and real practices of these approaches, followed by a comparison between the two. Hence, it was important to consider professionals and novice on DT and SD as they have different experiences and can answer this question with different insights and considerations about these approaches.

To give a response to this research question, during the data collection, interrogations related with the scope of the project were made in order to understand the object that was being studied and questions regarding the approach's principles, process and tools.

The second question aims to analyse in depth DT and SD in order to know in which aspects they diverge and converge and whether they are two separate approaches or if they complement each other.

In order to answer this research question, after participants being asked about the approaches they have been using, they were questioned about the main differences, similarities and overlaps between the used approaches.
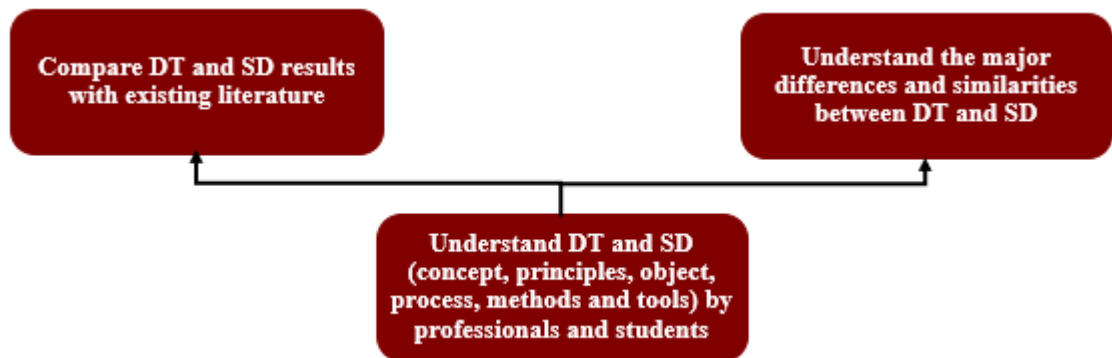
Figure 1- Objectives of the study

1.4　Report Outline

To answer the research questions, this study was divided in three stages: 1) collect knowledge and investigate literature on DT and SD; 2) Follow a qualitative approach to collect data and analyse the participant's insights about DT and SD; and 3) Present the results regarding the information in the literature and the evidences retrieved from the interviews, answering to the research questions presented previously.

Section 2 presents the theoretical aspects which serve as a reference and basis for this study. In the literature review the following subjects are addressed: Service Science, DT, SD and the integration of DT and SD. These topics support and frame the study and serve for the purpose comparison with the next research steps.

In order to present the process carried out during the study, an exploratory study using qualitative research was conducted and described in Section 3. Therefore, this section describes the reason for choosing this methodology, the explanation of the sample design and its organization, as well as the data collection made through in-depth interviews to professionals and students and its analysis built with the help of the software NVivo12.

Section 4 is based in the theory presented in Section 2 and the collection of information described in Section 3 as it states the analysis and discussion of the results, comparing the information gathered in the literature with the collected one during the interviews. Hence, a comparison between DT and SD is also made, answering the research questions. To this end, following the data analysis, the results were organized in categories, being each one of them analysed. Then, the results of these categories were compared with the ones in the literature, ending with the comparison among DT and SD.

Section 5 discusses the main findings of this study, as well as the main faced challenges. Additionally, some topics for future research are suggested.

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2   Literature Review

This section contains the research areas relevant to this research in order to, provide an understanding about these topics before presenting the followed methodology in the next section. Considering that research, this literature review encompasses three principal subjects: 1) Service Science 2) Design Thinking and 3) Service Design.

2.1   Service, Service-dominant Logic and Service System

With the advances in technology, access to information was facilitated, allowing to achieve customers through several channels. This access to information has also allowed new configurations of resources (Chesbrough & Spohrer, 2006), while the focal point transited from tangible resources to intangible resources (Spohrer, Maglio, Bailey, & Gruhl, 2007), and their particular way to create value (Hitt, Ireland, & Hoskisson, 2007). Thereby, over the years, companies have discovered that could differentiate through the delivery of a service together with a product (Edvardsson, Gustafsson, Johnson, & Sanden, 2000). Service-dominant (S-D) logic emerged which is supported by the value-in-use and cocreation of value rather than the value-in-exchange and embedded-value, concepts of the goods-dominant (G-D) logic (Vargo & Lusch, 2014).

With the development of this S-D logic, it was clear the lack of research on the subject. However, since the beginning of the twenty-first century this reality has been changing, as there have been made researches about a service in different fields such as design, engineering and marketing, with the aim to unite these fields. Thus SSMED or service science is emerging as a discipline intending to end this research gap as it aims to understand the innovation of service systems, joining many disciplines (Spohrer & Kwan, 2009).

2.2   Customer Experience, Complex Service Systems and Service Experience

Customer experiences are crucial to differentiate and add value to the organization's offerings (Pine & Gilmore, 1998). Experiences are co-created through the interactions among the customer and the organization, being these interactions dependent on several factors which are not only determined by the service provider (Verhoef et al., 2009). Although the service is designed aiming to provide experiences to the customer, these experiences cannot be predesigned (Patrício & Fisk, 2011). Hence, a service must be designed in a holistic and adaptable way, allowing customers to co-create experiences regarding their preferences (Patrício & Fisk, 2013).

A service is nowadays empowered by complex systems, which are in turn configurations of people, processes, technologies, physical evidence and other resources which allow customers to co-create value (Maglio, Vargo, Caswell, & Spohrer, 2009; Meroni & Sangiorgi, 2011; Patrício & Fisk, 2013). The service systems formulate a customer value constellation whereby customers co-create value for an activity.

To design the service systems some aspects must be defined: service offerings and interfaces, tangible evidence, service processes, people's roles and technology solutions. Service experiences are co-created by customers from the exploration of the service system through a sequence of service encounters. These last ones are the points where the customer interacts with a service interface. Thus, it is important for the organizations not to just design the service encounters in detail, but also look upon how each one of them contribute to the service experience (Patrício & Fisk, 2013).

2.3   Design Thinking

There is not a unique meaning for DT, it is viewed differently regarding the situation, being it practical or theoretical (Ulla, Jill, & Mehves, 2013).

Design Thinking (DT) stimulates innovative transformation and development and it is defined by several ways from different authors (Gurusamy, Srinivasaraghavan, & Adikari, 2016). Brown (2008), president and CEO of IDEO, which was one of the first companies that started implementing design tools in various branches, defines DT as "human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success".

DT nowadays it is not only a cognitive process, but has turn into a toolkit for process innovation, which connects the creative design approach to the traditional business thinking, with the objective of planning and solving problems (Tschimmel, 2012). It allows users to have hands-on experiences with products and services during its development which helps to develop a solution that better fits user's needs (Stickdorn & Scheinder, 2011)

Thereby, over the years there were developed three visions on Design Thinking (DT) (Kimbell, 2011):

- DT as a cognitive style concentrating the attraction on individuals and their capabilities (Dorst, 2010);

- DT as discipline for solving wicked problems (Buchanan, 2009);

- DT as resource for business aiming to create innovative solutions (Brown, 2008).

DT embraces human skills namely creativity and synthesis (Cross, 2005), business, and several technological aspects in problem solving. It is a human-centric methodology which integrates experts from a wide range of areas such as design, social sciences, engineering and business (Gurusamy et al., 2016). This integration raises divergent and convergent thinking. Divergent thinking is used to create innovative ideas, through the collection of several inputs, resulting on the definition of the problem. In this phase it is important for multidisciplinary teams to obtain all kinds of information about the field to be contextualized with it and analyse the several factors concerning the problem they want to solve (Brown, 2009; Buchanan, 2009). Creativity is significant to Divergent Thinking, as it requires a process of applying new knowledge (Gurteen, 1998). Thus, subsequently in the Convergent Thinking, teams put ideas into action and chose the most innovative solution (Brown, 2009).

Nowadays, organizations have gone through transformations to provide an improved customer service and experience. As a result, the need for new business models for digital transformation emerged, being this transformation implemented using agile methodology. One of the more important aspects about digital transformation is creativity and the exchange of ideas (Gurusamy et al., 2016).

Meinel & Leifer (2012), considered DT relation to IT development approaches in the context of agility. These authors concluded that DT and agile have some analogies such as being user centric and the need of an interactive learning and communication between the team.

Agile methods have been increasingly used in environments involving innovative and dynamic project development. These methods aim to deliver a small amount of work to the customers as soon as possible in small iterations (Gurusamy et al., 2016). Agile methodology does not pursue sequential practices alike the traditional ones. It is essentially applied when there is some ambiguity of the requirements and the customer has not an exact idea of the desired output.

Therefore, with Agile, the customer explains the general objective, and then the system is developed in sprints, which have different goals and always require a retrospective analyses to know if the team is working according to the user requirements (Steinke, Al-deen, & Labrie, 2017).

The integration of user-centered design specialists with agile developers in each iteration, improves the usability of the products, increasing in this way the value of the innovative development (Fox, Sillito, & Maurer, 2008).

2.3.1 Process, Principles and Tools

There are different process models for DT and although they include different stages and tools, the majority is based on the combination of divergent and convergent thinking. Some of the most well-known models are the ones created by the design agency IDEO (3 I model and the HCD model), the Double Diamond model from the British Design Council and the model created by the Hasso-Plattner-Institute called Design Thinking Process (Tschimmel, 2012). 3 I Model considers that DT has 3 main steps: inspiration, ideation and implementation and the HCD Model forms an acronym for hearing, creating and delivering (Brown & Wyatt, 2010). The Double Diamond model describes divergent and convergent phases (Tschimmel, 2012).

In general Design Thinking, begins with a problem that needs a solution, always having the final user as the focus. According to (Plattner, 2015), Design Thinking has five stages:

- Empathize: during this phase the researcher tries to understand the customer. In order to design something that meets the customer's expectations it is crucial that the researcher gain empathy to understand what is important and know the intended results;

- Define: considering what the researcher learned during the empathize phase, in the define stage is where all the issues are clarified. In other words, is when the researcher, based on the gathered data, defines the challenge that will be faced by clarifying all this data;

- Ideate: this stage is when the researcher focuses on generating ideas that could be possible solutions, or part of the solution;

- Prototype: in this stage the researcher creates a prototype that can be either post-it notes or a physical product. The aim here is to create a prototype that is as realistic as possible to receive good feedback and insights for improvement;

- Test: this stage is when the researcher solicit feedback from the users about the created prototypes. Testing is another opportunity to empathize with the user and compare the feedback with the initial one. This last feedback helps redefining prototypes and know if the defined problems are being addressed in the best way.

This model shows that stages are not always sequential, and that some steps can loop to previous ones (see Figure 2) (Dam & Siang, 2019).
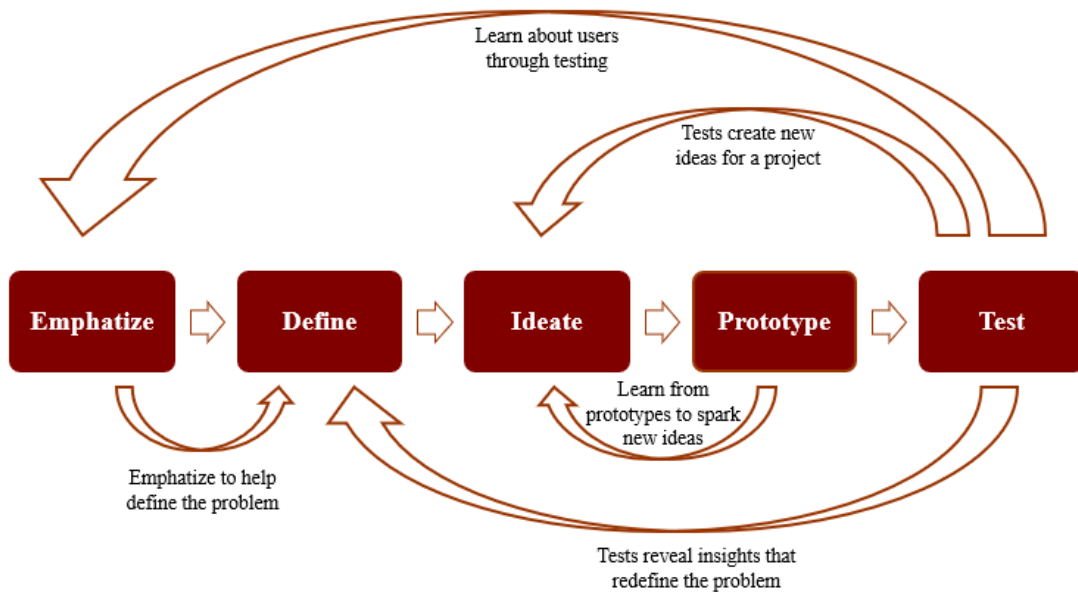
Figure 2- Non-linear steps of DT (Source: Dam & Siang (2019)

DT embraces four important pillars: empathy, collaboration, testing and human-centered. DT is human-centered as it integrates all people including users and stakeholders during the process. Therefore, being focused on the user, it is important to understand their needs and behaviour trough an empathizing process. To supress these needs, good and innovative ideas must emerge. In this way, teams must work in a collaborative way in order to achieve consensus to then test several times in order to achieve a desired solution (Brown, 2009).

