

2021

HUGO REIS ROCHA

Paradigm shift in Design Education
Contributions for a New Design
Competencies Framework to
foster Strategic Innovations, Sustainable
Solutions and Social Change

Tese apresentada ao IADE - Faculdade de Design,
Tecnologia e Comunicação da Universidade Europeia, para
cumprimento dos requisitos necessários à obtenção do
grau de Doutor em Design realizada sob a orientação
científica da Doutora Ana Margarida Ferreira, *Professora
Associada com Agregação do IADE - Universidade
Europeia* e do Doutor Jefferson Manhães de Azevedo,
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Tecnologia Fluminense (Brasil)*.

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palavras-chave

Ensino do Design; Sustentabilidade; Impacto Social; Competências; Inovação Estratégica.

resumo

Enfrentamos hoje crises sem precedentes na história contemporânea. Sejam elas sociais, económicas ou ambientais, tais crises assolam o mundo e desafiam o equilíbrio dos sistemas. O crescimento da população mundial, crises sanitárias, imigração, aumento da violência, terrorismo e crises de privacidade são alguns dos problemas complexos que a sociedade tem de enfrentar para construir um futuro desejavelmente mais sustentável.

Em 2020, o mundo se deparou com uma das pandemias mais agressivas da era contemporânea. A eclosão da COVID-19 expôs as fragilidades do sistema atual e pôs em causa a capacidade de resiliência da sociedade. Hospitais lutaram para superar a falta de profissionais de saúde. Setores prósperos, como o turismo, a aviação civil e o retalho, viram uma quebra de receita inesperada e significativa. Na educação, a necessidade repentina de encerramento das escolas forçou a rápida mudança para ambientes de *e-learning* que, por vezes, negligenciaram uma parcela marginalizada da sociedade que ainda não tem acesso a computadores ou conexão adequada à internet.

Ainda antes da situação pandémica da COVID-19, a Organização das Nações Unidas (ONU) já havia reivindicado uma resposta para estas assimetrias por parte dos governos. Ao definir, em 2015, os 17 Objetivos de Desenvolvimento Sustentável (ODS), os países membros concordam em trabalhar em conjunto no sentido de atingir um mundo melhor e mais justo para todos. Esses objetivos são parte de uma visão ambiciosa de um mundo no qual a sociedade pode prosperar sem comprometer os mais fracos e os recursos naturais, proporcionando oportunidades iguais ou semelhantes para um máximo número de pessoas.

Todavia, esta situação pode ser entendida mais do que um momento de crise, como um momento de oportunidades, também para o Design e para o Ensino da profissão. Há décadas que o Design se tem focado em atender às necessidades do mercado e em servir de ferramenta estilística para impulsionar o consumo. Compreender o papel do Design neste cenário de crise é, na nossa perspectiva, essencial para redefinir o seu ensino e preparar os futuros designers para assumirem posição de destaque na gestão de processos complexos como agente de mudança.

Tal premissa permeia o desenvolvimento deste estudo que procura identificar como o Ensino do Design se deve adaptar para formar futuros designers aptos a resolver problemas complexos. Para esse efeito, foi necessário identificar as novas competências a promover juntos dos Designers para que sejam capazes de atuar de forma mais efetiva para um futuro sustentável.

Este estudo foi desenhado em três momentos de investigação, iniciado com a revisão da literatura. Após este processo, tornou-se factualmente evidente o cenário de crises apresentado anteriormente. Ao mesmo tempo, foi possível identificar iniciativas de Designers, que começam a compreender o papel ativo do Design neste novo paradigma, traduzindo numa nova abordagem e mentalidade para Design. Esse diagnóstico tornou clara a necessidade de se repensar o Ensino do Design como, entre outras coisas, um impulsionador da mudança desejada.

O primeiro momento da investigação também identificou duas lacunas principais que se apresentaram como oportunidades para o desenvolvimento deste estudo. A primeira, fez emergir a necessidade de identificar as competências específicas para que o designer se torne um agente ativo de mudança. A falta de um conjunto claro de competências enfraquece a capacidade do Ensino do Design de atuar, pois não fornece de uma forma clara ou direta, um caminho que ajude a desenhar programas educacionais focados na resolução de problemas complexos, entre outros. A segunda lacuna remeteu para a oportunidade de propor um *Framework* que facilitasse aos professores de Design a identificação de métodos e ferramentas que promovessem a aprendizagem pretendida, e em consequência, e que contribuam para a formação de designers preparados e agir e liderar a mudança de forma ativa numa nova direção.

O segundo momento do estudo centrou-se na hipótese da investigação, o que permitiu definir os instrumentos a utilizar para a recolha de dados junto a um público mais amplo. No que diz respeito à metodologia utilizada durante esta investigação, foi desenvolvido, tendo em atenção o estudo exploratório que se pretendia. Seguindo uma filosofia pragmática com uma metodologia de investigação mista, o estudo baseia-se na abordagem abductiva para o desenvolvimento do conhecimento. A estratégia de recolha de dados foi realizada com métodos qualitativos e quantitativos. Os instrumentos adotados foram inquérito por questionários e workshops participativos.

Dois questionários permitiram recolher opiniões de estudantes de design em quatro países diferentes, nomeadamente Brasil, Portugal, Espanha e Chipre. Os questionários foram concebidos e aplicados de forma sequencial, a fim de recolher informações complementares. Em seguida, foram realizados três workshops participativos facilitados com estudantes de design em Espanha, Chipre e Brasil. Cada instrumento utilizado na recolha de dados serviu de base para a identificação das competências necessárias para que futuros designers possam atuar como agentes ativos de mudança já num novo enquadramento sustentável.

