



Design Thinking brasileiro: Uma revisão sistemática da literatura em teses e dissertações

Brazilian Design Thinking: A systematic literature review of theses and dissertations

Daniel de Salles Canfield, Design na Universidade de Passo Fundo
daniel@4sc.com.br

Maurício Moreira e Silva Bernardes, Universidade Federal do Rio Grande do Sul
bernardes@ufrgs.br

Resumo

Este artigo pretende analisar teses e dissertações brasileiras sobre Design Thinking para fornecer um cenário atualizado de como este elemento estratégico está sendo utilizado na perspectiva da pós-graduação acadêmica no Brasil. Uma revisão sistemática da literatura foi realizada utilizando o site da Capes, uma vez que é o banco de dados online oficial brasileiro de teses e dissertações. O resultado é 65 estudos que seguem os critérios de seleção de possuir o termo "Design Thinking" ou "Design thinker" no título da pesquisa, resumo ou palavras-chave e publicados até dezembro de 2016. Os resultados mostram que as pesquisas brasileiras sobre o DT estão concentradas em poucas instituições e focadas, quase que inteiramente, em um conceito do DT.

Palavras-chave: Design Thinking, Brasil, Revisão sistemática da literatura, Teses, Dissertações

Abstract

This paper aims to analyze Brazilian theses and dissertations examining Design Thinking to provide an updated picture of how this strategic element has been used in the academic postgraduate perspective in Brazil. A systematic literature review was performed using the Capes website, since it is the official Brazilian online database of theses and dissertations. The result is 65 studies that meet the selection criteria of having the term "Design Thinking" or "Design Thinker" in the research title, abstract or keywords and were published up to December of 2016. The results show that Brazilian DT research is concentrated in few institutions and focused almost entirely on one DT concept.

Keywords: Design Thinking, Brazil, Systematic literature review, Theses, Dissertation

1. Introduction

From the inception of design to the present day, design has been constantly changing and evolving. Design is gaining space in the management environment, leaving it to act simply as an operational tool and gaining territory as a strategic element. According to Simon (1996), design is a common knowledge for all areas and its role is to support any professional in solving a problem. With this role in mind, Design Thinking (DT) emerged as a methodology based on this multidisciplinary approach to transform the reality through innovation. DT can be applied in many contexts, such as companies, the public sector, and education. However, Buchanan (2008) comments that organizational change is only achieved by the relation of theory and practice.

Therefore, the objective of this systematic literature review is to identify how Brazilian postgraduate researchers and institutions are using DT in their theses and dissertations. To provide an original landscape and to identify new studies' gaps and directions, it is relevant to perform this research, since DT is a novel topic that must be tracked in the academic world. Additionally, the interdisciplinary aspect that surrounds the DT subject expands its use beyond design boundaries, making it a valuable point of interest in many other areas of knowledge.

This study first presents the term Design Thinking. This term's definition by the main authors, the historical evolution in the world and Brazil and principal models and tools are described. Second, the method used in this systematic literature review is noted by describing the search strategy protocol based on Dresch, Lacerda and Antunes Jr (2015). Third, the results of the 65 postgraduate publications are identified and explained, individually or in groups, through 11 reviewed elements. Finally, a discussion is performed to highlight the most important aspects of the research papers, to review their limitations and to suggest future approaches.

2. Design Thinking (DT)

Since the economy is shifting from "industrial manufacturing to knowledge work and service delivery", innovation is significantly expanding. The economy's purpose is shifting from only physical products to new "processes, services, IT-powered interactions, entertainments, and ways of communicating". These human-centered activities are exactly the aspects in which DT "can make a decisive difference" (BROWN, 2008, p. 6). Design thinking is a human-centered approach that creates solutions in a collaborative way that uses the designer's sensibility and methods to convert need into demand (TSCHIMMEL, 2012).

Although the study of designers' cognitive process has its origins long before the term Design Thinking was used by many scholars (Osborn in 1953; Bono in 1967; Simon in 1969; Koberg and Bagnall in 1972; Rittel and Webber in 1973 and Cross in 1982), it was first stated in 1987 by Peter Rowe (architecture and urban design professor at Harvard University) in his book *Design Thinking*. The author argued that designers have a unique way of approaching their work, a unique problem-solving process (KIMBELL, 2011; LUPTON, 2011; TSCHIMMEL, 2012, 2014; WOULDHUYSEN, 2011). Following the same DT concept, a group of researchers (Cross, Dorst, Roozenburg, Lawson, Eastman, McCracken and Newstetter) continued to study it, focused on the

designers' cognitive process: "identifying the essential mental strategies of designers while working on a project" (TSCHIMMEL, 2014, p. 2).

Furthermore, Richard Buchanan added a second holistic concept of DT with the article *Wicked Problems in Design Thinking* (1992) based on a wicked problems approach formulated by Horst Rittel in the 1960s. Buchanan's DT description is concerned to "connect and integrate useful knowledge from the arts and sciences [...] in ways that are suited to the problems and purposes of the present". Additionally, Kimbell (2011, p. 292) states that Buchanan's conceptualization is "less concerned with individual designers and how they design, but rather seeks to define design's role in the world".

However, DT became 'famous' in 2003 when the founders of IDEO (one of the world's most influential design consultancies), David Kelley, Tom Kelley and Tim Brown, renamed their methodology for generating innovation from DeepDive to Design Thinking (NITZSCHE, 2012). This methodology is a thinking process that introduces the design culture and methods into business innovation to create new realities (transformation, evolution and innovation), and according to Bonini and Sbragia (2011, p. 8), it is associated as part of the business strategy: "process of transformation, focused on organizational processes and creative thinking strategies". It offers new models of processes and toolkits that can be used by multidisciplinary teams to improve, accelerate and visualize every creative process (ALMENDRA; CHRISTIAANS, 2013; BROWN, 2008; LIEDTKA, 2014; TSCHIMMEL, 2012). Forthwith, the term expanded its scope through an increasing number of researchers, such as Dunne, Martin, Littman, Lockwood, Leifer, Meinel, Plattner, Liedtka, and Ogilvie.

As observed, DT has more than one concept and, according to Hassi and Laakso (2011) and Kimbell (2011), it can be classified in three major dimensions: (1) related to designers' cognitive process of solving problems; (2) general theory of solving problems in many disciplines; and (3) design process as part of business strategies. Given these points, Table 1 highlights these three different concepts of DT.

	<i>Design Thinking as a cognitive style</i>	<i>Design Thinking as a general theory of design</i>	<i>Design Thinking as an organizational resource</i>
Key texts	Cross 1982; Schön 1983; Rowe [1987] 1998; Lawson 1997; Cross 2006; Dorst 2006	Buchanan 1992	Dunne e Martin 2006; Bauer e Eagan 2008; Brown 2009; Martin 2009
Focus	Individual designers, especially experts	Design as a field or discipline	Businesses and other organizations in need of innovation
Design's purpose	Problem solving	Taming wicked problems	Innovation
Key concepts	Design ability as a form of intelligence; reflection-in-action, abductive thinking	Design has no special subject matter of its own	Visualization, prototyping, empathy, integrative thinking, abductive thinking
Nature of design problems	Design problems are ill-structured, problem and solution co-evolve	Design problems are wicked problems	Organizational problems are design problems
Sites of design expertise and activity	Traditional design disciplines	Four orders of design	Any context from healthcare to access to clean water (Brown and Wyatt 2010)

Table 1 Different ways of describing DT. Source: Kimbell (2011)

In Brazil, Tenny Pinheiro and Luis Alt (founders of the consultancy Live.work) introduced Design Thinking through the first DT course at ESPM/ São Paulo in 2010. One year later, the term gained public expression in the first Brazilian TED, in Rio de Janeiro, by designers Rique Nitzsche and Paulo Reis (CIEB, 2016). As previously occurred internationally, several researchers continued the pioneers' initiative and started writing about DT, spreading its reach in the national territory. These researchers included Bonini and Sbragia (2011), Instituto Educadigital (2013), Neves (2014), Vianna, M. *et al.*(2014) and others.