Tools are essential in the DT process for an efficient decision making and communication among the members of the multidisciplinary teams. These tools can be physical or a software and help teams to visualize the design process and reflect about it through a convergent or divergent view (Chasanidou, Gasparini, & Lee, 2015).

According to Plattner (2015), there are some important tools that must be done during the steps of a DT process. Therefore, tools as interviews, observation and conversations allow the researcher to empathize with the user and gather requirements. Also, building personas, role objectives and explore customer's pain points are helpful in the defining stage. In the prototyping stage, several tools such as building prototypes, body storming, mind mapping and sketching are important to give new views about the problem or even a possible solution (Plattner, 2015).

Liedtka & Ogilvie (2012) also divide tools through the stages of the DT process. These authors consider that DT can be illustrated by combining four basic questions, which have 10 essential tools:

- What is?: Journey Mapping, Value Chain Analysis, Mind Mapping;
- What if?: Brainstorming, Concept Development;
- What wows?: Assumption Testing, Rapid Prototyping;
- What works?: Customer Co-creation, Learning Launch.

Chasanidou et al. (2015) consider also the stakeholders map, customer journey map, service blueprint, business model innovation and rapid prototyping tools which can be implemented during the DT process.

According to Brown (2009), every challenge should start with "How might we?" questions, as they are a frame to ideate and for launching brainstorming and visual thinking, which in turn contribute to divergent thinking of creating choices. On the other hand, a simple tool as the post-it note is used for convergence. Besides, storyboards, help to create alternative scenarios.

To gather more precise information about the interaction between people and groups, tools like video ethnography and computer interaction analysis are also important (Brown 2009).

2.4 Service Design

Through Service Design (SD), innovative ideas can be created (Patrício & Fisk, 2013). It involves not only the creation of a new service but also the improvement of existing service offerings, processes and business models (Ostrom et al., 2010) as well as the all experience regarding the process of transforming the service into a feasible solution and its delivery (Moritz, 2005).

SD is a creative, iterative and human-centered approach, since it is based on a deep understanding of the different customers and stakeholders and their context. (Patrício, Gustafsson, & Fisk, 2018). It considers people, processes, physical environment (Teixeira et al., 2012) and the applicable technologies (Patrício & Fisk, 2013). Also, it conceptualizes service solutions and prototypes the way the service can be performed (Brown, 2008; Stickdorn & Scheinder, 2011).

SD is a holistic and multidisciplinary approach as it combines and understands multiple areas, that range from fields such as operations and engineering to marketing and design (Patrício & Fisk, 2013; Zomerdijk & Voss, 2009), which are associated with the continuous application of design methodologies and principles to the design and development of a service (Holmlid & Evenson, 2008).

Being human-centered, SD enhances organizations and people by connecting them with the network of stakeholders and thus allowing the co-creation of value through the discovery of new opportunities (Meroni & Sangiorgi, 2011).

As a result, SD aims to create a service which is "useful, usable, desirable from the user perspective, and efficient, effective and different from the provider perspective. It is a strategic approach that helps providers to develop a clear strategic positioning for their service offerings." (Mager & Sung, 2011).

The process of SD is fostered by the design mindset, always trying to find innovative solutions for a problem. SD is an iterative process, since it works "in a series of repeating, deepening, explorative loops" (Stickdorn, Hormess, & Lawrence, 2017).

2.4.1 Process, Principles and Tools

There are several frameworks to illustrate the SD process, but this process is commonly illustrated from three to more steps. They share the same view about the first step which is related with an exploration and research phase and the final step associated with the delivery and implementation of the solution (Foglieni, Villari, & Maffei, 2018).

'Double Diamond", illustrated in Figure 3, is a well-known representation developed by British Design Council which divides the SD process in 4 steps (discover, define, develop and deliver),

varying with divergent and convergent moments during the iterative process (Foglieni et al., 2018).
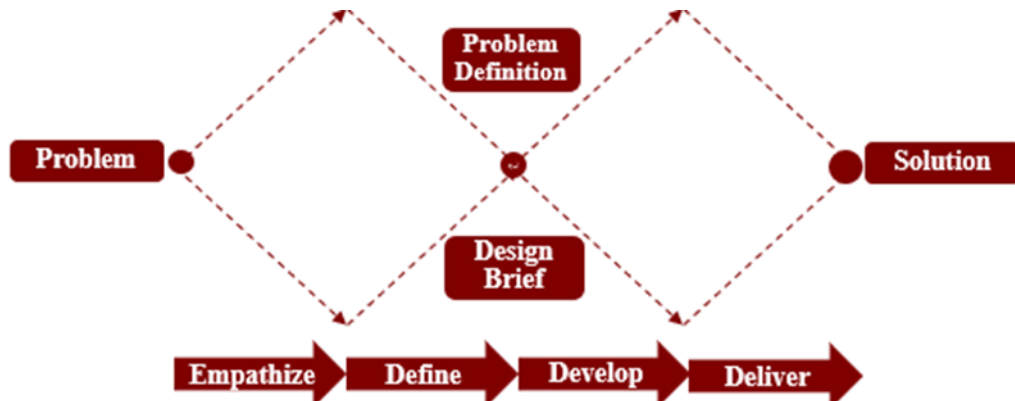
Figure 3- Double Diamond Model (Source: Design Council (2019))

Stickdorn, Hormess, and Lawrence (2017) created the This is Service Design Doing (TISDD) Service Design Framework and consider that SD has 4 main activities: research, ideation, prototyping and implementation. On the other hand, Meroni and Sangiorgi (2011) also consider four main activities but call it analysing, generating, developing and prototyping. These authors refer to this process as the Four Design Activities of a Design Process.

According to Patrício & Fisk (2013) and Stickdorn & Scheinder (2011) this iterative process passes through several stages: (1) exploration, (2) ideation, (3) reflection and (4) implementation, as illustrates Figure 4.
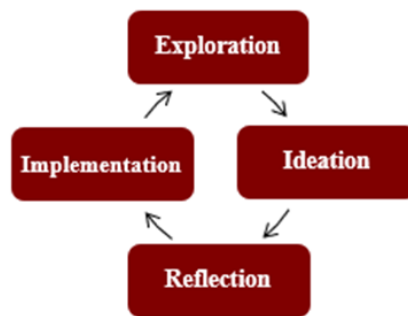
Figure 4: Service Design Process (Source: Patrício & Fisk (2013))

The first stage, exploration, can be defined as the study and understanding of the customer and all stakeholders regarding their experience and activities, problems, context and needs in a human-centered approach (Thomke & Hippel, 2002). The goal on this stage is not to achieve a solution but identify the problem and interpret user's behaviour and their perception about the problem (Brown, 2008; Patrício & Fisk, 2013; Stickdorn & Scheinder, 2011). The customer involvement during this stage is essential to support and help service designers enhance the process of generating innovative ideas to then grow a better service interpretation (Steen, Manschot, & Koning, 2011). In fact, co-creation improves the efficiency and effectiveness of the service. On one hand, improves efficiency in the sense that it increases the service, reducing the risk of failure. On the other hand, improves effectiveness, since the service is developed according to the user's needs, culminating in good attitudes regarding the service and also better

relationships between the service provider and the customer (Hoyer, Chandy, Dorotic, Krafft, & Singh, 2010).

The second stage, ideation, is a generative stage where new ideas are created and developed. In this stage it is important to work with the main stakeholders and multidisciplinary teams in order to generate a wide range of different ideas. At this stage, visual representation helps teams to communicate their ideas. Ideation is strictly related with the following step, reflection, since ideation seeks for new service concepts and reflection tests and prototypes that concepts in an interactive way. This stage is crucial as it allows an analysis of several solutions before the implementation (Brown, 2008; Stickdorn & Scheinder, 2011). In essence, when ideas are generated, a selection process must take place and consequently all elements of the service system and the service experience must be designed to then be validated (Foglieni et al., 2018).

The third stage, reflection, involves prototyping the service concepts and testing them with the customers in an iterative way. In other words, the generated ideas and concepts are immersed in a process of testing, improving and retesting (Patrício & Fisk, 2013). Prototyping makes users and the design team perceive the service concept and know how the service will look and work, through a flexible and holistic process (Saffer, 2010). Additionally, with this perception of the service concept, users can give feedback and empower or even give new ideas to the existing service. Thus, this activity also enhance communication (Teixeira et al., 2012).

The fourth and last stage, implementation, is when the new service concept is operationalized and delivered to the customer, involving planning, implementing and reviewing all the necessary changes, being also an iterative process, which can repeat many times before being delivered to the market (Brown, 2008; Patrício & Fisk, 2013; Stickdorn & Scheinder, 2011).

When building solutions, service principles are extremely suggested in order to outline the solution following a logic and taking into account the goals of that solution (Erl, 2005). Therefore, there are some authors that established some principles that must be followed when developing a service design process.

Stickdorn and Scheinder (2011), established some SD principles namely: user-centered, co-creative, sequencing, evidencing and holistic. However, SD have evolved and recently the authors changed these principles, due to the lack of some important characteristics in the previous principles, particularly the iteration, lack of opinions and concepts and lack of relevance regarding business processes and opportunities (Stickdorn et al., 2017).

In accordance with Stickdorn, Hormess, and Lawrence (2017), the new principles of service design are:

- Human-centered as it considers users and stakeholders participation;

- Collaborative since it integrates multidisciplinary teams;

- Iterative as the process is constituted by iterative stages of understanding the customer, designing the service offering and prototyping the experience;

- Sequential as the service actions are all interrelated through a sequence;

- Real as the process must occur in a real context, which means researching and prototyping real ideas and transforming intangible in tangible.

- Holistic since it works with all parts of the system, addressing the needs of the users and stakeholders.

In regard to SD tools, there are no rules for the use of these tools, as they are used in different projects and in different ways, sometimes they are even used several times during a SD process (Meroni & Sangiorgi, 2011).

Meroni and Sangiorgi (2011) divide the different tools into the four principal design activities of analysing, generating, developing and prototyping. The tools used in the analysing activity, aim to gather, document and share information. Some of those tools are customer journey map, emotional map, design documentary, video-blog, film diary, user diary and story collection. The tools used in generating ideas seek for build meaning from the information gathered from the users and stakeholders. These tools are: idea sketches, glimpse, service mood board. In the developing activity, tools are used to elaborate and develop service ideas, being some of them: storyboard, service blueprint, expressive service blueprint, visual service scripts, service breakdown, system map, service interaction design guidelines. Finally, the prototyping tools give conditions to test the service quickly, as follows: video sketch, living labs, FASPE (fast service prototyping and simulation for evaluation), experience prototype (Meroni & Sangiorgi, 2011).

Alves & Nunes (2013) developed a study aiming to understand which tools were most commonly used by the SD community and their relevance. As a result to this study, these authors, analysed 25 tools and methods such as service blueprint, brainstorming, contextual interviews, customer journey map, focus group, observations and prototyping. Service blueprint is a model that details the service interaction nature and features in order to verify, implement and maintain the service (Stickdorn & Scheinder, 2011). Customer journey map is a visualization of customer experiences to achieve a certain objective. It is used to see which parts of the service work for the user and the ones that need improvements. Brainstorming is a problem-solving technique which is applied by a group to generate ideas. Contextual interviews are used to gather information regarding the daily activities of communities. Focus group is a tool that combine a group of selected people controlled by a moderator to give feedback regarding a subject. Observation is used to identify problems during the interaction of people with the service. Prototyping is a tool to test the service through the observation of the interaction of the user with the prototype (Erlhoff & Marshall, 2003).

Beyond these, Stickdorn, Hormess, and Lawrence (2017) also consider other tools like research data, personas, journey maps, system maps, service prototypes and the business model canvas.

These authors divide SD tools into data collection and data visualization, synthesis, and analysis. Data collection tools are desk research which involves preparatory and secondary research; self-ethnography approaches which include autoethnography and online ethnography; participant approaches involving participant observation, contextual and in-depth interviews and focus groups; non-participant approaches which include non-participant observation, mobile ethnography and cultural probes; co-creating workshops whose tools are personas, journey mapping and system mapping.

Regarding the tools of data visualization and analysis, Stickdorn, Hormess, and Lawrence (2017), consider eight: building on a research wall, creating personas, mapping journeys, mapping systems, developing key insights, generating jobs-to-be-done insights, writing user stories and compiling research reports.

In compliance with the Multilevel Service Design (MSD), which is a multidisciplinary approach to service design which integrates all contributions from interaction design, service science, management and engineering, service offerings are integrated at three hierarchical

levels: service concept, service system and service encounter (Patrício, Fisk, Falcão, & Constantine, 2011).

First it is important to develop a study about the costumer experience, which involves the value constellation experience, the service experience and the service encounter experience. This stage involves data collection techniques such as observation, focus groups, usability testing or walkthroughs. The value constellation experience shows the interactions between the customer and the different organizations, being a result of the several service experiences. The service experiences are co-created through the interactions between the customer and the service system, which are called service encounter experience (Patrício et al., 2011).