Durante o terceiro e último momento de investigação, foram analisados os dados recolhidos durante o segundo momento de investigação, juntamente com as informações do primeiro momento de investigação. A análise dos dados oriundos das diferentes fontes culminou no desenvolvimento do *Design*

Competencies Framework, uma ferramenta que tem como intuito servir de suporte aos professores de Design para que possam abordar a mudança no Ensino do Design. Para a construção do *framework* foi necessário delinear a sua estrutura e sequência, para facilitar a compreensão e utilização deste recurso.

O *Design Competencies Framework* desenvolvido e apresentado nesta Tese consiste num modelo construído para facilitar o desenvolvimento de competências de Design que se tornaram cruciais para que os futuros designers. Tais competências devem equipar os profissionais no sentido de os ajudar a enfrentar o número crescente de problemas complexos emergentes na sociedade.

A construção do *Design Competencies Framework* foi baseada em três dimensões: Área, Competência e *Enablers*. As áreas agrupam competências por afinidade ou *clusters*. Catorze competências foram identificadas pelo estudo e são apresentadas neste modelo conceptual. Por fim, os *Enablers* são ferramentas, métodos e técnicas de Design que podem impulsionar o desenvolvimento de uma ou mais Competências. Os *Enablers* foram identificados pela análise de *Design Toolkits* disponíveis publicamente e devidamente referenciados. A versão inicial do *Design Competencies Framework* apresentado neste estudo, contempla 185 *Enablers*.

Na parte final deste trabalho de investigação o modelo desenvolvido foi validado, assim como a hipótese desta tese. Esta atividade foi fundamental para a avaliação e otimização dos resultados do estudo. A validação do instrumento foi realizada em dois momentos distintos, com recurso a dois métodos de investigação complementares e contou com a participação de dois tipos utilizadores. O primeiro momento foi realizado durante o workshop participativo com estudantes de Design. O segundo momento de validação teve como foco a apresentação do *framework* e o feedback de especialistas das áreas de Design, Ensino do Design e Sustentabilidade. Os resultados de ambos os momentos mostraram que o *Design Competencies Framework* está construído sobre uma base sólida e suportou a hipótese equacionada e ligada à necessidade de tal ferramenta para auxiliar a Ensino do Design no presente. Finalmente, o processo de validação revelou oportunidades para futuras iterações da dinâmica do modelo com base no rico *feedback* recebido de ambos os momentos de colaboração e validação.

Por fim, é importante relembrar que o objetivo desta Tese passou por identificar um conjunto de novas competências de Design para que os designers se mantenham relevantes e, mais importante, abram o caminho para um futuro desejavelmente melhor. Além disso, procurou-se entender como o Ensino do Design pode integrar tais competências nos seus currículos para que os alunos tenham as experiências e os estímulos necessários ao novo desenvolvimento. Tais objetivos, conforme descrito, foram cumpridos com o do *Design Competencies Framework*. Um instrumento que

resultou do trabalho colaborativo e que contou com a participação de estudantes de Design de quatro países diferentes, de investigadores e de especialistas da área de Design, com foco em Educação, Inovação Social ou Sustentabilidade.

Keywords

Design Education; Sustainability; Social Impact; Competencies; Strategic Innovation.

abstract

The world faces crises that find an unprecedented match in contemporary history that create complex challenges and a society that struggles to solve them. Nevertheless, whilst being a time of crisis, it is also a time of opportunities for Design and Design Education to prepare future designers to assume a position of change agent.

Our study was designed with three moments of research. During the first moment, we defined the research design, conducted the literature review resulting in the state of the art, and identified two gaps in knowledge addressed in the Tese. The first gap highlighted the need to identify the specific set of competencies needed for the designer to become an active agent of change. Furthermore, the second gap showed the opportunity to propose a new framework built to support Design Education to build the competencies identified.

The second moment of research was guided by our hypoThesis and defined the data collection supported by a mixed methodology approach with a combination of qualitative and quantitative methods using surveys and elements of active research. Throughout this stage, we also collected all the data with the designed instruments.

The data collected during the second research moment and with the information from the first research moment were analysed in the final research moment. The rich information gathered and examined culminated in developing the Design Competencies Framework set to be a valuable tool to support Design Education fostering change and train designers to deal with complex problems and become agents of change. At last, we sought validation of our findings and reflected on the results accomplished, allowing us to conclude and envision future developments.

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Table of Contents

Table of Contents.....	xvii
List of Figures.....	xx
List of Tables.....	xxiv
List of Acronyms	xxvi
Introduction	1
1. Context of the study	1
2. Motivations	3
3. The structure of the Thesis.....	4
Chapter 1 Theoretical framework.....	6
1.1. Introduction	6
1.2. Literature review.....	6
1.3. Overview of Design	9
1.3.1. Notes from the Design field	12
1.4. Design and Sustainability.....	13
1.4.1. Circular Economy	18
1.4.2. Planet-centred Design	19
1.5. Design for Social Impact	21
1.5.1. Social Design.....	22
1.5.2. The Social designer	23
1.5.3. Social Innovation.....	24
1.6. Overview of Design Education.....	26
1.6.1. The purpose of Higher Education	26
1.6.2. The contribution of HE for Social Impact.....	27
1.7. Paradigm Shift in Design Education	28
1.7.1. The role of non-formal education.....	31
1.8. Active Learning.....	33
1.8.1. Problem Based Learning	35
1.8.2. Design as an active learning approach.....	36
1.9. From Design knowing to Design Thinking	37
1.9.1. The d.school framework	40
1.9.2. Double Diamond Framework	41
1.9.3. Convergent and divergent thinking in problem-solving.....	44