According to Bono (2006), the need for Design Thinking is not absolute to date, since individuals find it difficult to understand the existence of a whole way of thinking that is different from thought. These researchers do not know about the existence of another way of thinking that can be used not only by designers but also by any “professional with an open mind who can think, act, make it tangible and participate in an innovation process” (HANSON; NITZSCHE, 2003, p. 12). For this reason, DT has expanded its reach beyond the design discipline, moving especially to the “fields of management and marketing” and moving from ‘designing for users’ to ‘designing with users’ (TSCHIMMEL, 2012, p. 162). In other words, the final customers and users are considered the product and service experts; they participate in the full process, from data research to design solutions.

DT has been the focus of many studies, and several models were developed to support the achievement of creative solutions. Though all models have the same purpose (problem solving), they have significant differences among them (e.g., number of stages and name of the stages). One of the best known methodologies is represented in Figure 1 and described as follows.

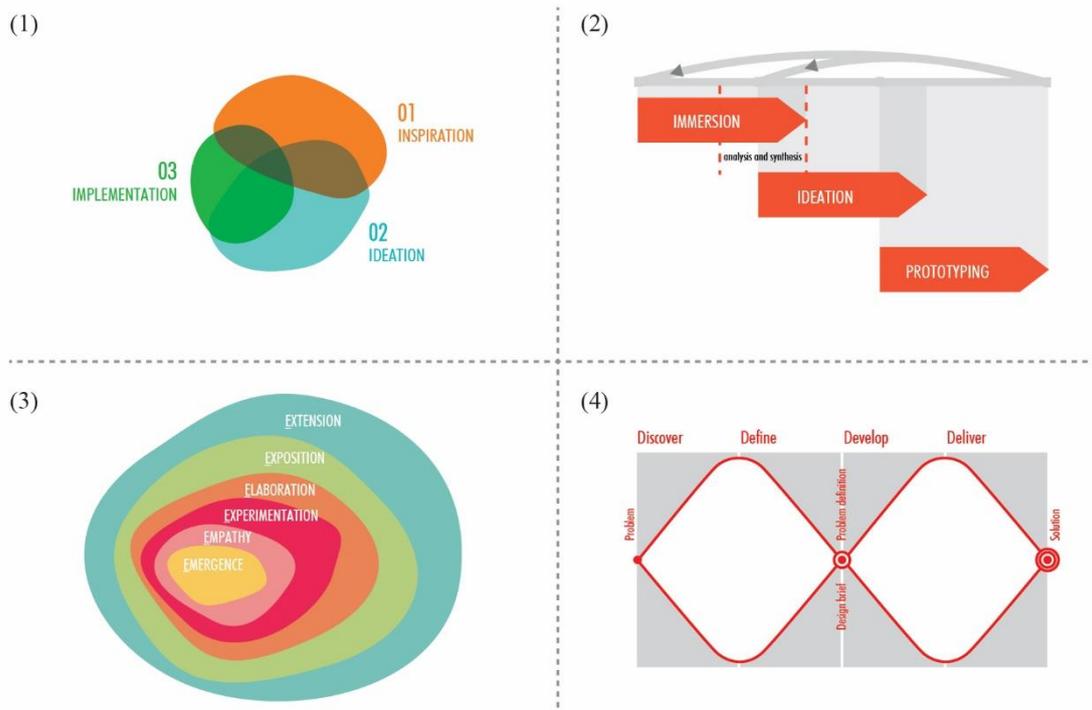


Figure 1 Design Thinking Models. Source: Design Council UK (2015), IDEO (2015), Mindshake (2015) and Vianna, M. *et al.* (2014)

(1) The HCD (human-centered design) Model was created by IDEO and is defined as a not “perfectly linear process”. Each project has its own contours and character. However, all of them follow the three main phases: Inspiration, Ideation and Implementation (build and test the ideas) (IDEO, 2015). (2) Although the Vianna Model is similar to the HCD, since it has three main phases, that is, Immersion, Ideation and Prototyping, the main difference is the addition of a transition phase between the two first phases, known as Analysis and Synthesis, which has the purpose of “organizing the data visually to point out patterns that help the understanding of the whole and identifying opportunities and challenges” (VIANNA, M. *et al.*, 2014, p. 17). (3) The Evolution 6² Model was developed by Katja Tschimmel and differs from the other models in the number of phases. This model contains six “process spaces” called E-phases (all start with an ‘E’): Emergence, Empathy, Experimentation, Elaboration, Exposition and Extension (MINDSHAKE, 2015). (4) The Double Diamond Model was created by the Design Council UK (2005) and it has a significant advantage over the other models: easy and effective visual description. All the four stages (Discover, Define, Develop and Deliver) are divided in two categories: divergent (creative stage) and convergent (refine stage), which facilitates the understanding and memorizing of the model (DESIGN COUNCIL UK, 2015).

Since visual perception is dominant among the senses, one of the primary contributions of DT is the visual aspect. The entire process is visually described, and DT tools provide the necessary support to improve the optical environment. Hence, designers apply sketches, drawings and material models because thinking in multiple perspectives regarding future possibilities is difficult when using only internal mental processes. Thus, the designers need to interact with an external representation (CROSS, 2011).

3.Methods

This research paper utilized a systematic literature review to identify, in Brazilian theses and dissertations, concepts and applications of DT from different viewpoints. According to Dresch, Lacerda and Antunes Jr (2015), systematic literature review is critical step in scientific research that aims to generate a coherent report or synthesis on a specific research topic, through the mapping and evaluation of primary studies.

To structure the search strategy, a protocol developed by Dresch, Lacerda and Antunes Jr (2015, p. 142) was used, since it is “oriented towards systematic reviews for academic purposes, which can be adapted to reviews for other purposes.” The protocol is illustrated in Table 2, and each step is described below.

Search strategy protocol	
Conceptual framework	Since Design Thinking was introduced in Brazil only 7 years ago (2010), it is important to identify how Brazilian postgraduate researchers and institutions are approaching this methodology in their studies.
Context	Theses and Dissertations available in Capes online database
Horizon	Studies published until December of 2016
Theoretical currents	Three DT theories: (1) cognitive process, (2) general theory of design and (3) business strategy.