Consequently, based on the study about the customer experience, the customer value constellation is designed representing the service offerings and relationships, followed by the representation of the service system architecture and service system navigation. The service system architecture defines the structure of the service system and the service system navigation describes the different paths customers may follow across each service encounter. Finally, the service experience blueprint, aims to illustrate each service encounter (Patrício & Fisk, 2013).

2.5 Integrating Design Thinking and Service Design

In order to understand these approaches as a whole, it is important to analyse the dimensions involving each one of them. Therefore, during the literature review the concept, principles, objects, process and tools were addressed using various authors.

Table 1 summarizes the dimensions of DT and SD following the authors previously mentioned. From the analyses of the Table 1 it is possible to conclude that there are some repeated authors in DT and SD. In addition, there are also some recurrent terms, namely in the principles, process and tools. From this, it is remarkable the existence of overlaps between DT and SD, however there is a lack of theoretical evidence on this.

Regarding the concept, the essential point taken from literature is that DT is human-centered and work to get an innovative solution that go in accordance with the user's problems and needs (Brown, 2008) as well as SD (Patrício et al., 2018). With respect to principles, Brown (2009) considers DT human-centered and collaborative as it focus working in teams and integrates the user in the process. Stickdorn et al. (2017) considers the same but in relation to DT. The studied object has also similarities since DT involves the development of a service (Stickdorn & Scheinder, 2011) just as SD (Patrício et al., 2018).

Considering the process, Plattner (2015) divides DT into 4 steps, just like Patrício & Fisk (2013) and Stickdorn & Scheinder (2011) regarding SD, being the phase with the same denomination ideation.

Lastly, there are several tools considered in the two approaches. As shown in Table 1, some of them are used in both approaches, for instance observation, interviews, service blueprint, brainstorming and prototype. The salient differences are the how might we questions, and the learning launch used in DT and the cultural probes and conjoint analysis used in SD.

Table 1- Integration of DT and SD

	Design Thinking	Service Design	Common
Concept	Considered human-centered approach as it applies the tools of a designer and embraces human skills to stimulate transformation and development (Brown, 2008)	It is a creative, iterative and human-centered approach, once it seeks for understanding the users and stakeholders and their context (Patrício et al., 2018)	Human-centered and work to get an innovative solution that go in accordance with the user's problems and needs (Brown, 2008) as well as SD (Patrício et al., 2018)
Principles	Empathy; Collaboration; Testing; Human-centered (Brown, 2009)	Human-centered; Collaborative; Iterative; Sequential; Real; Holistic (Stickdorn et al., 2017)	Human-centered and collaborative (Brown, 2009; Stickdorn et al., 2017)
Objects	Product; Service; Experiences (Stickdorn & Scheinder, 2011)	Service; Service Systems (Patrício et al., 2018)	Service (Patrício et al., 2018; Stickdorn & Scheinder, 2011)
Process	3 I Model: inspiration, ideation and implementation (Brown & Wyatt, 2010); HCD Model: hearing, creating and delivering (Brown & Wyatt, 2010); Double Diamond: divergent and convergent phases (Tschimmel, 2012); The Design Thinking Model by the Hasso-Plattner-Institute: Empathize; Define; Ideate; Prototype; Test (Plattner, 2015)	Service Design Process: exploration, ideation, reflection; implementation (Patrício & Fisk, 2013; Stickdorn & Scheinder, 2011) Double Diamond: discover, define, develop, deliver (Foglieni et al., 2018); TISDD Service Design Framework: research, ideation, prototyping and implementation (Stickdorn et al., 2017); Four Design Activities of a Design Process: analysing, generating, developing and prototyping (Meroni & Sangiorgi, 2011)	Plattner (2015) divides DT into 4 steps, just like Patrício & Fisk (2013) and Stickdorn & Scheinder (2011) regarding SD, being the phase with the same denomination ideation.
Tools	Interview; Observation; Conversations; Personas; Role objectives; Explore customer's pain points; Body Storming; Mind Mapping (Plattner, 2015); Sketching; Value Chain Analysis; Brainstorming; Concept Development Assumption; Customer Co-creation; Learning Launch (Liedtka & Ogilvie, 2012); Stakeholders Map; Customer Journey Map; Service Blueprint, Business Model Innovation; Rapid prototyping tools (Chasanidou et al., 2015); "How might we?" questions (Brown, 2009)	Affinity Diagram; Blueprint; Brainstorming, Character Profiles; Conjoint Analyses; Contextual Interview; Customer Journey Map; Cultural Probes; Documentaries; Empathy Tools/Probes; Ethnographic User Research; Focus Group; Immersion (Workshop); Observations; Prototyping; Questionnaires/Surveys; Role Play; Scenarios; Service Prototype; Shadowing; Stakeholders Map; Storyboarding; Task analysis Grid (Alves & Nunes, 2013)	Observation, Interview, Service Blueprint, Brainstorming and Prototype

3 Methodology

In order to achieve the research objectives, an exploratory study using qualitative research was conducted. This chapter describes all the steps which enabled the results. Firstly, the chosen approach and respective justification will be described. Subsequently, it is explained how this approach was used through the presentation of the sample design, data collection and analyses.

3.1 Qualitative Research

An exploratory study is applied when seeking for an understanding about the general nature of a problem, the several possible hypotheses and relevant variables to be considered. This kind of research aims to increase knowledge about the research problem, define the focus and priorities of the study and understand behaviours and attitudes of the people involved (Jebb, Parrigon, & Woo, 2017). There is not much literature about the differences and complementarities between Design Thinking and Service Design as well as the way they are described in literature and used in practice. As such, this research follows a qualitative research with some tenets of Grounded Theory in order to come up with information regarding these topics.

According to Neuman (2014) a qualitative research is suitable to acquire in-depth understanding about a subject, in other words, it provides information detailing the reasons and motivations in form of words and pictures.

A qualitative research is not quantifiable but interpretative, as it investigates aspects such as experiences, behaviours, feelings and interactions. There are three important components which represent a qualitative research: data collection, coding and results presentation. The data can come from several sources as interviews, observation, records and documents. Then this data needs to be interpreted and organized through coding, which conceptualizes and reduces data, creating categories and dimensions. Lastly, there are other procedures that take part on this analytical process, which are nonstatistical sampling, writing of memos and diagrams, that can be presented verbally or written (Strauss & Corbin, 1996).

Within the qualitative research, there were used some principles and practices of Grounded Theory, such as the simultaneous data collection and analysis to perceive and reflect about the insights of the participants, as well as, coding of the full interviews transcriptions to categorize and summarize the data (Charmaz, 2006; Strauss & Corbin, 1996).The results show the relationships between the emergent concepts during the interviews with the ones in theory (Gioia, Corley, & Hamilton, 2012).

This methodology is considered the most suitable one, once it allows exploring, understanding and learning about experiences and behaviours from the openness given (Charmaz, 2006), thus allowing to answer to the research questions.

3.2 Sample Design

When developing a research, choosing the sample is a crucial step, to make the study practical, ethical and efficient. Qualitative sampling approaches define a representation of the population, so that the results achieved with the sample can be generalized back in the population (Marshall, 1996).

According to Marshall (1996), there are three approaches for selecting a sample for a qualitative study: convenience sample, theoretical sample and judgement sample. The convenience sample is not very rigorous and focus on the selection of the most accessible objects. The theoretical sample is defined as the research evolves, which means that this sample creates theories from

the emerging data and then selects a new sampling to study about those theories. The judgment sample is based on the researcher's choice of the sample and for that reason the researcher must have knowledge about the research area, as well as the existing literature.

This last sample was the chosen one to be applied on this study, as the identified and selected individuals were chosen since they were proficient and well-informed regarding the phenomenon of interest. The aim of the judgement sample is to focus on people with certain characteristics that can contribute to the research (Etikan, Musa, & Rukayya, 2016).

Hence, to define the sample design for this research, it would be important to find people who work directly and are familiar with DT and SD. In this way, Porto Design Factory (PDF), characterized as an innovation platform where students from different areas and nationalities cooperate in order to develop innovative projects, was chosen. PDF has a model of education based on problem-based learning and uses human-centered design approaches to develop the educational projects. In addition, projects are developed with business organizations. Thus, some students and teaching assistants were interviewed. The interviewed students attend the ME310 – Product and Service Innovation Post-Graduation which is focused on teaching students the innovation methods and processes for designers, engineers, and project managers of the future, and the SQUAD program focused on digital design and experience design. Later, and in order to diversify the sample, more professionals with experience in innovation services were contacted.

To the development of the study, it was decided to divide the sampling into students and professionals (Table 2) in order to perceive the understanding of people with and without experience about the different service innovation approaches.

Table 2- Organization of the sample design

Current Function		Number of participants
Students	ME310 – Product and Service Post Graduation	9
	SQUAD program	4
Professionals	Teaching Assistant at PDF	2
	Arts and Design Teacher	1
	Healthcare industry Lead	1
	Service Line Manager	1
	UX Specialist	1
	Former ME310 Student and Teacher	1
	Total	20

As illustrated in the Table 2, interviews were conducted to 20 people from different fields. More concretely, 13 students and 7 professionals. ME310 Students have already finished their degree and have background in design and engineering. SQUAD students hare finishing their degree and have background in design, marketing and social sciences. Regarding the professionals, the teaching assistants have already attended a course at PDF and the remaining have background

in engineering, design and economics and work at companies that use DT and SD to develop their projects.

3.3   Data Collection

In order to understand the different approaches used during service innovation projects, in-depth interviews were conducted. These interviews are useful to know detailed information about the thoughts and behaviours of the participants and to explore new issues (Boyce & Neale, 2006). In other words, in-depth interviewing allows in-depth exploration of an specific topic or experience, being therefore appropriate for interpretive inquiry (Charmaz, 2006).

As mentioned before, 20 in-depth interviews were conducted. After an initial contact with PDF, students and teaching assistants were contacted to schedule the interview. Later, more professionals were also contacted and scheduled the respective interview. The interviews were conducted in person and via Microsoft Teams according to the convenience and geographical constraints of the participants. The average length of the interviews was 28 minutes. A guideline with open questions was used during all interviews as can been seen in the interview protocol in Appendix A. Open questions enable the participants to develop the topic, causing the exploration of some details which can be important (Charmaz, 2006).This guideline was initially developed to the PDF participants, however when the sample was increased by contributors out of PDF, there was a need to adapt this script and only do some of the questions. Each one of the interviews was audio recorded and literal transcribed in order to be later analysed, being the record carried out with the interviewees agreement by signing an informed consent also integrated in the interview protocol in Appendix A.

The interviews started with an introduction about the goal and scope of the research. In addition, a contextualisation was also made and some documentation with definitions shown, in case there were doubts about the subject. During the interviews, it was intended to understand the participant's point of view and insights regarding service innovation approaches.

Concerning the structure of the interview guideline, it started with some questions intended to know an innovation project the participants were involved in or that already have been involved. The following questions were linked to the approaches used during the development of the project, as well as its advantages and disadvantages. Regarding the approaches, it was also questioned the used tools and the followed principles and steps. Lastly, the final questions were related to the expected results.

3.4   Data Analysis

In order to undertake the analysis and coding of the qualitative data, the software NVivo12 was used. This software played an important role during this process since it allowed: management of data as it organized the transcriptions of interviews; management of ideas as it systematized and provided quick access to the information present in the interviews as well as the context from which that information came from; query data since it was possible to ask both simple and complex questions of data and retrieve all the information regarding the answers to those questions; visualize data as the software showed all the contents during the analysis process and represented the relationships between those concepts; report from the data using the information of the interviews (Bazeley & Jackson, 2013).

The first step to start the analysis of the interviews was its transcription. To perform these transcriptions, NVivo Transcription. This extension of the NVivo12 enabled the download of the audio files and the automatic transcription in several segments. Although this extension was

not very precise, it helped to save some time, since the transcriptions needed some adjustments and corrections.

Afterwards, the process called initial coding started, which means that, the data was categorized into segments with short designations (Charmaz, 2006). The codes, constituted by categories and subcategories, demonstrate how the data is selected and organized, helping in the analytic process. The categories help in the organization of data, making its retrieval quicker and more efficient. Through the analysis of the multiple categories, it is easy to identify themes across the data and obtain an increased knowledge about the research.

To define these categories, the research goal, the knowledge about the research and the primary ideas which came up throughout the transcriptions were taken into consideration. Thereafter, the transcriptions were analysed exhaustively, and these categories were reformulated and refined. This process was iterative as it required the constant analyses of data in order to represent the best way possible the reality of the research. As the research evolved, the data was coded several times in different categories and concepts.

Next, after the definition of categories and concepts, there is another coding phase called axial coding (Charmaz, 2006). This coding is the process of relating the codes (categories and subcategories) to each other, creating a hierarchy.