1.10.	Overview on competencies	45
1.10.1.	Clarifying the difference between Skills and Competencies	45
1.10.2.	General Competencies for the 21 st century	47
1.11.	The gap of knowledge and opportunities for research	50
1.12.	Chapter summary.....	52
Chapter 2	Conceptual framework and research design.....	54
2.1.	Introduction	54
2.2.	Research Nature and Purpose.....	56
2.3.	Philosophy	57
2.3.1.	Pragmatism philosophy	59
2.3.2.	Approaches to theory development.....	60
2.4.	Methodological choice	60
2.5.	Strategy	62
2.6.	Time Horizon	63
2.7.	Research Questions	63
2.8.	Hypothesis and Research Variables.....	65
2.9.	Conceptual model development.....	66
2.10.	Research structure	67
2.11.	Research timetable	70
2.12.	Chapter summary.....	71
Chapter 3	Data collection	72
3.1.	Introduction	72
3.2.	Techniques, Procedures and Instruments	72
3.2.1.	Secondary data sources.....	78
3.2.2.	Survey Research.....	79
3.2.3.	Participatory Workshop	83
3.3.	Chapter Summary	97
Chapter 4	Data analysis and evaluation	98
4.1.	Introduction	98
4.2.	Secondary Data Analysis.....	98
4.2.1.	Phase 1: Individual document analysis	99
4.2.2.	Phase 2: Semantic Grouping.....	104
4.2.3.	Phase 3: Analysis	106
4.2.4.	Phase 4: Final list of core competencies.....	106
4.3.	Questionnaire Q1 Data Analysis	107
4.3.1.	Comprehensive data analysis	108
4.4.	Questionnaire Q2 Data Analysis	116
4.4.1.	Comprehensive data analysis	116
4.5.	Participatory Workshop Data Analysis	126
4.5.1.	Comprehensive data analysis	127
4.6.	Key findings	132
4.7.	Chapter Summary	133
Chapter 5	A New Design Competencies Framework	134
5.1.	Introduction	134
5.2.	Defining the structure of the framework.....	134
5.3.	Core Design Competencies	137

5.3.1.	Iteration 1: Consolidation of sources	140
5.3.2.	Iteration 2: Semantic Grouping	143
5.3.3.	Iteration 3: Nomenclature Adjustment	144
5.3.4.	Iteration 4: Building the clusters	145
5.4.	Identifying the competency <i>Enablers</i>	151
5.5.	The Design Competencies Framework.....	155
5.6.	Chapter Summary	179
Chapter 6	Design Competencies Framework Validation	181
6.1.	Introduction	181
6.2.	Validation with students	181
6.2.1.	Result analysis	182
6.3.	Validation Workshops	184
6.3.1.	Structure	185
6.3.2.	Data collection instrument	186
6.3.3.	Participants' Profile	187
6.3.4.	Results	190
6.4.	Key takeaways	204
6.5.	Chapter Summary	205
Conclusions and future developments		206
1.	Discussion	206
2.	Contribution to knowledge	210
3.	Limitations of the study	212
4.	Future developments	213
5.	Closing remarks	214
Bibliography		216
Appendices		231
Appendix 1:	The Design Competency Framework	231
Appendix 2:	Research Design	232
Appendix 3:	Instrument Q1	233
Appendix 4:	Instrument Q2	234
Appendix 5:	E-mail sent to specialists with the invitation to participate in the card sorting activity.	239
Appendix 6:	Welcome page for the card sorting activity.....	240
Appendix 7:	Online card sorting activity.	241
Appendix 8:	List of <i>Enablers</i>	242
Appendix 9:	Interview Guides – Paris College of Art	243
Appendix 10:	Publications.....	245
Appendix 11:	Workshops facilitated	246
Appendix 12:	Attendance in national and international conferences	247
Appendix 13:	Oral communications	248
Appendix 14:	Complementary formation.....	249
Appendix 15:	Other research related activities	250

List of Figures

Figure 1: Literature Map of the Research	9
Figure 2: The conventional economic view of the interaction between the economy, society, and environment. Source: (Cato, 2009, p. 37).....	14
Figure 3: Re-imaging the relationship between society, economy, and environment. (Cato, 2009, p. 37).....	15
Figure 4: The six spheres of Sustainability proposed by Akama (2014), adapted by the author.	16
Figure 5: The five Ps for sustainable development (United Nations, 2015). Adapted by the author.	17
Figure 6: Human-centred Design approach. Adapted from IDEO.org (2015).....	19
Figure 7: d.school's five-step process. Adapted from Doorley et al. (2018, p. 2).....	40
Figure 8: Design Thinking process: Expectation vs Reality. Adapted by the author from Plattner et al. (2011, p. xiv).	41
Figure 9: Simple representation of the Double Diamond. Adapted from Ball (2019)	42
Figure 10: The non-linearity of the double diamond. Adapted from Ball (2019)	43
Figure 11: Convergent and divergent thinking, adapted from Brown (2009, p. 41).....	44
Figure 12: The opportunities for research identified during the literature review.	52
Figure 13: The research onion. Adapted from Saunders & Bristow (2019, p. 130).	56
Figure 14: The components of a paradigm. Adapted from Leavy (2017, p. 25).....	58
Figure 15: Research's conceptual model and variables.	66
Figure 16: Designer's mindset path to becoming agents of change.	67
Figure 17: First research moment. Source: Author.	68
Figure 18: Second research moment. Source: Author.	69
Figure 19: Third research moment. Source: Author.	70
Figure 20: Research Gantt chart. Source: Author.....	71
Figure 21: Sample Techniques highlighting, in bold and italics, the choices for this research. Adapted from Saunders et al. (2009).....	73
Figure 22: Sustainable Development Goals.	85