Languages	Portuguese and English languages
Review question	How Brazilian postgraduate researchers and institutions are using Design Thinking in their theses and dissertations until December of 2016?
Review strategy	Aggregative review (deductive method).
Search criteria	Inclusion criteria: (1) have the search term in the research title, abstract and/or keywords; (2) published until December of 2016. Exclusion criteria: (1) do not have access to the complete research document.
Search terms	Exact expression “Design Thinking” and “Design thinker”
Search sources	Capes Theses and Dissertations database (Capes Banco de Teses e Dissertações), online Brazilian university libraries, authors e-mail.

Table 2 Protocol for systematic review. Source: Adapted from Dresch, Lacerda and Antunes Jr (2015)

3.1 Conceptual framework

The DT methodology is quite new in Brazil. According to (CIEB, 2016), the term was introduced in 2010 through a DT course at ESPM São Paulo and gained wider attention one year later during the TED talk in Rio de Janeiro. Under those circumstances, the problem situation was formulated as how Brazilian postgraduate researchers and institutions are approaching DT in their studies?

3.2 Context

To discover important and reliable Brazilian publications examining DT, this systematic review aimed at postgraduate program research. For this reason, the context was limited to the theses and dissertations database, developed by the foundation of the Ministry of Education (MEC) named Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (Capes), since it is the official source of Brazilian postgraduate theses and dissertations. According to Capes (2015), it plays a fundamental role in the expansion and consolidation of *stricto sensu* (master's and doctorate) postgraduate courses in all states of Brazil.

3.3 Horizon

The theses and dissertations were searched from January of 2017 until March of 2017. Thus, the result was studies that were published between 2011 and 2016. It must be remembered that the term DT was introduced in Brazil 7 years ago (2010). As a consequence, the first appearance of a Design Thinking scientific production in the Capes database is 2011. The time horizon final deadline was December of 2016, since this review needed a full year's data to use in the publications comparison. Consequently, the research was conducted until March of 2017, the period when Capes is updated with the academic research from the past year.

3.4 Theoretical currents

As previously stated, DT has been the focus of several researchers from its creation until the present day. Consequently, the meanings and theories created about it have ‘evolved’, as well. Therefore, this paper intends to identify what DT theories Brazilian researchers are using in their theses and dissertations. Therefore, the search strategy was not limited to a specific theory. Accordingly, the three main theories developed about Design Thinking, highlighted by Kimbell (2011), shall be taken into account: (1) cognitive process, (2) general theory of design and (3) business strategy.

3.5 Languages

Since the purpose of this research is to identify DT Brazilian studies through the Capes Theses and Dissertations database, a Brazilian platform with national studies only, the decision of a specific language was assumed to be unnecessary. However, during the research, one study was found in English, expanding the research language consideration to Portuguese and English.

3.6 Review question

With the intention of providing a Brazilian DT panorama, this systematic review must answer the following question: How are Brazilian postgraduate researchers and institutions using DT in their theses and dissertations until December of 2016?

3.7 Review strategy

The aggregative review strategy was chosen since closed questions were used to test the theory (deductive method) and the results of the reviewed studies were aggregated to answer the review question. Another key point of this strategy is the narrowed extension scope of the researched works leading to the use of a homogeneous primary studies variety.

3.8 Search criteria

The inclusion criteria obeyed the following requirements: (1) to have at least one of the two exact expressions (“expression in quotation marks in the defined search indexes”) in the research title, abstract and/or keywords and (2) to have been published in the period between January of 2011 (year of the first appearance of a Design Thinking scientific production in Capes) and December of 2016 (DRESCH; LACERDA; ANTUNES JR, 2015, p. 139). On the other hand, the exclusion criteria were based on the requirement of not having the exact expressions in the research title, abstract or keyword, and (2) not having access to the complete research document.

3.9 Search terms

To identify studies focused on DT, the search terms used were restricted to these methodology expressions. First, the exact expression “Design Thinking” was used, and the result was a total of 77 scientific productions. Second, another exact expression was utilized to enlarge the quantity of research. Thus, the “Design Thinker” exact expression returned one complementary study. Third, the truncated expression “Design think*” was searched on the Capes website expecting some variants. However, it did not return any studies. Lastly, the Portuguese translation of the term DT (“*Pensamento de Design*”) did not return any results, either.

The number of studies found using the search criteria (inclusion and exclusion) and search terms is presented in Table 3.

Criteria	Included				Excluded		
	Title	Abstract	Keywords	Total	Missing title, abstract or keyword	Missing complete file	Total
“Design Thinking”	29	59	46	64	9	3	12
“Design thinker”	1	1	1	1	0	0	0

Table 3 Search criteria x Search terms (number of studies). Source: Authors

3.10 Search sources

The main database source used in this systematic review was the Capes Theses and Dissertations database website (<http://bancodeteses.capes.gov.br>). Since this online source is limited to a simple search with only one text field, the results could not be previously filtered. Therefore, all 77 studies titles, abstracts and keywords were read directly on the Capes website to select the publications that actually had the listed criteria. As a result, nine of those were not used since they did not mention Design Thinking or Design Thinker in the title, abstract and keywords. The result was a total of 68 scientific productions meeting the conditions to be used in this research paper.

Later, since 10 digital files were not available to be downloaded directly from the Capes website, online libraries from 7 universities: MACKENZIE (http://www.mackenzie.br/teses_dissertacoes.html), PUC-Rio (<https://www.maxwell.vrac.puc-rio.br/>), UAM (<http://portal.anhembi.br/biblioteca/bibliotecas-digitais/>), UFSC (<https://repositorio.ufsc.br/>), UNIRITTER (<http://dspace.uniritter.edu.br/>), UNISINOS (<http://www.repositorio.jesuita.org.br/>) and USP (<http://www.teses.usp.br/>) were used to seek the missing thesis and dissertation digital documents.

Lastly, authors of five academic publications were personally contacted by the Lattes website (Brazilian researchers’ curriculum database that provides a means for direct messages between researchers), by email and by social network to provide the complete files because they were not available at the online university libraries. After several attempts, two files were collected, and three had to be excluded, since the researchers did not provide the documents.

4. Results and Discussion

After the search strategy was executed, a floating reading of all 65 studies was conducted with the objective of answering the research question. Thus, 11 aspects were previously defined and identified in each study as illustrated in Table 4.

Number	Reviewed element	Number	Reviewed element
RE1	Type of production	RE7	Economy sector
RE2	Year of publication	RE8	DT author
RE3	Institution	RE9	DT concept
RE4	Institution program	RE10	DT objective
RE5	Author's academic background	RE11	Data collection instruments
RE6	Publication keywords		

Table 4 Reviewed elements. Source: Authors

4.1 Type of production (RE1)

It is important to realize that Brazilian master's degrees have two categories: academic master's degree and professional master's degree. According to Capes (2007) professional master's degree is a terminal title, which is distinguished from the academic degree because the latter prepares a researcher, who should continue his career with the doctorate, while for a professional degree, what is intended is to immerse a graduate student in research, make him know it well but not necessarily so well that he will continue to study. What matters is that he (1) knows from experience what the research is, (2) knows where to locate research in the future that interests his profession, and (3) learns how to include existing and future research in his professional work.

From a total of 65 scientific productions (Table 5), 52 dissertations were found, corresponding to 80% of all research analyzed, where 43 were academic dissertations (66.1%), and nine were professional dissertations (13.8%). Furthermore, 13 theses (20%) completed the sum of DT post-graduate studies in Brazil.