As illustrated in Figure 5, to develop the analysis process of this research, there were created five main categories:

- Meta category: this research sample is divided into students and professionals;

- Data: this category was developed in order to understand the current function of the participants and be able to relate it with other information;

- Design Thinking: this category emerged throughout the interviews, as some participants used this approach to develop their projects;

- Service Design: this category has also arisen over the interviews, as some participants used this approach on their projects.

Within these categories, subcategories emerged from the results of the analysis of the transcriptions, being further subdivided into other subcategories that will be explained in Chapter 4. For example, when an interviewee described a principle within the Service Design Approach, that information is coded in the following way:

- Service Design; Principles; Human- centered.

In this example, principles and human-centered are subcategories of the category Service Design.

Figure 5- NVivo12 coding tree

After all the codification, the analysis process began. NVivo12 enabled querying the data in a matrix format (Figure 6), allowing to do a range of questions about patterns and gain access to the content that shows those patterns. In other words, matrix coding queries enabled comparisons to be made in order to achieve the research goals. Based on the references retrieved from the interviews and stored in each node, NVivo12 crosses information of the references in different nodes and shows the impact of each node, since it shows the number of references for each node and illustrates also how many interviewees referred that node. For example, what were and how many professionals and students referred the DT principles.

At last, all the queries where analysed and interpreted, in order to achieve the results presented in the next section.

Figure 6- Example of a Matrix in NVivo12

4   Results

This section presents the exploration of the results obtained during the interview's analysis and coding. Firstly, the main categories of the research are introduced and explained, through the presentation of the various relationships between categories. While addressing the categories, the results of the relationships are being discussed.

Next, the final conclusions are made, in the sense that, the results of Design Thinking and Service Design are compared in order to know in what extent these approaches are different and complementary.

The categories will be presented using quotes, tables and diagrams. Every table presented during the analyses represent the number of participants, professionals and students, who referred the content that is being analysed. As the number of respondents is twenty, these values vary from 0 to 20. Therefore, the results presented with the value 0 mean that, the subcategory in question was not mentioned during the interviewees responses.

As already mentioned, the sample design of this research is divided into professionals and students to understand the different points of view of people with and without experience regarding service innovation approaches. Hence, concerning DT, the results presented are from interviews with 4 professionals and 13 students, being that three professionals talked about both approaches. The outcomes on SD came only from 3 interviews with professionals, since students were not aware of SD. Therefore, the total number of respondents was 20.

4.1   Design Thinking

Recalling the concept of DT, it is considered a human-centered approach which applies the tools of a designer and embraces human skills to stimulate transformation and development (Brown, 2008). For this reason, the aim is not only to study the DT as a general term, but also to understand what the participants consider about everything that involves DT.

To address this objective, the DT category is divided into seven subcategories: definition, principles, object of study, process, models, tools, advantages and disadvantages. Some subcategories are also subdivided in others which will be following explained.

4.1.1   Concept

Considering the DT definition, some interviews consider DT not an approach but a mindset and a practical way to reach a solution, as it aggregates several tools.

"Design Thinking is a mindset and is an aggregator of a set of theories and a set of methods that have been worked on for many years."

Professional, UX Specialist, about DT

"If we think of DT as a way of seeing things it is a methodology, but what is on paper are tools to get results."

Student, SQUAD, about DT

In addition, the creative side of DT is also related to what they call a mindset, since creativity comes from the ability to know the existing elements and connect them, in order to generate a new solution to an existing problem. The activation of creativity during the several phases of DT occur using visual tools.

> *"It is a mindset because it works with reality to solve problems in a creative way and then designers use visual communication and DT also has integrated in that mindset graphic communication tools."*

<div align="right">Professional, Arts and Design Teacher, about DT</div>

Being DT human-centered, it will meet the needs and motivations of an audience or it will be developed a solution which fits an opportunity to achieve that audience. In this way, it is necessary to create several hypotheses to be tested, and to create those hypotheses it is important to know well the target and even use abductive thinking to grow those hypotheses and ideas.

> *"DT is analysing a solution hypothesis, because everything you create is not a solution, it's a solution hypothesis. There is no solution to anything, there are several prospects of a solution."*

<div align="right">Student, ME310, about DT</div>

> *"DT is an abductive thinking, since it is not regular, that is, it doesn't matter if I go from the general to the particular or vice versa to solve a problem. It uses a lot of instinct to solve a problem, and that's why it is a mindset. It is the predisposition to be attentive to the way of doing things at all levels, in all channels, to all protocols, to identify needs and to improve"*

<div align="right">Professional, Arts and Design Teacher, about DT</div>

From these results, and making a general definition from them, DT can be considered a human-centered mindset which uses visual tools to promote the abductive thinking in order to solve problems.

4.1.2 Principles

DT is carried out considering some principles, which are fundamental to understand problems, deal with obstacles and analyse and test new solutions. In this way, and because it is crucial to follow principles in the creative process, a question was asked about the principles of DT.

Thereby, it was created a subcategory named principles, which in turn was divided into 8 subcategories: Human-centered; Iterative; Collaborative; Build on top; Build to think; No criticism; Sequential and Testing. Table 3 illustrates the number of participants who referred each principle.

<div align="center">

Table 3- Number of respondents in each DT principle

	Professional (N= 7)	Student (N= 13)	Total
Human-centered	3	10	13
Real	0	13	13
Iterative	3	8	11
Collaborative	1	5	6
Build to think, don't think to build	1	2	3
Do not criticize	0	1	1
Sequential	1	0	1
Testing	1	0	1

</div>

The first principle of DT indicated the human-centered principle since DT is considered by the respondents, as it is essential to put in the place of the human being, seeking to understand his experiences and the social context he is involved, understanding what makes their behaviours

and decisions. Thus, respondents also consider that using this mindset allows the creation of solutions more desirable by the user precisely because it involves them in the process in several ways.

"Our solution must be done all around and on behalf of the users because they will use the solution. There must be considered other stakeholders as suppliers, but it is always the user who commands."

Professional, Teaching Assistant at PDF, about DT principles

"There must be a radical focus on the user"

Professional, Service Line Manager, about DT principles

"The process is always made around the user"

Student, ME310, about DT principles

Another principle considered throughout the interviews was that DT is real. DT occur in real contexts, which means that every research or prototyping is legitimate. Here it is important to emphasize that students work for real companies in the development of projects.

"… it is always based on real users."

Student, SQUAD, about DT principles

The iterative side of DT is also spoken during the interviews, as the participants consider that the way people say will behave is different to the way they will actually behave, so it is important to do a lot of user research and several tests in order to achieve a true knowledge of the users. In this way, it is important to get back to the beginning several times instead of doing a long project and only analyse the results at the end. This constant evaluation allows to achieve better results.

"...is to do, to learn and then do it in a better way"

Student, ME310, about DT principles

"It is a loop, where you observe, reflect and perform"

Professional, Service Line Manager, about DT principles

"Prototype an idea, test and then reiterate. Depending on the result of the test and always with a considerable sample, we will reiterate if necessary, to realize what failed and what can be improved, and this can generate several laps until a satisfactory improvement of the solution."

Professional, Teaching Assistant at PDF, about DT principles

Collaboration is considered another important principle as it is essential to create a multidisciplinary set of knowledge so that ideas and innovative insights can emerge to solve the observed problems.

"Working in multidisciplinary teams generates more possibilities… it is this multidisciplinary team that will allow to have more perspectives and to have more options."

Professional, Service Line Manager, about DT principles

"Working with designers and developers it is a great benefit"

Student, SQUAD, about DT principles

Respondents see the concept "build to think, don't think to build" as a principle of DT. They consider that instead of thinking what they are going to build, they try to converge about what they are going to build. This will prevent an analysis paralysis from constantly trying to build consensus in group where everyone is saying something different. A respondent compares this process to the process of assembling LEGOS, in which they can be changed several times in order to fit.

> *"We are going to build in order to think and this is also a DT principle... it is through the construction of my LEGOS that I can reorganize, and I come to the end and I have my LEGOS mounted and a picture of what the group confessed."*
>
> Professional, Service Line Manager, about DT principles

> *"We are formatted to think about how we are going to do something, how to execute, what we will need, what we are going to do next. With DT it is the exact opposite, we do to then think in what went well and wrong, what we can improve and how."*
>
> Student, ME310, about DT principles

Another considered DT principle was no criticism. Interviewees consider that DT is open minded and there is no censorship regarding anything. In other words, every idea is heard and analysed.

> *"Regarding the principles, it is not criticizing anything"*
>
> Student, ME310, about DT principles

DT is viewed as sequential, in the sense that it respects some steps that are interrelated. However, those steps do not have to follow any specific order, which means that they can occur in parallel and be repeated in an iterative manner.

> *"DT is sequential, where we start to define the problem…then we empathize… subsequently we create ideas and test. These steps can occur several times over the process"*
>
> Professional, Teaching Assistant at PDF, about DT principles

> *"The steps do not have to be linear. There is necessarily an iteration and a cyclic divergence and convergence, but it does not mean that at the beginning, for example, I always make a needs identification, I can create something new or think I created without doing a market study"*
>
> Professional, Arts and Design Teacher, about DT principles

Finally, Testing is considered another fundamental principal of DT as it is essential to analyse and observe a hypothesis in a particular context or circumstance. Participants recognize that taking creativity from paper to real-word practice with people in different contexts, picking feedbacks and taking ideas into solutions is imperative. Innovation is directly linked to the creation of new solutions in an effective and efficient way. Testing allows to discover these new ways avoiding big mistakes, while small mistakes are understood and repaired.

> *"When we begin by observation, we firstly reflect, and then we do. We are effectively making solutions to problems, not vice versa."*
>
> Professional, Service Line Manager, about DT principles

> *"Testing is an essential part of the process."*
>
> Student, SQUAD, about DT principles

In conclusion, the stated principles can foster DT and innovation. In general, in order to succeed in the DT process, it is necessary to experience staying in the user's place, work in team to achieve a result that is better than just the sum of the parts and test, validate and improve each idea, always having a flexible thinking.

4.1.3 Object

Turning to the study object of DT, it can be applied in several fields that range from for example education to architecture.

> *"DT can be applied to everything: services, architecture, social problems, product, etc. We can apply DT to a wide range of situations and one of those is services."*

Professional, UX Specialist, about DT applicability

According to the results of the interviews, most of the objects described are related to service, product service systems and products as illustrated in Table 4. The number of responses presented is related, in the case of students, with the fact that they are developing service projects and projects that include both service and product.

Table 4- Number of respondents in each DT object

	Professional (N= 7)	Student (N= 13)	Total
Service	1	9	10
Product Service System	3	4	7
Product	1	0	1

4.1.4 Process

In relation to the DT process and as defined in the literature described in Chapter 2, the interviews defined DT as having 5 steps as illustrated in Table 5. This table also shows the number of professionals and students who referred each step.

Table 5- Number of respondents in each DT step

	Professional (N= 7)	Student (N= 13)	Total
Empathize	5	9	14
Define	1	12	13
Ideate	3	5	8
Prototype	2	5	7
Test	1	5	6

The first step named Empathize, is considered very important as it is necessary to understand the context. Therefore, interviewees claim that it is necessary to get together with multidisciplinary teams to understand the problem by immersing in what is the reality of the user. In general, empathizing is to perceive the problem and its context through investigations which can be with the user, stakeholders or even in literature.

> *"Then we empathize with that problem, see the state of art, current situation, see the context of the problem, do some research through interviews, observation, gathering visual evidences, etc."*

Professional, Teaching Assistant at PDF, about DT steps

The next step is called Define, which is considered an interpretation step. Participants state that after the research, it is necessary to identify common trends among the results. However, it is

also important to look at extreme users, in the sense that they expand the scope of the project by bringing different insights. At the final of this stage, what are the client wants and the factors influencing that desire must be defined.

"All the research information is spread and at this stage we will organize it"

Student, ME310, about DT steps

"Instead of just considering the average of people, it is important to understand why someone makes something so different. If you think about doing something to the extreme users, it can give you insights since you never expected to have someone thinking out of the box."

Professional, Former ME310 Student and Teacher, about DT steps

The third step is called Ideation described as the phase to generate ideas. Participants say that creativity is essential at this stage in order to develop innovative ideas which can be a potential solution to the problem. Once more, in this stage, a multidisciplinary team is critical in order to exchange ideas through brainstorming.

"In the ideation phase, we bring several ideas to the table."

Student, ME310, about DT steps

The fourth step is Prototype described as a process where the ideas are prototyped in order to be seen in a different way, by becoming tangible. Interviewees also consider that this phase must be rapid, so that if there is any mistake, they can quickly learn and to it again. It is important that the initial prototypes are very basic and cheap to not take risks by investing on an idea that does not have success.

"Do a rapid prototyping cycle, learn from the mistakes and redo it. Look for the needs until achieve a better version"

Student, ME310, about DT steps

"We start by a low-fidelity prototype, very basic and fast things and without much investment and over time, this investment will grow and the prototype becoming more complex"

Student, SQUAD, about DT steps

The last step is testing, viewed by the participants as a process where the prototypes previously developed are tested with the future users. They consider this step the most important one, since through testing they can gather a lot of information about the behaviour of the user regarding the prototype and realise if they are following the right path or not. In other words, they learn from these tests and as they test different critical points, they can then develop a solution from the small tests.