Figure 23: Students during the Workshop in Brazil	86
Figure 24: Set of Cards. Photo credit: author	88
Figure 25: Example of the Theme Card with the theme "No Poverty"	90
Figure 26: Canvas designed that the students used to organise their decisions during the workshop.	91
Figure 27: Participants brainstorming during the participatory activity in Brazil. Source: Author.	94
Figure 28: Participants filling the canvas with the cards during the participatory activity in Brazil. Photo credit: Author.	95
Figure 29: Participants discussing their decisions during the participatory activity in Spain. Photo credit: Author.	96
Figure 30: Participants presenting their outcomes from the workshop in Spain. Photo credit: Author.	97
Figure 31: Secondary data analysis pipeline	98
Figure 32: Semantic grouping of the competencies identified during the literature review.	105
Figure 33: Data visualisation of the competencies found in the literature review.	106
Figure 34: Results for question Q1Q5: "Do you believe that the designer, by his professional activity, has an influence in changing our society?"	109
Figure 35: Results for question Q1Q1: "During your course, were you in some Design project that addressed social aspects?"	110
Figure 36: Results for question Q1Q2: "Do you believe that the designs developed by you have a positive impact on society?"	111
Figure 37: Results for question Q1Q3: "Some of the developed projects resulted from the real needs of society?"	112
Figure 38: Results for question Q1Q6: "The Design training acquired at your Design course promotes the critical thinking focused on Sustainability and Social Responsibility?"	113
Figure 39: Results for question Q1Q7: "The specific theme of Sustainability is addressed by teachers in the subjects of the different courses/units?"	114
Figure 40: Results for question Q1Q7A.....	114
Figure 41: Results for question Q1Q4: "About the Design teaching and the culture of Design promoted at your institution, do you consider that it is appropriate to today's world crisis?"	115
Figure 42: Results for question Q2Q1: "During your course, have you participated in social projects?"	117
Figure 43: Results for item Q2Q3: "Design Education contributes to social, cultural, and environmental development."	118
Figure 44: Results for item Q2Q4: " The collaboration between schools and companies or other civil organisation can foster Innovation in products and services."	119

Figure 45: Results for item Q2Q5: "Design Education plays an important role in finding innovative solutions and strategic paths to overcome the social challenges faced today, such as environmental degeneration, climate change, ageing, extremism, migration, and so on."	120
Figure 46: Results for item Q2Q6: " The projects that I developed during my course are innovative, have social characteristics and contribute to Sustainability."	121
Figure 47: Results for item Q2Q11: "After your Bootcamp, do you feel prepared to solve complex Design projects that tackle social challenges?"	125
Figure 48: two canvas from two different activities. Photo credit: Author.	127
Figure 49: The Themes chosen by the groups of students during the three editions of the workshop.	128
Figure 50: Tools and Methods selected by the students during the workshop.....	129
Figure 51: Human Resources selected by the students during the workshop.....	130
Figure 52: Skills selected by the students during the workshop.....	130
Figure 53: Common structure identified in the analysed frameworks.	136
Figure 54: Proposed structure for the Design Competencies Framework. Source: Autor.	137
Figure 55: Consolidation of results scheme from the data collection instruments. Source: Author.	138
Figure 56: List of competencies' iterations during the process of developing the Design Competencies Framework. Source: Author.....	140
Figure 57: Final clusters naming for the Design Competencies Framework. Source Author.	150
Figure 58: Summary of compiled information in the Tabidoo database.	154
Figure 59: The Design Competencies Framework overview. Source: Author.	156
Figure 60: The Design Competencies Framework's areas. Source: Author.	157
Figure 61: Map of relationship amongst competencies. Source: Author.	159
Figure 62: Detail of the relationship between System Thinking and other competencies. Source: Author.	160
Figure 64: Summary of the level of education of the participants in the validation workshop.	187
Figure 65: Summary of the scientific area of the participants in the validation workshop.	188
Figure 66: Summary of professional practice of the participants in the validation workshop.	189
Figure 67: Summary of years of professional experience of the participants in the validation workshop.	189
Figure 68: Summary of the country of residency of the participants in the validation workshop.	190

Figure 69: Results for question Q3Q1: "Accordingly to what was presented, do you consider the Design Competencies Framework a useful instrument to foster change on how design students are trained if aiming for designers as active agents of change?"...	191
Figure 70: Results for question Q3Q2: "Do you consider that the Design Competencies Framework contains the basis to support Design Education on the development of the competencies identified in our investigation?"	193
Figure 71: Results for question Q3Q3: "Accordingly to what was presented, do you consider the Design Competencies Framework a useful instrument to train designers to tackle wicked problems, such as sustainability?"	195
Figure 72: Results for question Q3Q4: "Do you consider adequate the way the Areas were structured in the Framework?"	197