	Academic Diss.	Professional Diss.	Dissertations	Theses	Total
Number of studies	43	9	52	13	65

Table 5 Publications by Type (RE1). Source: Authors

4.2 Year of publication (RE2)

The chart in Figure 2 show the evolution of the quantity of DT works from its first appearance on 2011 February 25th with Ana Paula Perfetto Demarchi's doctorate study at UFSC engineering and knowledge management program, until the end of 2016.

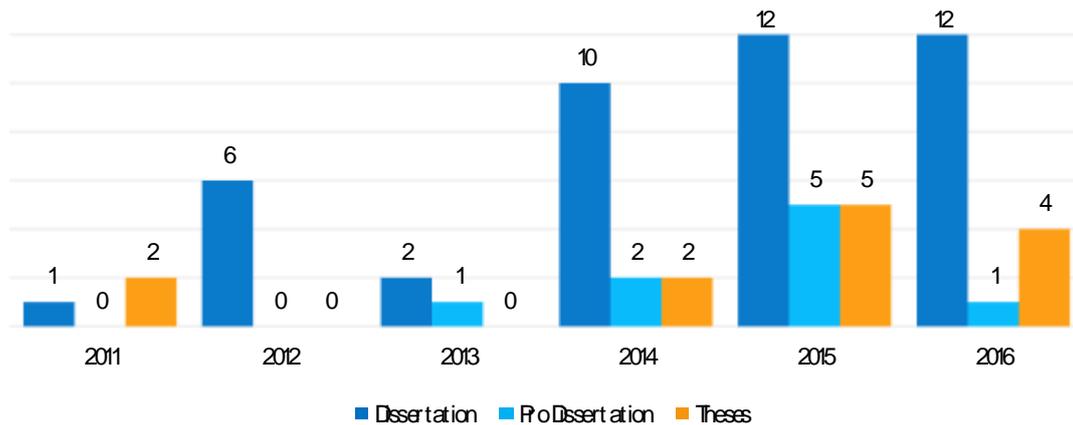


Figure 2 Publications by year (RE2). Source: Authors

As observed, there was considerable growth in the number of studies (100%) from 2011 (n=3) to 2012 (n=6). This aspect can be related to design researchers' initial interest, since four out of six studies (66.6%) were developed at design post-graduate programs (UAM, UFSC, UNISINOS and PUC-SP). Conversely, the number of theses decreased from two (2011) to zero (2012). The next year (2013) saw the lowest amount of DT production in Brazil, since no theses were published and only three DT dissertations were concluded. Two academic dissertations were from business administration programs (UFPR and FGV-SP) and the first professional dissertation was developed by Carlos Eduardo Freire Gurgel at UFPE computer science program. In 2014, the number of publications reached double digits and remained there until 2016. It varied from 14 studies in 2014, to 22 studies in 2015, to 17 studies in 2016. This finding is observed because DT became nationally known in 2011, and consequently, some institutions significantly increased their range of DT publications, such as UFPE (n=8), UFSC (n=7) and UNISINOS (n=7).

4.3 Institution (RE3)

The Brazilian Design Thinking post-graduate production is distributed across 28 institutions from around the entire country (Figure 3). However, four institutions are responsible for almost half (n=32, 49.3%) of the publications, as follows. The institution that produced the largest amount of DT research is the Universidade Federal de Santa Catarina (UFSC) with 10 publications that can be divided in two main types of production/program: four theses and two dissertations from engineering and knowledge management programs and three dissertations from design programs. It is important to note that 80% (n=8) of these UFSC researchers have design academic backgrounds.

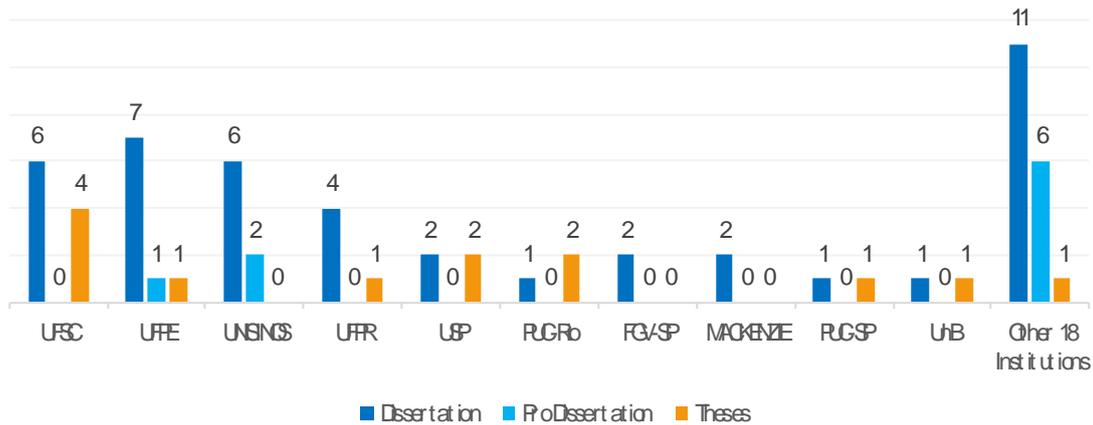


Figure 3 Publications by Institution (RE3). Source: Authors

Universidade Federal de Pernambuco (UFPE) is the second major DT contributor with nine scientific productions. The theses and dissertations belong exclusively to two programs: computer science (n=5, 55.5%) and design (n=4, 44.5%). However, the researchers' academic backgrounds do not follow the same proportion because they are distributed among business administration, computer science, economics, mechanical engineering and design. The third institution is the Universidade do Vale do Rio dos Sinos (UNISINOS) that produced a total of nine dissertations (six academic and three professional) in four different programs: business administration, design, management and business and education. The researchers' academic backgrounds are even more distinct since they have eight different graduation bases. Another seven institutions have more than one post-graduate study based on DT, and 18 more institutions support the development of Design Thinking in the Brazilian scenario with just one research production each. When the locations of the top 10 (DT contributors) institutions are analyzed, the result is that 80% of them are located in five states in the south and southeast (RS, SC, PR, SP and RJ), as observed in Figure 4.