"The most important is to test with the user using many prototypes."

Student, SQUAD, about DT steps

Therefore, and according to the responses, these 5 steps shape the DT process. The most important learning to retain from these results, is that in fact DT takes to users the solutions that they truly desire, keeping them always involved since, to some extent, the solution is also developed by them.

The answers given by the participants did not differ from the DT process in the literature. However, it was given great importance to the test step and to the iterative nature of the process.

In addition, they also agree that this process does not happen in a linear way and depending on the project the steps are always tailored to the its objective.

The Double Diamond model is also referred during the interviews by 4 professionals and 1 student. Participants describe Double Diamond as having four steps of divergence and convergence. Firstly, they research about the problem, following the creation of some assumptions (divergence). Then they test and start to close hypotheses (convergence). From here it is the phase of execution, when they start to open again to some concepts (divergence) and end with the execution (convergence).

Double Diamond is essentially used by the participants who were working on digital projects. These participants claim that they relate DT with Agile. In this way, the empathize, define and ideate, which correspond to the first convergence and divergence in Double Diamond, is done through DT and the construction and delivery is done through an Agile process called sprints, corresponding to the last convergence and divergent in Double Diamond. After having all the functionalities to the solution, they do a sprint to each one of those solutions.

> *"We integrate DT with Agile because we work on digital. There are designers and programmers in the team and the solution has to be developed in phases."*

> Student, SQUAD, about DT and Agile

4.1.5 Tools

Table 6 shows the tools referred by the participants as well as how many participants, professionals and students, referred each one of the tools.

Table 6- Number respondent in each DT tool

	Professional (N= 7)	Student (N= 13)	Total
Interviews	3	9	12
Ideation Techniques	4	8	12
- 6 3 5	1	0	1
- Brainstorming	1	7	8
- Scamper	1	0	1
Personas	3	7	10
Prototypes	3	7	10
- Critical Experience Prototype	1	3	4
- Critical Function Prototype	1	5	6
- Dark Horse Prototype	1	4	5
Benchmarking	2	7	9
Empathy map	2	5	7
Business Model Canvas	1	5	6
Observation	2	4	6
- Inclusive observation	0	1	1
- Shadowing	0	1	1
User Journey Map	1	5	6
Questionnaires	0	4	4
Storyboards	1	2	3
MPV (Minimal Viable Product)	1	2	3
Stakeholders map	0	3	3
Research	0	3	3
Mockups	1	1	2
Focus Groups	2	0	2
Mind Map	0	2	2
Workshops	1	0	1
Clusters	0	1	1
Gantt chart	0	1	1
Hook Model	0	1	1
How might we question	0	1	1
What people say vs What people do	0	1	1

Therefore, through the analysis of the table, the most used tools by both professionals and students are: interviews, ideation techniques mainly brainstorming, personas, prototypes benchmarking, empathy map, business model canvas, observation and user journey map.

Interviews are essentially used in the empathize phase and also in the test phase. Participants consider that face-to-face contact helps in gathering accurate and more complete information.

"Interviews are very important to understand the user, both when we are getting to know the users and when we are presenting an idea"

Professional, Former ME310 Student and Teacher, about DT tools

In addition to the interviews, participants also consider important to do brainstorming, stakeholders research, benchmarking and observation in the beginning to understand the critical points in order not to being based on assumptions. Then, build personas to represent the different user types, helping to recognize the different needs and expectations. Based on the personas, empathy maps are also created to understand and prioritize user needs.

"We built personas and empathy maps after the interviews to organize the information"

Student, ME310, about DT tools

The user journey map is also stated as a crucial tool used in the ideation, prototype and test phase to envision the user experience while using the solution.

Prototypes are applied in the prototyping phase and in the test phase as in this last one, the prototypes are tested with the users. Participants consider that prototypes must show and prove the innovative concept of the idea they are showing.

"The prototype must be expositive and functional to demonstrate the innovative concept."

Professional, Teaching Assistant at PDF, about DT tools

Finally, the business model canvas is considered an important tool to use as it allows to discover opportunities, by the analysis of the business.

"The Business Model Canvas allows to evaluate everything that involves the business."

Professional, Service Line Manager, about DT tools

According to the results, the Venn Diagram illustrated in Figure 7 was developed. This diagram demonstrates the several tools enounced during the interviews and in which stage or stages they were applied. As there are no significant differences between what professionals and students use, the diagram has been drawn demonstrating the answers of both.
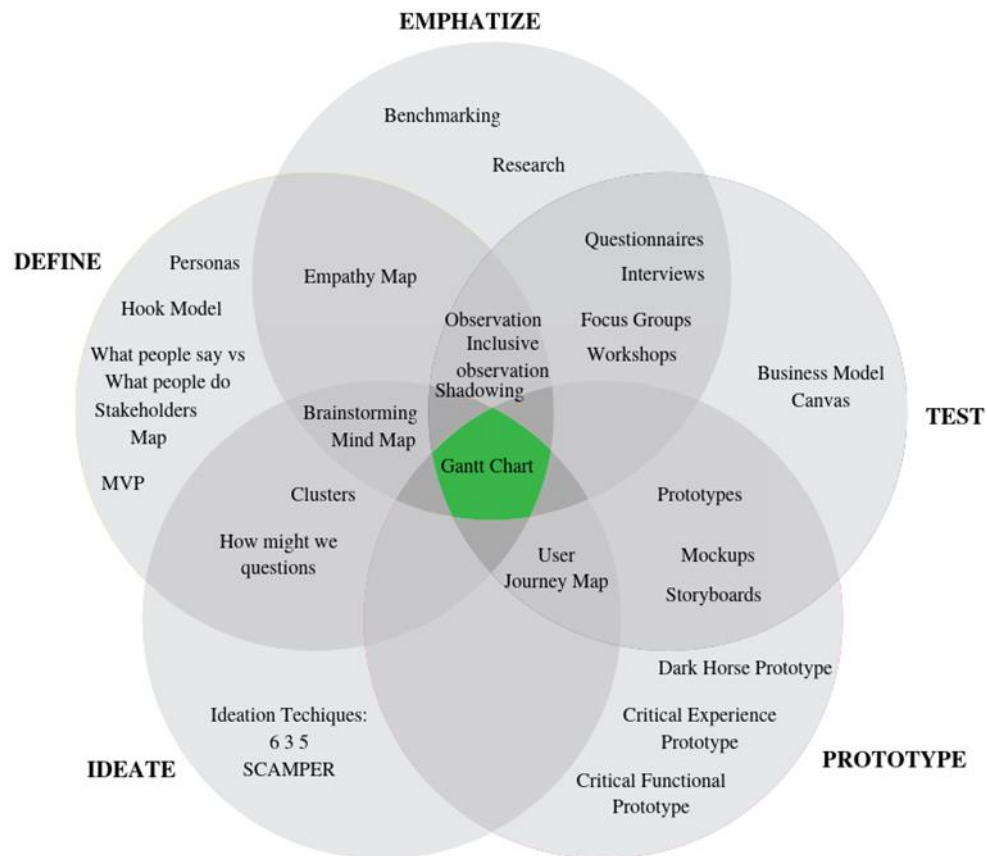
Figure 7- Venn Diagram about the DT tools and each step

The several tools listed are not exclusively used in one phase of DT. In the empathize phase interviewees use benchmarking and research. However, they also apply empathy maps the define phase as this tool is a good background to the construction of personas. Questionnaires, interviews, focus groups and workshops are tools adopted not only to know the problems and needs of the customer but also and once the solution is ready to test and receive feedback.

Inclusive observation and shadowing are considered tools to empathize, define and test as they help to create a sense of empathy allowing to once more receive feedback and defining the problem.

In the define phase, participants consider tools like personas, hook model, what people say vs what people do, stakeholders map and the calculation of the minimal valuable product to synthesize all the information and know what is valuable to the user. Besides, brainstorming and mind maps are used in defining, but also when empathizing and ideating since in these phases is important to get insights and organize it. Clusters and how might we questions are used in order to search for opportunities and give sense to all data gathered from, for example, a brainstorming session.

In the ideation phase, 6 3 5 and SCAMPER are used in order to improve creativity. SCAMPER answers to some questions regarding the solution in order to help create innovative ideas. 6 3 5 consists of 6 participants who are required to write 3 ideas in a paper within 5 minutes and then the paper swaps to a team member, helping in gathering inspiration between them.

In the prototype phase, participants considered that it is important to build several prototypes. The dark horse prototype is used to build disruptive ideas. Critical Function and Experience Prototypes are used to prototype the special functions of the solutions and demonstrate the

purpose. Then, these prototypes help create a better final one. Storyboards, mockups and prototypes are used both in prototyping and testing since they are developed to be shown to users and to provide additional information.

The user journey map, is a tool used during ideation, prototyping and testing as it provides a view of the customer experience, allowing to have important information to ideate, prototype and test.

Finally, in the end of the test phase, interviewees consider the Business Model Canvas an important tool to synthetize how the solution will create, deliver and capture value.

4.1.6   Advantages and Disadvantages

During the interviews, the advantages and disadvantages of DT were also mentioned. Starting with the advantages illustrated in Table 7, DT is considered an iterative and explorative approach since the problem and the solution are explored and this process happens several times in order to know if the solution fits in the resolution of the problem.

Also, interviewees find interesting working in multidisciplinary teams since everyone is essential at a point of the project. Tests are considered fundamental, and it is critical to spend time with the user and in order to get some understanding.

Participants consider that in DT verbs are more open when innovating which allows to extend hypotheses. Besides, it is also an open-minded approach since it does not censor anything and all ideas that arise are analysed. Lastly, DT allows to have different perspectives in the sense that it is an innovative approach and enables to see problems in a different perspective by being iterative, permitting in turn the improvement of the solution.

Table 7- Number of respondents in each DT advantage

	Professional (N=7)	Student (N=13)	Total
Iterative approach	5	9	14
Explorative approach	3	8	11
Allows working in multidisciplinary teams	2	6	8
Allows testing and with the user	4	5	9
Allows understanding the user	2	5	7
Improves the creation of ideas	3	4	7
Open hypothesis	2	5	7
Do not censor anything	1	5	6
Allows to have a different perspective	0	5	5

Regarding the disadvantages illustrated in Table 8, interviews consider DT time consumer. They say that it is spent a lot of time on the ideation phase that could sometimes be shortened. However, they state that this can be resolved through practice and with the improvement of the project management.

Another disadvantage is the fact that sometimes DT looks like a vicious circle, since it is necessary to do a lot of tests that do not have a positive result which leads to seem inefficient. They add that sometimes it is difficult not to get lost with ideas as they are always discovering new ones and abandoning others These advantages were stated only by students, which may lead to the conclusion that the lack of experience can make them think in this way.

Additionally, they find that DT lacks analytical rigor as it works with insights and with what people say, but sometimes the sample is not enough to validate.

Finally, they consider DT subjective, as it depends a lot on the personal touch each one gives to it and it depends on how people interpret for example the observation they are making.

Table 8- Number of respondents in each DT disadvantage

	Professional (N=7)	Student (N=13)	Total
Time consumer	2	8	10
Seems like a vicious cycle	0	7	7
Sometimes seems inefficient	1	5	6
Get lost in ideas	0	5	5
Lack analytical rigor	1	3	4
Subjective approach	0	3	3

4.1.7 Design Thinking Literature vs Practice

Table 9 shows a summary of the comparison between what is written in the literature and the results described previously. Thus, the main differences essentially arise in the definition of the concept, since in literature is considered an approach and in interviews a mindset. Regarding the principles, in practice the respondents see DT more broadly, however they also focus on essential points present in literature.

The objects, process and tools responses have many similarities with the literature. Regarding the process participants use the steps of The Design Thinking Model by the Hasso-Plattner-Institute, although they don't name the model used during the process. In conclusion, in practice DT is not considered a methodology, since people don't see DT as something to follow rules, but rather a way of thinking due to being iterative and promote abductive thinking,

Table 9- Major differences in literature and practice regarding DT

	Design Thinking		
	Literature	**Practice**	**Common**
Concept	Considered human-centered approach as it applies the tools of a designer and embraces human skills to stimulate transformation and development (Brown, 2008)	Considered a human-centered mindset which uses visual tools to promote the abductive thinking in order to solve problems	Human-centered
Principles	Empathy; Collaboration; Testing; Human-centered (Brown, 2009)	No criticism; Testing; Build on top; Build to think, don't think to build; Collaborative; Real; Iterative; Human-centered.	Testing; Collaboration; Human-centered
Objects	Product; Service; Experiences (Stickdorn & Scheinder, 2011)	Service; Product Service System; Products	Product; Service
Process	3 I Model: inspiration, ideation and implementation (Brown & Wyatt, 2010); HCD model: hearing, creating and delivering (Brown & Wyatt, 2010); Double Diamond: divergent and convergent phases (Tschimmel, 2012); The Design Thinking Model by the Hasso-Plattner-Institute: Empathize; Define; Ideate; Prototype; Test (Plattner, 2015)	Double Diamond Empathize; Define; Ideate; Prototype; Test	Double Diamond Empathize; Define; Ideate; Prototype; Test
Tools	Interviews; Observation; Conversations; Personas; Role objectives; Explore customer's pain points; Body Storming; Mind Mapping (Plattner, 2015); Sketching; Value Chain Analysis; Brainstorming; Concept Development Assumption; Customer Co-creation; Learning Launch (Liedtka & Ogilvie, 2012); Stakeholders Map; Customer Journey Map; Service Blueprint, Business Model Innovation; Rapid prototyping tools (Chasanidou et al., 2015); "How might we?" questions (Brown, 2009)	Prototypes; Interviews; Ideation techniques mainly brainstorming; Benchmarking; Observation; Personas; Empathy map; Business Model Canvas; User Journey Map	Interviews; Prototyping; User Journey Map

4.2   Service Design

Recalling the concept of SD, it is a creative, iterative and human-centered approach, once it seeks for understanding the users and stakeholders and their context (Patrício et al., 2018). Therefore, and once more, the objective is to understand all components of SD.