List of Tables

Table 1: Comparison of stages in divergent and convergent thinking for the d.school and Double Diamond frameworks.....	45
Table 2: Summary of parts of a Competency (Draganidis et al., 2006; Earnest & Melo, 2001; Sanghi, 2007; Tripathi et al., 2010).....	47
Table 3: List of secondary data sources analysed	79
Table 4: Structure of the instrument Q1	80
Table 5: Structure of the instrument Q2	82
Table 6: Additional questions for the second variation of instrument Q2	83
Table 7: Summarised information about the participatory workshop	87
Table 8: Options of cards available for the students during the participatory workshop...	89
Table 9: Summary of Competencies identified in the Future of Jobs: Report 2018. Source: (Leopold et al., 2018).	99
Table 10: Summary of Competencies identified in the document The Future of Education and Skills: Education 2030. Source: (OECD, 2018).....	100
Table 11: Summary of Competencies identified in the document The Future of Education and Skills: Education 2030. Source: (Musa et al., 2012)	101
Table 12: Summary of Competencies identified in the document Education for Sustainable Development Goals: learning objectives. Source: (UNESCO, 2017)	102
Table 13: Summary of Competencies identified in the document Restarting Britain: Design Education and growth. Source: (Pryce & Whitaker, 2011).....	103
Table 14: Summary of Competencies identified in the document Rethinking Education: Towards a global common good?. Source: (UNESCO, 2015).....	104
Table 15: Summary of Competencies identified in the document Paradigm shift in Design Education: An overview on issues and possibilities for change. Source: (Rocha et al., 2018a)	104
Table 16: List of competencies originated from the analysis of the data from the literature review.	107
Table 17: Top ten skills responses from questionnaire Q1.....	108

Table 18: Top ten skills responses from questionnaire Q2.....	116
Table 19: Selected statements from the item Q2Q9.	123
Table 20: Top ten skills responses from the participatory workshop.	126
Table 21: Final list of competencies obtained from inputs i1, i2 and i3. Source: Author.	139
Table 22: Common competencies present in at least two sources (i1, i2 and i3). Source: Author.	141
Table 23: Identification of competencies related to the designer as an agent of change, accordingly to the literature.	142
Table 24: Design Competencies: Iteration 1.	143
Table 25: Design Competencies: Iteration 2.	144
Table 26: Comparison between Design Competencies Iteration 2 and 3.....	145
Table 27: Competency clusters initially proposed by the author.	146
Table 28: Most common responses from the card sorting activity. Adapted from the results available at the Optimal Workshop results.	148
Table 29: Grouping similarities' comparison from our initial research proposal and the card sorting results.	149
Table 30: Competencies' areas for the New Design Competencies Framework. Source Author.	151
Table 31: List of Design Toolkits analysed during the study.....	153
Table 32: The fourteen competencies' areas and key concepts.	158
Table 33: Summary of Themes and Proposed Solution for the Participatory Workshop.	182
Table 34: Structure of the instrument Q3.	186
Table 35: Demographics questions at instrument Q3.....	187
Table 36: Selected statements from Q3Q1A: "If possible, please explain your previous answer."	192
Table 37: Selected statements from Q3Q2A: "If possible, please explain your previous answer".....	194
Table 38: Answers from Q3Q3A: "If possible, please explain your previous answer".	196
Table 39: Answers from Q3Q4A: "If possible, please explain your previous answer".	198
Table 40: Answers from Q3Q5: "In your opinion what are the Strengths of the Design Competencies Framework?".....	200
Table 41: Answers from Q3Q6: "In your opinion what are the Weaknesses of the Design Competencies Framework?".....	202
Table 42: Answers from Q3Q7: "What, in your opinion, could be improved in a future iteration of the framework to make it more accessible to Design educators, making it easier to be adopted in the context of Design Education?".....	203
Table 43: Build Resilience and Understand Consequences competency areas.	210

List of Acronyms

AI GA : American Institute of Graphic Arts

CBPR : community-based participatory research

DIME : Diseño Mérida

DISCERN : Design for Social Change, Sustainable Innovation and Entrepreneurship

DMSTI : Danish Ministry of Science Technology and Innovation

HCD : Human-Centred Design

HE : Higher Education

HPI : Hasso-Plattner Institute

MA : Master of Art

NYC : New York City

OECD : Organisation for Economic Co-operation and Development

PBL : Problem-based learning

PCA : Participant-centric analysis

PDF : Portable Document Format

PhD : Doctor of Philosophy

PjBL : project-based learning

PPS : Product-service systems

QR : Quick Response

SDG : Sustainable Development Goals

SIA : Social Impact Assessment

UK : United Kingdom

UN: United Nations

UNESCO : United Nations Educational, Scientific and Cultural Organization

UNIDCOM : Unidade de Investigação em Design e Comunicação

UX/UI : User Experience and User Interface

WEF : World Economic Forum

Introduction

Preliminary notes

This Thesis was developed as part of the pre-requisites to obtain the Degree of Doctor in Philosophy in Design at IADE-Universidade Europeia. In this research work, we discuss the importance of a paradigm shift in Design Education as a fundamental mean to foster the necessary mindset for future designers to become agents of change towards Sustainability. This introductory section presents an overview of the context, motivations, objectives, research questions and design of the study. In the end, it summarises the content of each following chapter.

1. Context of the study

The world is facing crises that find an unprecedented match in contemporary history. Populations are growing in the cities every year, making the high density a danger for healthcare, and weakening the structures in the more rural areas. Groups of immigrants are caught entering developed countries frequently. Jobs are at risk for reasons such as automation and artificial intelligence. Violence and terror increase as inequality and economic instability rises, especially in marginalised communities and countries. Privacy and cyber-security are issues (UNESCO, 2015) embedded in today's society hidden in the thousands of apps and websites we deal with every day, where personal data is the new gold. The industrial era and the urge for consumption have generated a never seen environmental crisis. The elderly population grows in many countries that struggle to guarantee social retirement for younger generations. Countries like Portugal are expected to have their population decreased in half by 2100 (Pollet, 2020), having peaked in 2017, worsening the economic situation and consequently stimulating immigrants' arrival.