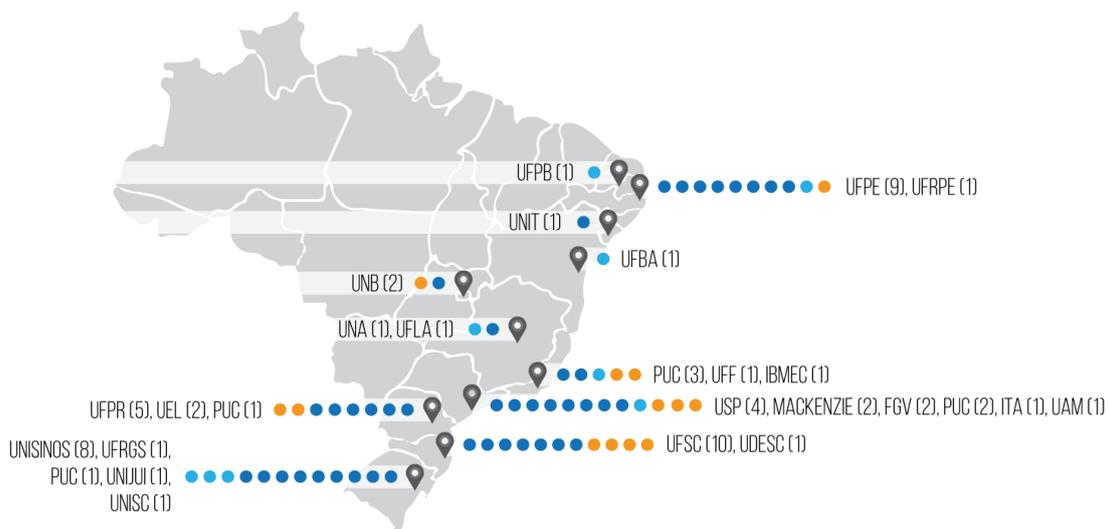


Figure 4 Publications by State. Source: Authors

4.4 Institution Program (RE4) and Author's academic background (RE5)

To perform the production research, no specific area of knowledge, course or program research filter was used, since Design Thinking has a multidisciplinary perspective. Consequently, 24 different programs had at least one study investigating DT in the last six years, and 19 different academic backgrounds were identified among the DT thesis and dissertation authors. However, they were gathered in 10 groups (Figure 5) to perform a better evaluation. For instance, the design group is a combination of design (18 studies) and technology of intelligence and digital design (one study).

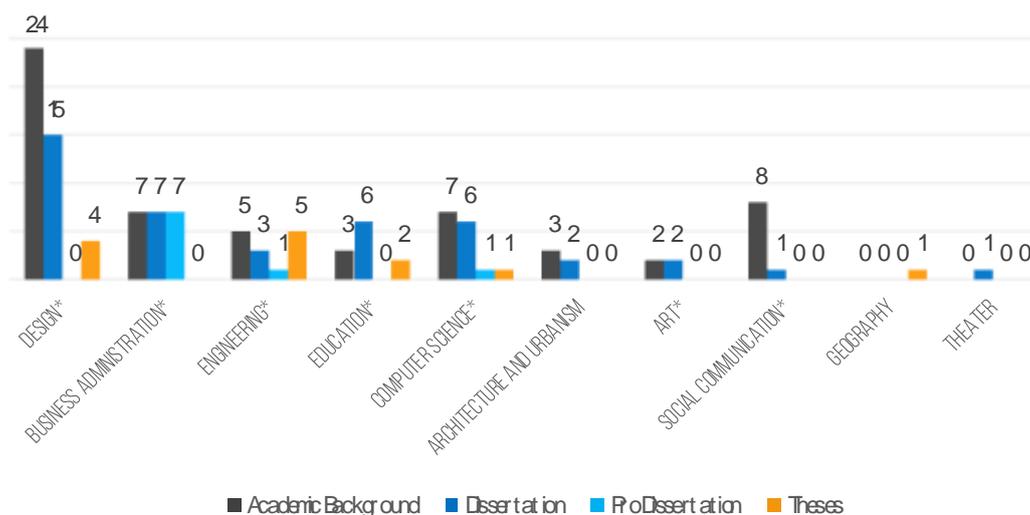


Figure 5 Publications by Author's academic background (RE5) and Institutions Programs (RE4). Source: Authors

As observed, the institution program and authors' academic background that contains most of the DT studies is design, since 24 researchers have degrees in design (some have more than one academic background) and 15 academic dissertations were developed in design programs. However, only four publications were from design doctorate programs, representing 30% of all 13 theses. This can be explained by the small number of design PhD courses (n=10) and design master's and doctorate programs (n=25) in Brazil (CAPES, 2017). Business administration and its variants (management and business, management systems, public administration and management in learning organizations) need to be highlighted because this is the second program with a total of 13 research works and seven authors' academic background. However, all the studies are master's degree level, indicating no interest among business doctorates in this research field.

Another important aspect is due the fact that the largest number of DT theses belongs to engineering programs (production engineering, electrical engineering, engineering and knowledge management and mechanical and aerospace engineering): five doctorate studies. Lastly, social communication (communication, journalism and advertising) has the second largest number of graduated students (n=8) interested in developing DT research. Conversely, this interest does not continue at a post-graduate level, since only one academic dissertation was identified.

4.5 Publication Keywords (RE6) and Economy sector (RE7)

The overall number of keywords identified in the 65 studies was 306, yielding an average of 4.7 keywords by study. However, 185 keywords (30.7%) were repeated, resulting in 212 different keywords (69.3%) to be analyzed. Posteriorly, the keywords were grouped in 17 main categories (Figure 6) using the search strategy of truncated words in which similar expressions and different spellings were included into the main search terms to return all variants (DRESCH; LACERDA; ANTUNES JR, 2015). For instance, the most used keyword was the truncated search term “design think*” (49 appearances corresponding to 23.1% of all 212 keywords), which is a combination of “design thinking” (n=48, 22.6%) and “design thinker” (n=1, 0.4%). This result is obvious and expected, since the primary focus of this literature review was these two terms.

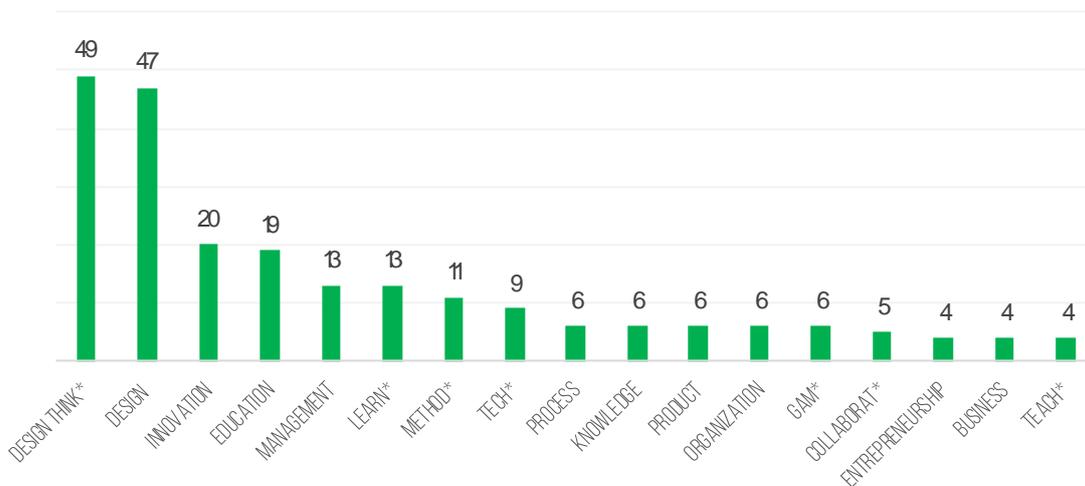


Figure 6 Publications by Keywords (RE6). Source: Authors

The second most applied term was “design” (n=47, 22.1%). However, this result is attributed to the variations of the term design (e.g., design management, design method, design process, and design science) instead of the exact word design with nine results, highlighting the multiple uses of DT in different perspectives.

The exact word “innovation” had a great number of appearances (n=20, 9.4%), since it is one of the major contributions of DT, and almost all studies based their DT background on Tim Brow’s concept (RE8, RE9 and RE10) that is defended in “How Design Thinking Transforms Organizations and Inspires Innovation” (title of his book).