To address this objective, the SD category is divided into seven subcategories: definition, principles, object of study, process, tools, advantages and disadvantages. Just like in DT, some subcategories are also subdivided in others which will be following explained. The sample analysed in SD was smaller than the one analysed in DT, since only three professionals considered using SD.

As already mentioned, the results on SD came only from interviews with professionals, since students were not aware of SD. Therefore, the following tables will just consider professionals.

4.2.1   Concept

Considering the SD definition, interviews consider SD a process to achieve results and that brings numerous benefits.

> *"A systematized engineering process that maximizes the results and benefits of the implementation we are developing."*

Professional, Healthcare Industry Lead, about SD

In addition, they consider that SD is a process to design a service, involving people and the processes which integrate that service. People are involved in the process in the sense that each step of SD is a cocreation step with the stakeholders, allowing to perceive their needs. Therefore, SD involves an ecosystem of interested parts, since they all take part on the experience and need to be integrated.

> *"There is the need to know and understand all people involved… who they are, their behaviours to help us develop new solutions"*

Professional, UX Specialist, about SD

However, before going to the process of developing the service itself, in other words, before starting a SD process, professionals consider that is important to know what a service is exactly. They add that to realize what SD is, a person has firstly to get awareness of what a service is and only then can think about the design of service innovation.

> *"You cannot think about SD without knowing what a service is."*

Professional, Arts and Design Teacher, about SD

From these results, and making a general definition from them, SD can be considered a human-centered process used to develop an innovative service through maximizing results by the integration of everything that is part of the service such as people and processes.

4.2.2   Principles

SD has some principles which help maximizing the quality of the service. To understand the interviewees thoughts about the nature of SD, a question was asked about its principles.

Thereby, it was created a subcategory named principles, which in turn was divided into 5 subcategories: open mindset, collaborative, human-centered, real and iterative. Table 10 illustrates how many participants referred each principle.

Table 10- Number of respondents in each SD principle

	Professional (N= 7)
Collaborative	3
Human-centered	3
Iterative	3
Real	3
Co-creative	3
Open mindset	1

Through the analysis of the Table 10, it is possible to conclude that the opinions about SD principles are unanimous, since they mentioned almost all the same principles. ´

SD is considered collaborative as it requires several teams from different fields. The example given during the interviews falls on the importance of having an UX team, developers team and market research team working on the same objective. Therefore, the knowledge acquired from several areas allow to develop a comprehensive solution and immerse in all details, which becomes important for the development of a complete and valuable solution. Besides, interviewees state that working in teams is also a motivation and helps to increase creativity.

"We have to be in contact with a wide range of teams."

Professional, UX Specialist, about SD principles

"We work together with people with several backgrounds such as designer, developers, business… in order to achieve better results."

Professional, Healthcare Industry Lead, about SD

"Humour in teamwork is the key and in SD we need it to be creative."

Professional, Arts and Design Teacher, about SD principles

Professionals also consider SD human-centered. They claim that when developing a service, it must be viewed as a whole, in which interacts with stakeholders also has a whole, meaning that SD is always in contact with stakeholders. Besides, they consider that, in addition to knowing what users want, it is important to understand users emotions in order to achieve a result which fits their needs. That's why fieldwork and direct contact are crucial to gather new opportunities.

"In SD I defend that we cannot fail to see it as a whole and the interactions with stakeholders."

Professional, Healthcare Industry Lead, about SD principles

"We need to be inspired by users behaviour and for this we need direct contact with them"

Professional, Arts and Design Teacher, about SD principles

Participants claim that SD is iterative as it has iterative stages of receiving feedback, designing the service and prototype and test. They consider that being SD a cyclic process, allows to do quick changes and refinements which in turn enables to create other development opportunities. Besides, it permits to improve the quality of the solution since there are continuous improvements.

"Stages can be repeated according to the context and needs of the project."

Professional, Healthcare Industry Lead, about SD principles

"It is this rotating process that allows us to always improve."

Professional, UX Specialist, about SD principles

"All this is an iterative cycle, we can be testing and then we may need to do new interviews."

Professional, Arts and Design Teacher, about SD principles

SD is viewed as real, since it transforms intangible in tangible and must be produced and consumed simultaneously as users are always present as cocreators. Besides, the whole process of SD is developed based on reality, since it gathers information and tests with the real stakeholders. Therefore, it is not based on assumptions, but in real evidences. They add that, when using SD it is important to pay attention to every detail that may arise, since the solution will be something valuable to a real person.

"SD works with reality because there is transformation of something that is not touchable in touchable. In addition, throughout their production they are also being consumed."

Professional, Arts and Design Teacher, about SD principles

"We cannot rely on what we think it is, we have to work with reality"

Professional, Healthcare Industry Lead, about SD principles

"We need to pay attention to everything because we are developing something that will impact people's daily routines."

Professional, UX Specialist, about SD principles

Responses also consider that stakeholders take part on SD as service cocreators. Therefore, SD is co-creative as it involves the insights of everyone inserted in the service. They add that the interactions of the teams with the users fosters new insights, which allows to develop more creative and sustainable solutions. Besides, this co-creation help in making decisions, since teams know exactly what the user intends.

"SD is co-creative, being the users to create the services."

Professional, Arts and Design Teacher, about SD principles

"Working with the user helps creating new ideas."

Professional, UX Specialist, about SD principles

"The users give everything, we just do the technical part"

Professional, Healthcare Industry Lead, about SD principles

Finally, the responses show that SD is an open mindset. Interviewees consider that listening is very important, which in turn makes it important not to build a preconception before developing a service but get to know some knowledge before. In addition, an open mindset consists also in letting the users express their opinions and needs by making open questions to identify processes more effectively. Therefore, it is possible to develop not something that is in the researcher mind but in the user's mind.

"We were born with two ears and one mouth and we should hear more than we say. We must go with some knowledge about the industry but let users express their opinions and needs"

Professional, Healthcare Industry Lead, about SD principles

In conclusion, the stated principles are used to have a successful SD process. Therefore, according to the results SD is considered collaborative, since it embraces several teams from

different fields. It is stated as human-centered as it is focused on users of the service and these users help to create it. SD is also considered iterative since it is a cyclic process which allows the continuous improvement of the service and is real as it develops a service to be used in real context. Finally, to develop a SD process it is important to have an open mindset since it is necessary to be open to new situations and to better understand the use.

4.2.3 Object

Regarding the studied object in SD, the only aspect addressed during the interviews was the development of a service as it can been seen in Table 11. Nevertheless, the interviewees consider that nowadays everything is a service and for that reason cover diverse areas. An example given during an interview was that in the past, to buy bread in a supermarket, it was necessary to have a ticket, but nowadays it is possible to do that through the mobile phone.

"SD is used to create innovative services"

Professional, Arts and Design Teacher, about SD object

"What I do daily is to work with services"

Professional, Healthcare Industry Lead, about SD object

Table 11- Number of respondents in each SD object

	Professional (N= 7)
Service	3

4.2.4 Process

Turning to the SD process as defined in the literature described in Chapter 2, professionals defined SD as having 4 steps as illustrated in Table 12.

Table 12- Number of respondents in each SD step

	Professional (N= 7)
Exploration	3
Reflection	3
Ideation	3
Prototyping and Test	3
Implementation	1

The first step named exploration is considered a step of discovery, where the problem will be identified through the contact with the user and the stakeholders. Professionals consider crucial to understand user behaviours and needs through direct contact. It is important to have contact with the people who have a relationship with the problem, which does not mean that are only the end users but also all stakeholders. Therefore, this phase gathers all the information from the stakeholders to define the problem to be solved.

"Firstly, we must discover, and we put everything on the table. From then on, we define concretely the problem or part of the problem we will work on."

Professional, UX Specialist, about SD process

"In Exploration phase we think about the concept as we do exploratory interviews"

Professional, Healthcare Industry Lead, about SD process

"To find out the needs, we have to contact the users"

<div align="right">Professional, Arts and Design Teacher, about SD process</div>

The second phase, which the interviewees call ideation is considered the stage when they try to diverge around what was found in the previous stage using tools such as brainstorming and mind mapping and then vote and reach a convergence and decide a solution to prototype in the next stage. Ideation is considered a collaborative process because it brings several teams and stakeholders together to generate ideas regarding the problem previously identified. Furthermore, the creativity is something inherent in this phase, as it is necessary innovative ideas to emerge.

"Then there is ideation, in which we seek to diverge, through divergence techniques. When there are already many ideas, we vote in the best one to reach a convergence and prototype a solution."

<div align="right">Professional, UX Specialist, about SD steps</div>

<div align="right">*"Several teams come together to create ideas"*</div>

<div align="right">Professional, Healthcare Industry Lead, about SD process</div>

<div align="right">*"Creativity is very important in ideation"*</div>

<div align="right">Professional, Arts and Design Teacher, about SD process</div>

The third phase is called by the participants prototyping and test. Interviews consider that at this stage is important to develop something visual and functional, allowing the user to interact with the prototype. Therefore, the prototype at the beginning must be simple and noticeable, so that the users can handle with it with no difficulties.

Participants add that, then it is necessary to test with the prototype in order to receive feedback from the users and evaluate the users behaviours regarding the service. In this phase, users can give insights that can be used to do improvements.

"Several solutions are chosen in which it is decided that one will be prototyped and tested to collect feedback. From here it is decided whether to advance or not."

<div align="right">Professional, UX Specialist, about SD steps</div>

<div align="right">*"Prototyping is something more visual and functional which allows to have feedback."*</div>

<div align="right">Professional, Healthcare Industry Lead, about SD steps</div>

<div align="right">*"Prototypes must be appealing to the user, so we can receive true opinions."*</div>

<div align="right">Professional, Arts and Design Teacher, about SD process</div>

The final stage is implementation, where interviewees claim that in this stage, the final service already developed is presented to the user in order to know if it is fits the needs. This phase is considered iterative since It can be repeated several times before the service is delivered.

"Then it is the implementation, you have to go out there already with the final systems and then this is repetitive phase."

<div align="right">Professional, Healthcare Industry Lead, about SD steps</div>

The only step that is different from the literature described in Chapter 2 is the prototyping and test step, which is called reflection in literature. However, what is written in literature and what was mentioned by the interviewees have the same objective.

Only one participant claimed that, when projects have a short time frame, it is important to apply design sprints in ideation. It is a very structuring method that allows in a few days to apply several tools and achieve a very interesting output.

"When doing an ideation session, I try to structure, and I usually apply a lot the methodology related to the design sprint of Google Venture"

Professional, UX Specialist, about SD steps

4.2.5 Tools

Table 13 shows the mentioned tools during the interviews and the number of professionals who referred each one.

Table 13- Number of respondents in each SD tool

	Professional (N=7)
User Journey Map	3
Ideation Techniques	3
Personas	3
Interviews	3
Focus Groups	3
Prototypes	3
Service Blueprint	2
Benchmarking	2
Service System Architecture	2
Service System Navigation	2
Service Value Constellation	2
Eye Tracking	1
Design Thinking as a Tool	1

Through the analysis of the table, the most used tools are: user journey map, ideation techniques, personas, interviews, focus groups and prototypes.

The user journey map is considered crucial during the ideation, test and prototyping phases in order to see the interactions of the user with the service. Ideation Techniques are used in order to promote creativity and personas describe the users in order to develop a solution that meets their needs.

Interviews, eye tracking and focus groups are essential used to have information from the user and used in the exploration phase.

"We use tools such as interviews, focus groups and eye tracking to receive information."

Professional, UX Specialist, about SD tools

Service value constellation is considered important to understand the relation between services. As well as the service blueprint which is claimed as being mandatory in the design of the touchpoint to see how the several information systems are related to each other and the type of the interfaces.

There is a participant that considers DT as a tool for SD. This is an isolated and conflicting result with the literature which needs further investigation. Thus, the conclusion that can be drawn from this answer is that DT is a creative process of SD.