In 2020, society came across one of the most aggressive pandemics of the modern era. The disease radically forced people to adapt and change their habits, growing peripheral crises and evidencing the world's already significant inequalities. The outbreak of COVID-19¹ pandemic exposed the system's fragilities in motion and caused a rush in solutions that are not fast or easy to implement. Hospitals struggled with the lack of health professional, which take years do train and be ready to work, and witnessed a shortage of beds, especially for those in need of intensive care. Thriving sectors, such as tourism, air travel and traditional retail, saw an unexpected and significant income break. In the educational sector, the sudden need to close schools forced fast shift to e-learning environments which left behind the marginalised portion of society with poor conditions, no access to computers and adequate internet connection (Ferreira, 2020a).

All these, to name a few, add to a mix of complex societal (Fry, 2009; Mau & Institute Without Boundaries, 2004) problems that the world struggles to solve. Even before the COVID-19 pandemic situation, the United Nations² (UN) had already claimed a response from the world. By setting 17 Sustainable Development Goals (SDG) and 169 targets, the member nations agree to pursue a better and more equitable world for all (United Nations, 2015). These goals and targets are a part of an ambitious vision of a world in which society can thrive without compromising the weaker and providing equal resources and opportunities. Ranging from violence to education, from wellbeing to access to food and water, amongst others, the SDGs envisions a world where countries can provide and enjoy a sustained, inclusive, economic growth and decent work for all. "A world in which consumption and production patterns and use of all natural resources — from air to land, from rivers, lakes and aquifers to oceans and seas — are sustainable." (United Nations, 2015, p. 7)

More than a time of crisis, this as a time of opportunities, especially for Design and Design Education (Ferreira, 2008a, 2020a; Franqueira & Gomes, 2017). Papanek (1971) and Margolin (2014) argue that, for decades, Design has been focusing on the responding to market needs, reinforcing its capability of creating beautiful products, messages and information (AIGA, n.d.; Margolin, 2014). Understanding the role of Design in this complex

¹ An infectious disease caused by a new strain of the coronavirus and first reported in 2019.

² The United Nations is an international organization founded in 1945. Currently made up of 193 Member States.

scenario is essential to redefine Design Education and prepare future designers to assume a position of agent of change. Designers must be ready to tackle complex problems, acting beyond the usual cosmetic outcome society got used to expecting from Design projects and that no longer meets society's current needs. Such a scenario raises the importance of reskilling the Design students. Design schools must provide the competencies needed to assist in a paradigm shift in society, as the starting point of the change in the world claimed by the United Nations. As the world goes through a moment of change, Design follows the same path (Ferreira, 2008b), as designers start to be part of complex structures, being recognised by their work in services and organisations seeking societal changes (Margolin, 2014).

2. Motivations

Within this outlined context, we were motivated by different perspectives to engage in this research path.

First and foremost, the study was motivated by the author's reflection after years of teaching experience. For that, rethinking the role of Design Higher Education (HE) as a core component of change towards a new design mindset was a crucial and constant reflection during the entire course of this research.

At an institutional level, having an international discussion, enabled by a foreign perspective of the European environment, allows for result in a plural experience to help restructure Design Education towards Sustainability and Social Impact in Brazil. Being exposed to different institutional and cultural realities provided valuable insights into considering and implementing more sustainable practices, particularly in public education which must have a more definitive role in acting upon complex societal problems.

At the Design dimension, we were motivated to provide reflections on methods and teaching-learning experiences that shall contribute to effective training programs and future professional practices to build the necessary competencies. We believe that a change in the designer's posture might contribute to a better understanding of the role of Design in sustainable development and social wellbeing, and as well as in businesses. Consequently, it can potentially elevate the Design process perceived value when linked to positive results in the economy, society, and the environment.

At last, we were motivated by the belief that this research shall enable a more ethical, impactful, and responsible practice from the Design community. Doing so will make it possible to shape a better society and a world worth living in. A world where the Design community plays – once again – a fundamental part in strategically co-designing a more sustainable future.

3. The structure of the Thesis

This Thesis is structured in six chapters that follow the **Introduction**, where we layout the study's context, motivations, and a brief note on the research design. The six core chapters are structures as following:

Chapter 1 presents the literature review on the main topics and subtopics related to our research: Design, Sustainability, Design Education and competency. At the end of the chapter, we identify the gaps of knowledge and opportunities for research that contributed to framing our research questions and hypothesis which guided our research design.

Chapter 2 defines the conceptual framework of the study. It introduces research nature followed by concepts regarding the research structure applying the research onion framework and defining our approach. It states the research questions and hypothesis and presents the structure and overall time table of the study.

Chapter 3 comprises the techniques and procedures to collect the necessary data for the nature of this research. It explains the sampling decisions and the design of chosen instruments to collect the necessary data, based on the mixed-methodology approach.

Chapter 4 is dedicated to analysing the data collected by the designated instruments. Each source is thoroughly analysed individually and then consolidated into a summary for comparison. In the end, it presents the most significant findings pre-conclusions drawn from all instruments designed for the study.

Chapter 5 presents a walk-through of the Design Competencies Framework's development. We start by defining its structure after the analysis of other available models of competency building. Following, we identify the fourteen core competencies based on the data presented and analysed in Chapter 4. The definition of the competencies is showcased as a process composed of four iterations: consolidation of sources, semantic grouping, nomenclature adjustments and cluster building. The fourth and final iteration was achieved in a

participatory activity with field specialists. At last, we thoroughly describe the Design Competencies Framework's purpose, principles, and dimensions.

Chapter 6 accounts for the validation of the Design Competencies Framework done in two distinct moments and two complementary research methods and end users. First, we analysed of the relationship between the problem-based approach used in the Participatory Workshop and the design solutions proposed by design students. Second, we held three sessions with a total of eighteen specialists from the Design, Design Higher Education, and Sustainability fields to receive feedback on the instrument developed in our Thesis. This chapter presents the structure, data analysis and takeaways for both validation moments.