It is important to highlight that the word “education” was used in 19 (8.9%) postgraduate studies. The reason for that is related to RE7. As seen in Figure 7, the economy sector education was the concentration of 21 studies (32.3%), demonstrating a strong effort to implement this strategic element (DT) to improve education at different levels (elementary and higher): “The purpose of this research is to present reliable results of the use of tools provided by Design Thinking in schools” (TERRES, 2015) and “Develop a course [...] for continuing education of teachers working in Basic Education, which was built on the approaches of Design Thinking for Educators and Experience Learning” (RIBEIRO, 2016).

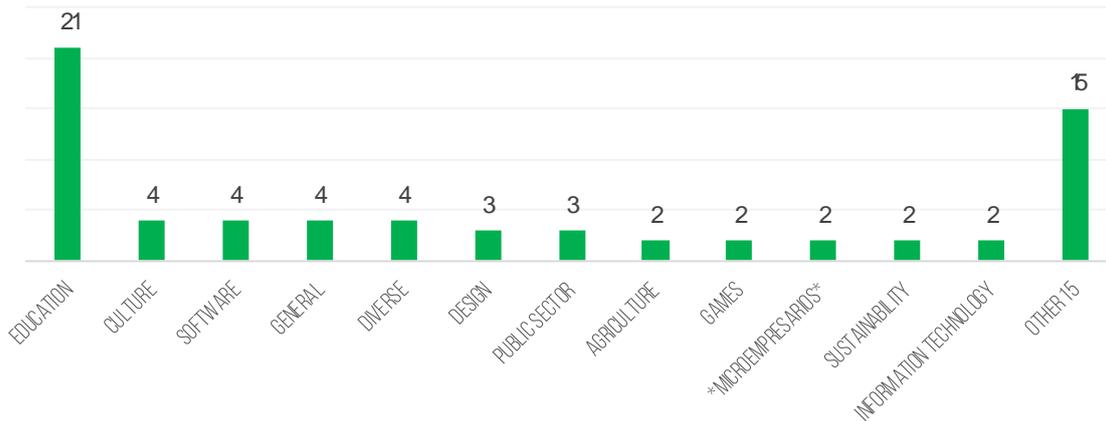


Figure 7 Publications by economy sector (RE7). Source: Authors

Many other sectors of the economy (n=24) were the context of DT research, though none of them had an expansive number of publications, similar to education. Thus, the economy sectors that can be emphasized are culture and software with four studies each (6.2%), design and public sector with three each (4.6%) and agriculture, games, micro-entrepreneurs, sustainability and IT with two studies each (3.1%).

4.6 DT authors (RE8), DT Concept (RE9) and DT objective (RE10)

The evaluation of these three research elements can be performed together since each one has a direct influence on the other. Thus, to select the DT authors (RE8) used in all 65 publications, a search was made following one specific inclusion criteria: the author must have been cited in the DT literature review. Additionally, a scanning was performed through the studies' references to avoid mistakes. Although the result was 192 different authors used to develop the DT foundation, only 19 authors were cited in more than five studies (Figure 8).

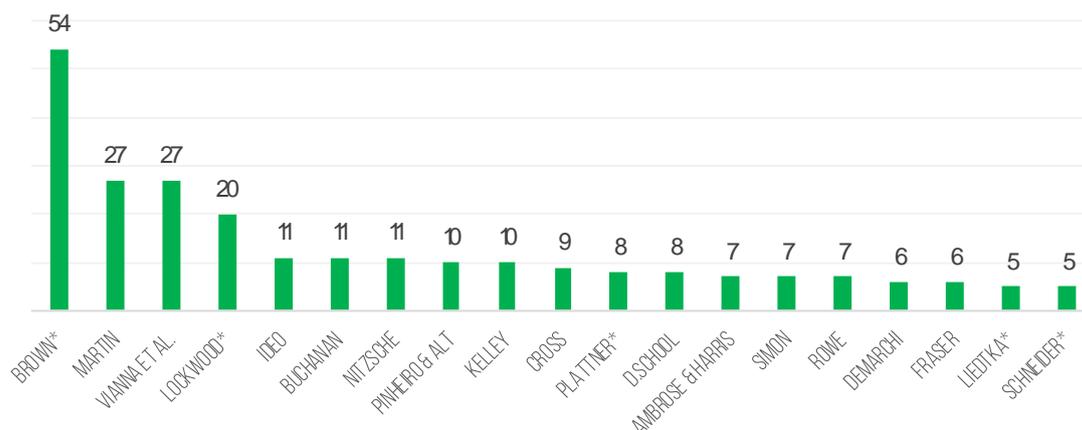


Figure 8 Publications by DT authors (RE8). Source: Authors

The DT concept (RE9) identification was performed by reading the publications recognizing the three different DT concepts stated by Kimbell (2011): cognitive style, general theory and

organizational resource (Figure 9). To identify ‘why’ DT was used in each study (RE10), all of the general and specific objectives were read and grouped into three different categories: tools, concept and study (Figure 10).

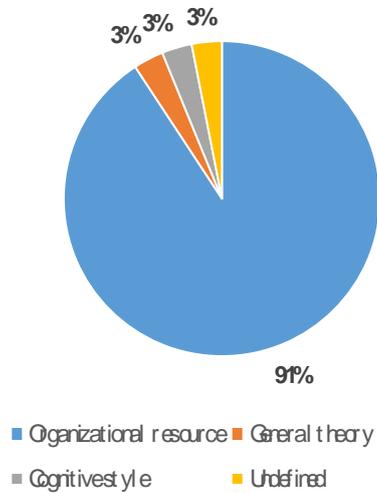


Figure 9 Publications by DT theory (RE9).
Source: Authors

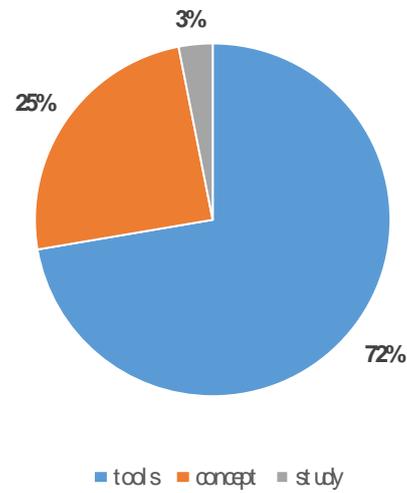


Figure 10 Publications by DT objective (RE10).
Source: Authors

The results show that the majority (n=59, 91%) of the 65 publications used the DT theory developed by IDEO to build their studies basis. Consequently, eight of the 10 authors most used in the DT literature review follow the same organizational resource theory. For instance, Tim Brown (one of the three IDEO’s DT methodology creators) was cited in 54 studies (83.1%), of which 50 citations were individual, and four citations were together with Jocelyn Wyatt. Additionally, two other researchers had an equal number of appearances (n=27, 41.5%): Roger Martin (dean of the Rotman School of Management, University of Toronto) and Vianna *et al.* (Maurício Vianna, Ysmar Vianna, Isabel K. Adler, Brenda Lucena and Beatriz Russo), Brazilian researchers that published in 2012 an objective and didactic Portuguese book named *Design Thinking inovação em negócios*. Furthermore, the other two DT theories (general theory and cognitive style) were used in only two publications each (3%), reflecting a small number of citations for their defenders: Richard Buchanan (n=11, 16.9%) and Nigel Cross (n=9, 13.8%), respectively.