"The DT tool itself is important. It is important to have access to physical evidences that allow rapid prototyping and to explain ideas at the physical moment. The post-its are very important. The voting labels are also important to realize what are the responsibilities of each one of the actors."

Professional, Healthcare Industry Lead, about SD tools

The Venn diagram present in Figure 8 demonstrates the several tools stated during interviews and the respective stage or stages they were applied.
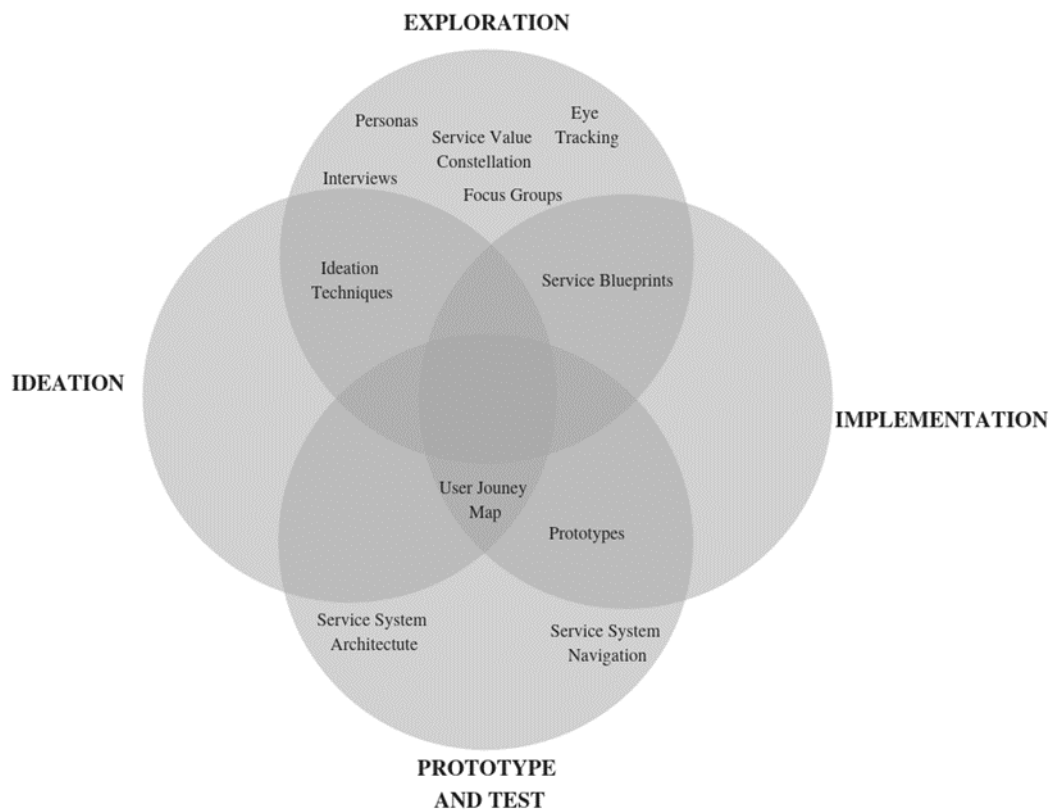

Figure 8- Venn Diagram about the SD tools and each step

The several tools listed are exclusively used in one phase of SD. In the exploration phase, professionals use personas, eye tracking, interviews, focus groups and the service value constellation in order to gather and organize information.

In the ideation phase, participants use ideation techniques in order to concentrate in idea generation.

In the prototype phase, they use the service system architecture and navigation in order to follow and register all the possible actions that the user might do. Also, interviewees develop prototypes in this phase, not just to be testes but also to help in the implementation phase.

In the implementation phase and in the exploration phase, service blueprints are used to show the customer in the frontstage, to define standards for each activity and specify the physical evidence, as well as the activities and supporting processes performed in the backstage. The service blueprint enables to do a more detailed analysis of each step and identify failure points.

Lastly, DT is considered a process used in SD, meaning that some contents addressed in DT can be applied in SD.

4.2.6 Advantages and Disadvantages

During the interviews, the advantages and disadvantages of SD were also mentioned. Starting with the advantages which can be seen in Table 14, SD is considered a tool which achieves good results since every phase is cocreated with the several stakeholders which allows to

understand well their needs. Therefore, this advantage relates to the next one since participants think that is valuable to have a close contact with the user.

Also, interviewees find positive that SD is an iterative process, since it is possible to test several times before implementing. With these tests, solutions are constantly being improved so that in the end, meet the needs of the user.

Lastly, participants claim that SD allows creativity, since to develop an innovative solution, it is important to have also innovative ideas. Therefore, during the process it is possible to become more sensible regarding the problem and begin to have original ideas.

Table 14- Number of respondents in each SD advantage

	Professional (N=7)
Achieve results	3
Close relation with the user	3
Allows to improve constantly	3
Iterative approach	2
Allows creativity	1

Regarding the disadvantages presented in Table 15, interviews consider that sometimes the process can be expensive, and the owners of a project may not be willing to pay. Besides, participants consider that SD takes some time and there is the risk that the solution become obsolete.

> *"When the design ends, although it has planned current and future needs, it may happen that the political or economic moment no longer is the same."*

> Professional, Healthcare Industry Lead, about SD disadvantages

Also, participants consider that the process may lead to some frustration, as it is necessary to lead with constant restart and with failure.

Table 15- Number of respondents in each SD disadvantage

	Professional (N=7)
Time consuming	2
Expensive	3
Constant restarts can lead to frustration	1

Generally, professionals did not point out many disadvantages regarding SD. They believe that SD is an effective process which helps achieving good results, regardless of the challenges that appear since its iterative nature allows to overcome failures.

4.2.7   Service Design Literature vs Practice

The Table 16 as well as in DT in the previous point, shows a summary of the comparison between what is written in the literature and the results described previously. Therefore, the main difference is essentially the fact that they consider DT as a creative process, since it allows access to physical evidences and thus enable the solutions to have the desired form. Regarding the principles, in practice the respondents add some principles which are not present in the literature which is the case of considering SD an open-mindset and co-creative.

About the process, responses are similar with the literature, however they add the design sprints used in ideation when projects which have a short time frame

The objects, models, methods and tools responses have many similarities with the literature. In conclusion, in practice SD is considered a human-centered process which uses several tools, being one of them DT, to achieve results.

Table 16- Major differences in literature and practice regarding SD

	Service Design		
	Literature	**Practice**	**Common**
Concept	It is a creative, iterative and human-centered approach, once it seeks for understanding the users and stakeholders and their context (Patrício et al., 2018)	Human-centered process used to develop innovative services through maximizing results by the integration of everything that is part of the services such as people and processes	Human-centered
Principles	Human-centered; Collaborative; Iterative; Sequential; Real; Holistic (Stickdorn et al., 2017)	Open mindset; Human-centered; Co-creative; Collaborative; Real; Iterative	Human-centered; Collaborative; Real; Iterative
Objects	Service; Service Systems (Patrício et al., 2018)	Service	Service
Process	Service Design Process; exploration, ideation, reflection; implementation (Patrício & Fisk, 2013; Stickdorn & Scheinder, 2011) Double Diamond: discover, define, develop, deliver (Foglieni et al., 2018); TISDD Service Design Framework: research, ideation, prototyping and implementation (Stickdorn et al., 2017); Four Design Activities of a Design Process: analysing, generating, developing and prototyping (Meroni & Sangiorgi, 2011)	Exploration; Ideation; Prototype and Test; Implementation Design Sprints	Exploration; Ideation; Implementation
Methods and Tools	Affinity Diagram; Blueprint; Brainstorming, Character Profiles; Conjoint Analyses; Contextual Interview; Customer Journey Map; Cultural Probes; Documentaries; Empathy Tools/Probes; Ethnographic User Research; Focus Group; Immersion (Workshop); Observations; Prototyping; Questionnaires/Surveys; Role Play; Scenarios; Service Prototype; Shadowing; Stakeholders Map; Storyboarding; Task analysis Grid (Alves & Nunes, 2013)	Benchmarking; User journey map; Eye Tracking; Focus Groups; Ideation Techniques; Interviews; Personas; Prototypes; Service blueprint; Service System Architecture; Service System Navigation; Service value constellation; Design Thinking as a creative process	Observation; Prototypes; Focus Groups; Service Blueprint

4.3   Comparing Design Thinking and Service Design: Practice Context

In order to perceive the differences and complementarities between SD and DT, together with some interview results, an analysis was made on this subject.

Table 17 presents a comparison between DT and SD regarding the more important findings. Thus, the table describes DT and SD definition, principles, object, process, models, methods and tools.

Table 17- Comparing DT with SD (Interview results)

	Design Thinking	**Service Design**
Definition	Considered a human-centered mindset which uses visual tools to promote the abductive thinking in order to solve problems	Human-centered process used to develop innovative service through maximizing results by the integration of everything that is part of the service such as people and processes
Principles	No criticism; Testing; Build on top; Build to think, don't think to build; Collaborative; Real; Iterative; Human-centered.	Open mindset; Human-centered; Co-creative; Collaborative; Real; Iterative
Object	Service; Product Service System; Product	Service
Process	Empathize; Define; Ideate; Prototype; Test Double Diamond	Exploration; Ideation; Prototype and Test; Implementation Design Sprints
Tools	Prototypes; Interviews; Ideation techniques mainly brainstorming; Benchmarking; Observation; Personas; Empathy map; Business Model Canvas; User journey map	Benchmarking; User journey map; Eye Tracking; Focus Groups; Ideation Techniques; Interviews; Personas; Prototypes; Service blueprint; Service System Architecture; Service System Navigation; Service value constellation; Design Thinking as a creative process

Starting by analysing the definition, DT and SD relate in the sense that both are human-centered and aim to address a need and develop innovative solutions through design. However, DT is considered a mindset and SD is a process.

> *"The two have similarities, at the very least in the concept of design, and this concept is closely associated with the idea of design, of constructing something. DT and ST at the very least are related in this expression."*

> Professional, Arts and Design Teacher, about DT and SD

Nevertheless, participants do not consider that both are methodologies, but rather that DT is a way of thinking and SD is a disciplinary area to develop a service.

> *"DT is when we try to be creative but when it comes to develop a service is SD."*

> Professional, Arts and Design Teacher, about DT and SD

Hence, DT and SD are related in the sense that to develop SD, meaning, to develop a service, it is necessary to use DT as it is fundamental to be creative and use several tools that boost creativity.

> *"It is natural for a SD professional to develop a good DT, develop a creative mindset that uses a lot of visual tools and create a lot of empathy."*

> Professional, Arts and Design Teacher, about DT and SD

"DT is a mindset and is an aggregator of a set of theories and a set of methods that have been worked on for many years. When we talk about DT, we are talking about one of the components of SD."

<div align="right">Professional, UX Specialist, about SD tools and methods</div>

With respect to principles, there are some similarities since both are human-centered, collaborative, real and iterative. Although the other principles, are not denominated in the same way, they are described in the same way, which is the case of no criticism and open mindset.

The studied objects are similar, since a service is developed in DT and SD. The process is identical as both have a phase to know the problem and the needs of the user, another to think about hypotheses to end that problem and a final where a possible solution is prototyped and tested to receive user feedback. Finally, there are several tools used in both DT and SD.

SD and DT proved to be two flexible ways to deliver value to the user. Hence, they have some similarities:

- Both DT and SD are human-centered and depend on empathy with people;

- The process is similar in DT and SD;

- Both use the creative thinking during all process;

- Both require the involvement of multidisciplinary teams and are iterative.

The greatest difference is that DT is considered a mindset and SD is results- oriented, meaning that it is focused on service development. In SD the application of tools is important to achieve the results. Therefore, SD and DT complement each other in the sense that, SD is the practical application of DT in service development.

The results were based on interviews made primarily with people working with service innovation. However, the difference between the number of responses about DT and SD was notorious. Students showed not to have any knowledge about SD, besides being working with innovation and development of a service. Thus, a missing link in understanding SD and DT is noticeable.

Besides, the integration of DT and SD is a new approach that has not been studied. This study concludes that this integration happens several times, but people do not recognize since they do not have enough knowledge about DT and SD.

5   Conclusion and Future Research

This exploratory study adopted a qualitative methodology to achieve the goals which were to understand DT and SD (concept, principles, object, process and tools) and based on these results, compare it with the existing literature and understand the major differences and similarities between the two. In order to make this comparative analysis, skilled people on DT and SD, particularly professionals and students, were interviewed.

The research goals were met as DT and SD (concept, principles, object, process and tools) were analysed and compared with the existing literature, as well as compared between each other. These results were illustrated throughout the study with tables. The qualitative methodology followed proved to be efficient as it enabled to capture the participants insights about DT and SD.

The study findings allow to conclude that DT is a human-centered mindset that in a practical way reaches solutions and solves problems through abductive thinking, which in turn is promoted by visual tools. Directly related to this definition, results showed that DT has 8 principles: no criticism; testing; build to think, don't think to build; collaborative; real; iterative and human-centered. Therefore, through these outcomes, it is possible to conclude that DT requires staying in the user's place, work in team in the validation and improvement of each idea, using a flexible thinking.