These six chapters are followed by the **Conclusions and future developments** of the research's findings, limitations, future developments, recommendations, and contribution to knowledge.

In the end, we present our **References, Appendices** and **Annexes** relevant and designed for our research activity.

Chapter 1

Theoretical framework

1.1. Introduction

This chapter presents the literature review on the main topics and subtopics related to our research: Design, Sustainability, Design Education and competencies. At the end of the chapter, we identify the gaps of knowledge and opportunities for research that contributed to framing our research questions and hypothesis which guided our research design.

1.2. Literature review

This chapter accounts for the literature review conducted to clarify what is already known about our research topic. The literature review is both a process and a product (Leavy, 2017). As a process, we searched for information, summarised and synthesised the existing body of work "produced by researchers, scholars and practitioners" (Fink, 2014, p. 3). The product of the literature review is an overview of previous research primarily related to our research questions (Leavy, 2017), in the form of a written argument that supports our position based on previous research (Machi & McEvoy, 2016). Conducting a literature review permits learning about the topic, helping understand if it is worthwhile and contributing to narrow it "from a general idea to a researchable topic" (Leavy, 2017, p. 58).

The literature review's nature is twofold: simple or complex (Machi & McEvoy, 2016). For our research, we conducted a complex literature review as we aimed to analyse the current state of knowledge and identify an opportunity for further exploration, which requires an

original study itself. As a result, we established what is known about the topic (Leavy, 2017; Machi & McEvoy, 2016) and recognise the appropriate methods to conduct our investigation.

To identify relevant work related to our study, we conducted keyword research (Creswell, 2009) in different databases to identify existing work. At this stage, the databases used were mainly online. Popular search engines such as Google, allowed to identify a broad body of knowledge in the distinct topics covered by our literature review. Additional searches were conducted in specific academic databases such as Google Scholar, ResearchGate, Academia.edu and Biblioteca do Conhecimento Online (b-on.pt). Supplementary, the process of analysis of the literature itself provided a constant update of our literature catalogue, as we were frequently exposed to new work within each piece, allowing us to expand our body of knowledge dynamically and organically.

Most of the consulted sources for the literature review consisted of scholarly work, limiting popular literature sources such as newspapers articles, essays and blogs to the minimum (Leavy, 2017). The classification for sources of information for the literature review varies from author to author. We followed the summary proposed by Ridley (2012) to indicate our sources and validate such sources. The author divides the sources by *books*, *journal articles*, *published literature reviews of a field*, *grey literature* and *websites*.

Likely to be the first source for many researchers, books are usually a reliable source of information. The rise of electronic books (e-books) allowed for broader access to quality work. Books may be divided into *Textbooks*, which usually contains generally accepted knowledge. *Specialised books*, which can be a collection of chapters by specialised authors with an overall editor or editorial board. And *Reference books*, including dictionaries and encyclopaedias. (Ridley, 2012)

Source of high academic value, journals group peer-reviewed articles from multiple authors in a particular field of knowledge. The peer-review procedure ensures quality by submitting the articles to the scrutiny of professionals or academics in the field. (Ridley, 2012)

Systematic reviews providing a summary and synthesis of a field of research. This work is usually done by a team of academics that aim to investigate a theory in detail. These studies are usually published in books or journal articles. (Ridley, 2012)

Important sources of information that have not been published commercially, thus being more challenging to obtain via bookselling and bibliographical channels. This type of literature includes *Reports*, which can be elaborated by government or organisations; *Theses and dissertations* from other master and doctoral students that have become more readily available via universities repositories; *Conference literature* published in proceedings as a form of abstract or full paper; *Monographs/work-in-progress papers*; and *Specialist literature and primary data sources* pertinent to some fields where documents such as music, diaries, manuscripts and patents, to name a few, are essential to the research. (Ridley, 2012)

There is a large amount of information available online. While not all information is found to have the quality needed for doctoral research, which might be assessed individually, it is possible to find pieces relevant to the investigation. Ranging from blogs and professional organisations websites to opinion articles published by renowned authors in non-academic portals and personal websites, this type of source can provide essential information that leads to other more reliable sources. (Ridley, 2012)

The sources of information can provide both primary and, when citing other studies or researches, secondary information. To assure the quality of the literature analysed, we proceeded to acquire as many original works as possible, either physical copies or electronic files if available. We intended to avoid indirect citations and to guarantee the reliability of the original idea. Only in extreme cases, where we could not access the original work, we relied on others' recounting (Leavy, 2017).

In order to organise our findings, a literature map (Creswell, 2009; Leavy, 2017) was designed, creating a visual summary of the research conducted by other authors. The map permitted a visual and hierarchical structure (Creswell, 2009) evidencing the connections between topics and how they relate to our research. The literature map (Figure 1) derives from our research theme and branches into the pertinent subtopics and sub-sub topics risen from our research questions.