Since the DT theory created by IDEO is a creative problem solving methodology that uses a set of tools to help individuals through the three spaces of innovation: inspiration, ideation, and implementation (BROWN, 2009), the DT objectives of the publications were, for the most part, to apply those tools and concepts to their research. First, with 72% (n=47) the use of DT tools was the primary objective of the studies: “Apply the Design Thinking tool in a network of franchises” (FERRO, 2014); “[...] use of DT tools to develop a methodology for learning object development” (QUEIROS, 2015); “Use of Design Thinking tools as a source of increment and methodological innovation for Management” (JÚNIOR, 2015) and many others.

Second, the objective for 25% (n=16) was to use only the Design Thinking concepts, without the tools, to support the development of their academic works: “The concepts of Design Thinking were used as a basis for the conception of the game system as a whole” (UHLMANN, 2014);

“Should use other themes, such as design thinking, [...] people-centered approach” (GURGEL, 2013); “Design thinking as ways to think of a problem of a complex reality” (CUNHA, 2015).

Lastly, two studies (3%) were focused on studying the theory of the term DT, such as “Analyze the theoretical approaches and the articulation of the relations between the philosophical principles of lean thinking and design thinking” (BERTÃO, 2015); “To present the translation process through which the term [design] passed considering the interaction between these two fields: design and management” (GROSS, 2016).

4.7 Data collection instrument (RE11)

As a consequence of the practical use of DT in the reviewed postgraduate studies (RE10) a methodology analysis was made to identify which data collection instruments were used to reach the research objectives. The result (Figure 11) shows that 17 different instruments were applied. However, nine of those were grouped in the category ‘others’ because they had only one use each.

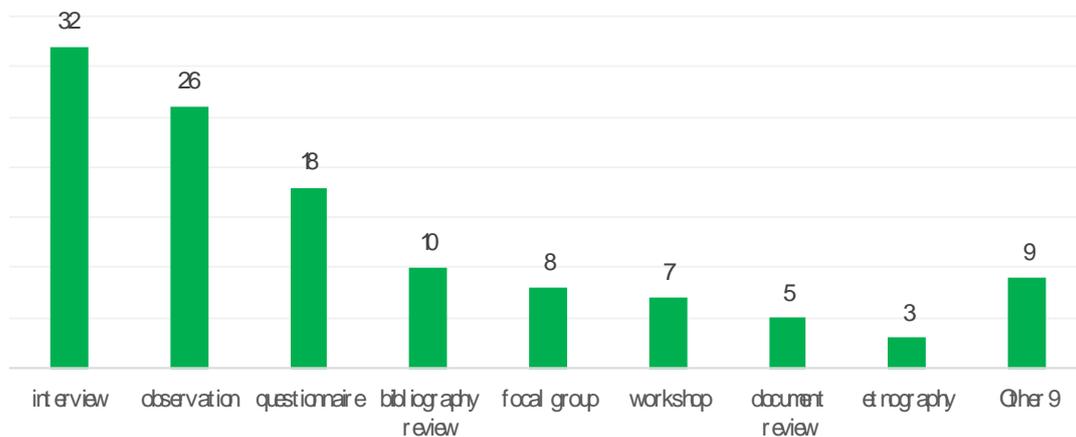


Figure 11 Publications by Data collection instrument (RE11). Source: Authors

Most of the instruments for data collection applied have a direct relation to the tools used by DT methodologies to identify problems (everything that harms people’s experience and wellbeing) and generate solutions (VIANNA, M. *et al.*, 2014). Thus, the instruments used during the methodology phase of the 65 studies: interview (n=32, 27%), observation (n=26, 22%), questionnaire (n=18, 15.3%), focus group (n=8, 6.8%) and workshop (n=7, 5.9%) are also instruments (tools) of DT models’ first phase (e.g., discover, inspiration, immersion, and emergence). For instance, they were applied with the purpose “to find out what the needs of the people are [...], for this the ability of empathy is fundamental, being able to even put itself in the lives of these people to increase the capacity of perception of the real needs” (BISCAIA, 2013) and to gain insights, such as “from the observation of the manipulation of the system by the focus group, a resource was identified that must be rethought to improve the relationship of the system with the user” (NETO, 2016).

5. Conclusions

Through a systematic literature review, this research attempted to determine how Brazilian postgraduate researchers and institutions are using DT in their theses and dissertations. First, the number of DT publications is considered low compared to a total of 397.536 academic studies available at Capes in the same period (between 2011 and 2016), investigating only 65 (0.016%). Additionally, the number of PhD level publications is even lower, since only 13 theses were dedicated to studying DT. This scarcity of publications can be attributed to the recent introduction of the subject in Brazil (2010), causing significant academic interest only after 2014. Consequently, only three institutions (UFSC, UFPE and UNISINOS) published more than five studies in the past six years. However, although most of the research was conducted by designers (academic background), DT is a multidisciplinary topic that has a strong potential for growth in the academic environment. DT is not limited to design academic background researchers and design postgraduate programs, reaching such disciplines as business administration and engineering.

When analyzing the studies, it became clear how Brazilian researchers are using DT. DT is applied, almost entirely, based on IDEO's concept of DT as an organizational resource to create innovation. Thus, IDEO's associate Tim Brown is the number one author cited, since he is the main propagator of this methodology, and its tools were applied in more than 70% of the publications. Lastly, although the context of DT theses and dissertations was very broad, extending from software companies to vineyards, the main purpose was to apply DT methodology tools to creatively solve problems in the educational sector.

To achieve a high-quality research standard, this investigation had to consider its limitations. The Capes Theses and Dissertations online database has a few difficulties because search filters are limited, the publications' information were not completely fulfilled and a number of digital files were not available. Additionally, the results of this paper cannot be generalized, since it is restricted to a Brazilian perspective and the type of production is limited to theses and dissertations. Under those circumstances, future research can be conducted with other types of publications and performed on international sources.

References

- ALMENDRA, R.; CHRISTIAANS, H. "Design Thinking" The Emperor's New Suit. **Design Principles and Practices**, 2013. v. 6.
- BERTÃO, R. A. **Lean thinking e design thinking: aproximações teóricas**. [S.l.]: Universidade Federal do Paraná, 2015.
- BISCAIA, H. G. **Design Thinking e sustentabilidade: estudo do sistema mandalla DHSA no combate à fome e à miséria**. [S.l.]: Universidade Federal do Paraná, 2013.
- BONINI, L. A.; SBRAGIA, R. O modelo de design thinking como indutor da inovação nas empresas: um estudo empírico. **Revista de Gestão e Projetos**, 2011. v. 2, n. 1, p. 03–25. Disponível em: <<http://www.revistagep.org/ojs/index.php/gep/article/view/36>>.
- BONO, E. De. Why so stupid? **Management-Issues**, [S.l.], 2006. Disponível em: <<http://www.management-issues.com/opinion/3231/why-so-stupid/>>. Acesso em: 15 jun.

2017.