Another outcome of the research showed that the study object of DT are service, product service systems and products and that this approach is formed by 5 steps: empathize, define, ideate, prototype and test. Hence, through all the DT steps, the solutions resulting from the process fit the user needs, as they are always involved in the development of the solution. In addition, results show the huge importance of the test step and the iterative nature of the process.

Outcomes also show that digital projects integrate DT with Agile using the Double Diamond Model. In this way, to gather all the functionalities DT is used through divergence and convergence. Then, Agile is used to develop the solution through sprints and once more from divergence and convergence.

Another finding from this research showed that the most used methods and tools of DT are: prototypes, interviews, ideation techniques mainly brainstorming, benchmarking, observation, personas, empathy map, business model canvas and user journey map. Interviews are essentially used in the empathize and test phase, since face-to-face contact helps in gathering accurate and more complete information. Brainstorming, stakeholder research, benchmarking and observation must be done at the beginning of the project to find out the critical points. Personas help in recognizing the different needs and expectations. Based on the personas, empathy maps must be created to understand and prioritize user needs. User journey map is a crucial in the ideation and prototype phase to envision the user experience while using the solution. Prototypes are applied in the prototyping phase and in the test phase.

Regarding the DT advantages and disadvantages, results show that in one hand DT has a different perspective, do not censor anything, it is an explorative and iterative approach, improves the creation of ideas, allows working in teams, it opens hypothesis and it allows testing and understanding the user. On the other hand, DT may lead to get lost in ideas, it lacks analytical rigor, sometimes seems a vicious and inefficient cycle, it is a subjective approach and time consumer. From here, the biggest conclusion is that, besides being an iterative and explorative approach, DT can bring disadvantages in the sense that it may not focus on the right aspects, such as the lack of analytical rigor and can also be time consuming.

Concerning the DT objects, principles, process and tools results have many similarities with the literature, being these conclusions in line with the literature reviewed. Therefore, this study has proven the application of what has been stated by different authors such as, Brown (2009), Stickdorn & Scheinder (2011), Plattner (2015) and Tschimmel (2012) about DT objects, principles process and tools.

The major conclusion from this research considering DT, is that in practice DT is not considered a methodology, since it does not follow rules, but is rather a mindset since it is iterative and boosts abductive thinking. This conclusion is not in line with the literature review since it is considered an methodology by Brown (2008).

In respect to the SD results, SD is considered a human-centered process used to develop an innovative service through maximizing results by integrating people and processes. Considering these process principles, the stated results include SD as being collaborative, human-centered, iterative, an open mindset and real. Therefore, SD concentrates all its process on the user. Results regarding SD principles are related with the SD process being an open mindset since it is necessary to be open to new situations to develop a SD process and human-centered as it is focused on the users. In addition is co-creative as it joins the user and team to develop the service. It is also considered collaborative, since it embraces teams from different grounds. SD is also considered iterative since is cyclical and allows improvements and is real as it develops a service to be used in real context. Regarding the study object of SD, the only information collected was the application of SD in the development of a service.

Turning to the SD process, results describe four steps: exploration, ideation, prototyping and test and implementation. Besides, results show that in projects with a short time frame, design sprints are applied in the ideation stage. Hence, there is an overlap of processes when there is a specific need.

The biggest advantages stated in results about SD is that it allows to achieve good results and it involves the user, allowing to develop more targeted solution results and identify goals. Also, SD improves creativity. Regarding the disadvantages, the results show that SD can be expensive and time consuming, as well as frustrating due to its iterative nature.

Another finding of this study is that the most used tools in SD are: user journey map, ideation techniques, personas, interviews, focus groups, prototypes, benchmarking, eye tracking, service blueprint, service system architecture, service system navigation, service value constellation and design thinking used as a creative process.

Considering SD object, results present similarities with the literature stated by Patrício et al., (2018) and Foglieni et al. (2018). Regarding the process, the only step which differs from the literature described by Patrício & Fisk (2013) and Stickdorn & Scheinder (2011) is the prototyping and test step, which is called reflection in literature. However, the stated information in literature and the one mentioned in the results have the same objective. In addition, results add the design sprints in the ideation phase. With respect to the principles, the results show more principles considering SD an open-mindset and co-creative which are not present in literature stated by Stickdorn et al. (2017).

Finally, this study suggests different perceptions among DT and SD when comparing the definition, principles, process, object and tools.

In conclusion DT is considered a mindset and SD a process, although they are both human-centered and intend to address a need to develop innovative solutions through design.

Regarding the principles, DT and SD present similarities as both are human-centered, collaborative, real and iterative. The remaining principles, criticism and open mindset, are not denominated in the same way, but they are described in the same way.

Considering the objects, this study concludes that they are similar as well as the process, whose stages, once again are not denominated in the same way but follow the same activities. With regard to the tools, there are also some similarities which the case of for example prototypes, interviews, benchmarking and ideation techniques.

The only noticeable difference between SD and DT is the concept, being DT considered a mindset and SD a process. Hence, this study supports that SD and DT complement each other since DT can be applied in the practice of SD. Although, this integration was not found in literature, therefore this study suggests further investigation on the integration of DT in SD.

Results also suggest that DT acts as a creative process for SD as it involves physical evidences which help the SD process evolve. However, this is a result based on a single respondent, which impose some restrictions on conclusions to be made. Moreover, this finding is not in the literature which needs further investigation.

This study presents some limitations. The main challenge was in conveying information, mainly with students who had less experience with the subject. It was noticeable the difficulty in describing the approaches, mainly by the students. Some interviews needed a more explanatory introduction and some clarifications, namely when asked about SD. Therefore, the SD results were only based on three interviews of professionals. Consequently, the conclusions drawn about DT are more detailed and robust than the ones about SD.

Therefore, this study concludes that there is a gap between professionals and students concerning SD expertise. A possible exploration for this gap could be to disseminate knowledge about SD among the students through theoretical classes, since the students of the sample had only the practical component of the course.

The integration of DT and SD is a new approach that has not been delivered. This study concludes that this integration happens several times, but people do not recognize since they do not have enough knowledge about DT and SD. Therefore, this research suggests future investigation regarding this integration. In addition, and as already mentioned, more research on considering DT as a tool of SD should be developed.

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APPENDIX A: Study protocol

<div align="center">

Resumo do projeto

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Nome do projeto

Understanding Innovation Approaches: Design Thinking and Service Design – an explorative study

Nome da entidade promotora

INESCTEC

Nome do investigador principal da entidade promotora

Cátia Miranda

Nome do investigador que efetuará o estudo

Cátia Miranda

Datas

14/02/2019 a 30/02/2019

Participantes

Profissionais e estudantes da Porto Design School

Outros profissionais do ramo de SD

Benefícios para os participantes

Partilha de conhecimento.

Riscos e inconvenientes para os participantes

Não está identificado nenhum risco para os participantes uma vez que o estudo apenas prevê uma entrevista. O inconveniente será o tempo despendido na entrevista, que está estimado entre 30 a 45 minutos.

Recolha de dados

Entrevista gravada em áudio. O guião para a entrevista está disponível no ponto 5 deste protocolo.

Confidencialidade

Não será gravado ou registado sob qualquer forma o nome do participante. As gravações serão identificadas por números. Os resultados serão reportados de forma agregada, nunca especificando detalhes que permitam identificar os participantes do estudo.

Consentimento Informado

Antes do início da recolha de dados será dado aos participantes um consentimento informado que deverá ser lido e assinado pelos mesmos e pelo investigador. Este consentimento está disponível no final deste documento.

Enquadramento e objetivos do estudo

Analisar diferentes perspetivas sobre o DT e SD

Perceber de que forma aplicam estas metodologias no trabalho diário

A estes objetivos gerais corresponde as seguintes fases de trabalho:

- Estudo exploratório (janeiro e fevereiro 2019)

- Estudo da experiência dos atores (março a maio 2019):

- Desenvolvimento do trabalho (maio e junho 2019)

O projeto irá ser desenvolvido usando uma metodologia qualitativa. Assim, começa com a definição de estado de arte. Depois identifica-se a amostra para a recolha de dados. Baseado nestes resultados, a segunda fase engloba o tratamento dos mesmos.

Estudo dos resultados

Este estudo é de índole qualitativa e tem como objetivo a compreensão aprofundada do conhecimento de cada um dos entrevistados.

Amostra do estudo qualitativo

 A amostra inicialmente prevista é 6 profissionais e 10 estudantes da PDF.

Recolha de dados e análise dos dados

A recolha de dados será realizada através das entrevistas individuais. As entrevistas serão aprofundadas, de acordo com o guião apresentado no ponto 5. Este guião tem como objetivo orientar as entrevistas e a recolha de informação, mantendo, no entanto, a flexibilidade para explorar outros temas que venham a surgir espontaneamente e que se venham a revelar importantes.

Para permitir uma análise aprofundada dos dados, as entrevistas individuais serão gravadas em áudio. As gravações serão posteriormente transcritas literalmente para análise de conteúdo. Os dados recolhidos no decurso deste estudo serão mantidos estritamente confidenciais. A análise dos dados recolhidos no estudo será sempre efetuada de forma anónima. As questões de confidencialidade estão salvaguardadas no consentimento informado apresentado no ponto 4, que será assinado pelo entrevistado e pelos investigadores antes do início da entrevista.

Os dados recolhidos através das entrevistas serão transcritos literalmente e sujeitos a uma análise de conteúdo com o suporte do software NVivo 12.

Resultados esperados

O estudo exploratório terá os seguintes resultados esperados:

Conhecimento aprofundado do tema a ser desenvolvido

CONSENTIMENTO INFORMADO

Estamos a solicitar a sua participação para um estudo no âmbito do desenvolvimento da dissertação do Mestrado em Engenharia de Serviços e Gestão.

Este estudo tem como objetivo avaliar todas as etapas dos diferentes projetos que a Porto Design Factory acolhe. Nesse sentido, estamos a realizar entrevistas com os membros dos mesmos. A sua participação fornecerá informações importantes para este projeto.

Estas entrevistas serão gravadas para possibilitar a sua transcrição e análise aprofundada. Só iniciaremos a gravação após a sua concordância, expressa através da assinatura deste consentimento informado.

A informação recolhida é estritamente confidencial e será apenas utilizada no âmbito deste estudo. Os resultados serão reportados de forma agregada, sem identificar individualmente os entrevistados. A informação poderá ser usada para relatórios, apresentações ou artigos científicos, mas o seu nome não será identificado.

A sua participação neste estudo é voluntária, pelo que a poderá interromper a qualquer momento. Nesse caso toda a informação recolhida até ao momento será inutilizada.

Para qualquer esclarecimento adicional, poderá contactar Cátia Miranda (catia.4.miranda@gmail.com), da Faculdade de Engenharia da Universidade do Porto, Rua Dr. Roberto Frias, s/n 4200-465.

O investigador:

Nome: _____

Assinatura: _____ Data ___ / ___ /___

O participante:

Declaro ter lido e compreendido este documento, bem como as informações verbais fornecidas e aceito participar nesta investigação. Permito a utilização dos dados que forneço de forma voluntária, confiando em que apenas serão utilizados para investigação e com as garantias de confidencialidade e anonimato que me são dadas pelo investigador.

Nome: _____

Assinatura: _____ Data ___ / ___ / __

ESTE DOCUMENTO É FEITO EM DUPLICADO: UM PARA O PARTICIPANTE E OUTRO PARA O INVESTIGADO

Guião da entrevista para estudo da experiência

Name: _____

Project: _____ Function: _____

Age: _____Time of experience: _____

1. Tell me about your project proposal
    a. What is the research area and the scope of your project?
        i. Can you explain it?
    b. What reasons led you to make this proposal?
    c. Why did you choose PDF to develop it?
    d. Who are the stakeholders/ partnership of your project?
    e. How do you characterize the project?
        i. What approach(es) did you use? (e.g. design thinking, project service system, service design, etc)
            1. What are the advantages and disadvantages of these methodology(ies)/ approach(es)?
            2. Is there any user engagement during the development of the project?
            3. What principles and tools do you use from one approach and another?
                a. What are the main differences, similarities and overlaps between one approach and another?
            4. Do you think that, being the result of the project a service, it does require any special approach in terms of: principles, stages and tools? In other words, how do you see the project regarding these three points?
                a. Principles
                b. Stages
                c. Tools
                    i. What are the advantages and disadvantages of those tools?
                        1. If so, how is that special approach involved in the development of the project?

2. Can you explain all the process involving the project? Describe the steps you to see it through as well as all the stakeholders involved.

    a. Is your team multidisciplinary?

3. Have you experienced failure during any stage of the process?

4. What are the key challenges that you have been facing?

5. What do you think that should be improved?

6. How could it be improved?

7. What are the expected results?

    a. How do you intend to enter the market?

        i. Do you believe the outputs are feasible?

        ii. Do you think that the users will accept the projects' outputs?

8. To what extent the hosting of PDF was good for the project?

    a. What did PDF bring to the project?