BROWN, T. Design thinking. **Harvard Business Review**, 2008. v. 86, n. 6, p. 252.

_____. **Change by design**. New York: Harper Collins, 2009.

BUCHANAN, R. Wicked Problems in Design Thinking. **Design Issues**, 1992. v. 8, n. 2, p. 5–21. Disponível em: <<http://www.jstor.org/stable/1511637>>.

_____. Introduction: Design and Organizational Change. **Design Issues**, 2008. v. 24, n. 1. Disponível em: <http://createhro.com/Design_Issues_Introduction.pdf>. Acesso em: 15 jun. 2017.

CAPES. Mestrado profissional, mestrado acadêmico e doutorado. [S.l.], 2007. Disponível em: <https://www.capes.gov.br/images/stories/download/artigos/Artigo_30_08_07.pdf>. Acesso em: 12 jun. 2017.

_____. Sobre a Capes. [S.l.], 2015. Disponível em: <<http://www.capes.gov.br/acesoainformacao/perguntas-frequentes/sobre-a-capes/7473-sobre-a-capes>>. Acesso em: 12 jun. 2017.

CAPES. Cursos Recomendados e Reconhecidos. [S.l.], 2017. Disponível em: <<https://sucupira.capes.gov.br/sucupira/public/consultas/coleta/programa/quantitativos/quantitativoIes.jsf?areaAvaliacao=29&areaConhecimento=61200000>>. Acesso em: 12 jun. 2017.

CIEB. **INOVAÇÃO ABERTA EM EDUCAÇÃO: CONCEITOS E MODELOS DE NEGÓCIOS**. [S.l.]: [s.n.], 2016.

CROSS, N. **Design thinking : understanding how designers think and work**. [S.l.]: Berg, 2011.

CUNHA, C. A. Da S. **Recomendações para preservação da cerâmica tradicional a partir da contribuição do design: um estudo de caso sobre a cerâmica de Rio Real – BA**. [S.l.]: Universidade Federal da Bahia, 2015.

DESIGN COUNCIL UK. The Design Process: What is the Double Diamond? [S.l.], 2015. Disponível em: <<http://www.designcouncil.org.uk/news-opinion/design-process-what-double-diamond>>. Acesso em: 12 jun. 2017.

DRESCH, A.; LACERDA, D. P.; ANTUNES JR, J. A. V. **Design Science Research**. [S.l.]: [s.n.], 2015.

FERRO, G. De S. **Modelo de análise para solução de desafios com base no Design Thinking e na Investigação Apreciativa: uma aplicação em uma rede de franquias**. [S.l.]: Universidade Federal do Paraná, 2014.

GROSS, A. A. **DESIGN E MANAGEMENT: um estudo de ciência e tecnologia no campo dos estudos organizacionais**. [S.l.]: FGV-EAESP, 2016.

GURGEL, C. E. F. **PM4Gov – Um framework para gestão de projetos de desenvolvimento na administração pública**. [S.l.]: Universidade Federal de Pernambuco, 2013.

HANSON, D.; NITZSCHE, R. Designing , a Transformação do Design Estratégico . [S.l.]: III SEGeT – Simpósio de Excelência em Gestão e Tecnologia, 2003. p. 1–15.

HASSI, L.; LAAKSO, M. Conceptions of Design Thinking in the Design and Management Discourse. **Proceedings of IASDR2011**, 2011. p. 1–10.

IDEO. **the Field Guide to Human-Centered Design**. [S.l.]: IDEO.org, 2015.

INSTITUTO EDUCADIGITAL. INSTITUTO EDUCADIGITAL. [S.l.], 2013. Disponível em: <<http://www.educadigital.org.br/site/>>. Acesso em: 15 jun. 2017.

JÚNIOR, J. E. Da S. **A contribuição do design para a gestão de estratégias corporativas**. [S.l.]: Universidade Federal de Santa Catarina, 2015.

- KIMBELL, L. Rethinking Design Thinking: Part I. **Design and Culture**, 2011. v. 3, n. 3, p. 285–306.
- LIEDTKA, J. Innovative ways companies are using design thinking. **Strategy & Leadership**, 2014. v. 42, n. 2, p. 40–45.
- LUPTON, E. **Graphic Design Thinking: Beyond Brainstorming**. New York: Princeton Architectural Press, 2011.
- MINDSHAKE. O Mindshake Design Thinking Model Evolution 6². [S.l.], 2015. Disponível em: <http://www.mindshake.pt/design_thinking>. Acesso em: 12 jun. 2017.
- NETO, E. M. Da G. **Realidade misturada e educação: uma experiência com o aplicativo mar**. [S.l.]: Universidade Tiradentes, 2016.
- NEVES, A. **Design Thinking Canvas**. [S.l.]: [s.n.], 2014.
- NITZSCHE, R. **Afinal, o que é design thinking?** São Paulo: Rosari, 2012.
- QUEIROS, L. M. **Proposta metodológica - processo de desenvolvimento de objetos de aprendizagem: um estudo de caso**. [S.l.]: Universidade Federal Rural de Pernambuco, 2015.
- RIBEIRO, L. A. M. **Curiouser Lab: uma experiência de letramento informacional e midiático na educação**. [S.l.]: Universidade de Brasília, 2016.
- SIMON, H. A. (Herbert A. **The sciences of the artificial**. [S.l.]: MIT Press, 1996.
- TERRES, M. B. **Design Thinking – Contribuições para a inovação na gestão estratégica em educação**. [S.l.]: Universidade do Vale do Rio dos Sinos, 2015.
- TSCHIMMEL, K. Design Thinking as an effective Toolkit for Innovation. Barcelona: XXIII ISPIM Conference: Action for Innovation: Innovating from Experience., 2012. p. 1–20.
- _____. Designer ou Design Thinker: reflexão sobre Conceitos. **Arte e Design**, 2014. p. 159–165.
- UHLMANN, T. S. **SCMDesign – desenvolvimento de serious game para a simulação da gestão da cadeia de suprimentos**. [S.l.]: Universidade Federal do Paraná, 2014.
- VIANNA, M. *et al.* **Design Thinking: Inovação em Negócios**. Rio de Janeiro: MJV Press, 2014.
- WOUDHUYSEN, J. The craze for design thinking: Roots, a critique, and toward an alternative. **Design Principles and Practices**, 2011. v. 5, p. 235–248.

Sobre o autor

Daniel de Salles Canfield

Doutorando em Design pela Universidade Federal do Rio Grande do Sul, possui mestrado em marketing pela Dublin Business School (Irlanda), MBA em Design Estratégico pela Escola Superior de Propaganda e Marketing (RJ) e graduação em Desenho Industrial/Programação Visual pela Universidade Federal de Santa Maria. Atualmente é professor do curso de Design na Universidade de Passo Fundo.

daniel@4sc.com.br

Maurício Moreira e Silva Bernardes

Possui graduação em Engenharia Civil pela Universidade Federal de Alagoas (1993), mestrado (1996) e doutorado (2001) em Engenharia Civil pela Universidade Federal do



Rio Grande do Sul. Pós-doutorado em Design pelo *Institute of Design do Illinois Institute of Technology/EUA*. Atualmente é professor titular da Universidade Federal do Rio Grande do Sul.

bernardes@ufrgs.br