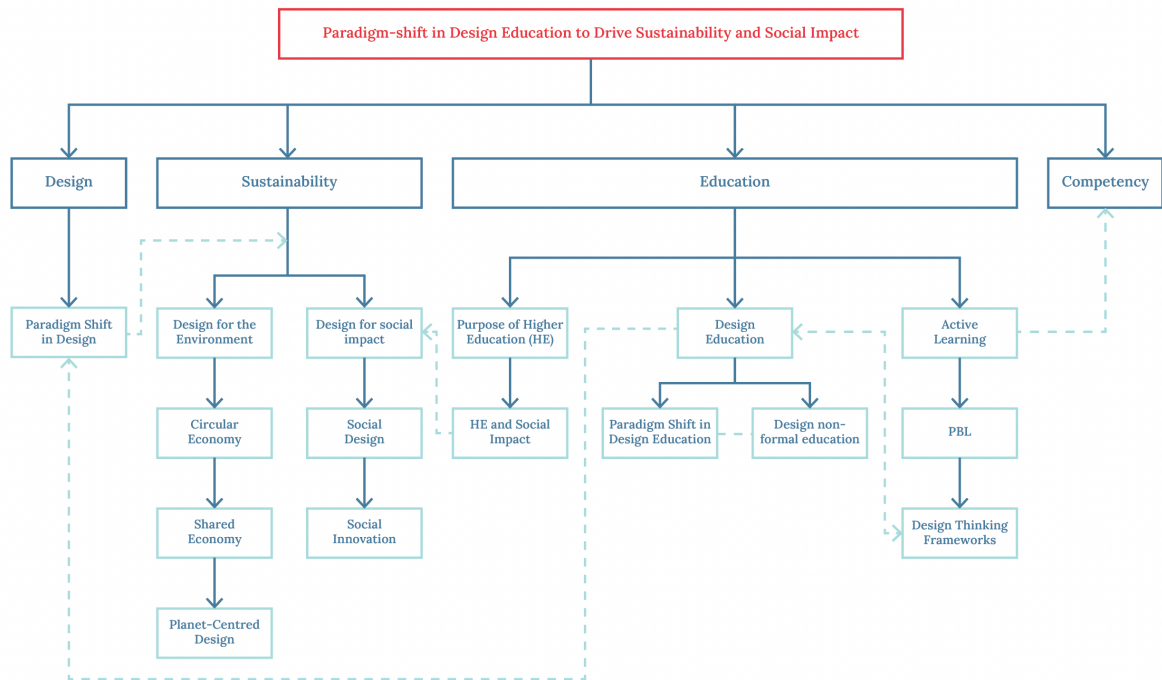


Figure 1: Literature Map of the Research. Designed by the author.

During the entire review of the literature, we kept a strict record of all the citations collected from the analysis of the documents (Leavy, 2017) organised by topics and subtopic related to our research. This literature catalogue was crucial to organise our findings and to help write the final written literature analysis with proper credit to the authors. Also, we used the software *Mendeley*³ to manage our references since the initial stages of our research, mitigating the possibilities of mistakes during our Thesis writing.

1.3. Overview of Design

Design is a problem-solving and decision-making discipline (Pryce & Whitaker, 2011) that considers several variables from the problem in question and seeks a strategic answer by applying a creative process (Cross, 2011; Lawson, 2005). Traditionally, the Design paradigm was based on contributing to consumerism as a form of economic growth, wealth and

³ Mendeley is a free reference manager with integration to Microsoft Word that generates bibliophiles automatically and quickly adjust to different citation styles.

prosperity. The United States primarily spread this ideology, post-World War I (Kuang & Fabricant, 2019), also contributing to waste, as Design sits in a "comfort zone of an ever-hungry consumer society" (Chapman & Gant, 2007, p. 5). Stebbing (2015, p. 24) defines this moment of Design history as "environmentally blind", focusing on a linear product life cycle, as resources were then considered limitless. AIGA (n.d.) to the moment of this research still defines Design as a discipline associated with improving the visual appearance and functions of messages, information, and products.

Limiting the holistic understanding of Design blinds the consequences of its professional activity, thus perpetuating the idea of Design as a mere cosmetic process of beautification of products (Margolin, 2014; Papanek, 1971; Shedroff, 2009) and creator of consumption (Franqueira & Gomes, 2017). Design, according to the report *AIGA Designer 2025: Why Design Education should pay attention to trends* (AIGA, 2017), was at the end of a top-down decision-making process that focuses on appearance as a differentiator. "Communication strategists viewed people in broad demographic terms, targeting them as passive consumers of segmented marketing." (AIGA, 2017)

"The personal statements of 100 'iconic' designers revealed that 1 per cent embed sustainable design thinking (they linked environmental, social and economic factors), 5 per cent occasionally embed eco-design thinking (linking economic and environmental factors), but the vast majority, 94 per cent, focused on other aspects of Design (business, production, aesthetics, emotions, innovation, digital)." (Fuad-Luke, 2007, p. 25)

In this context, Design can be posed as part of the problem (Armstrong et al., 2014; Manzini, 2007; Vezzoli & Manzini, 2008), especially on the environmental aspect (Russ, 2019). Design contributes to the production of more goods and entices consumption, eternising the idea that only the new is good, reshaping the sense of 'old' to anything else that is not the latest of models. Fry (2009) highlights the irony surrounding the creative nature of Design, pointing out also the quality of destruction as an intrinsic characteristic of the creative process and making a direct connection to Schumpeter's (1976) theory of "creative destruction", where the introduction of new products often eliminate the value of a previous model or good.

"The very way Design is reduced and presented in relation to bringing goods into being fails to grasp Design's ambiguity as an agent of both creation and destruction. This ambiguity applied as much of course to immaterial qualities, like value, as to matter itself- leaving aside the problem of defining the essence of value, what designers do is destroy value at the same time as they create it (a new style product is launched as 'the latest' thus rendering previous versions 'dated'). This means that while it is acknowledged that artefacts can prompt the creation of other objects (such as system elements and accessories) and deliver experiences (for example,

pleasure and the use of new skills) what they may equally destroy (knowledge, the use of a service, a craft practice, and so forth) is mostly overlooked.” (Fry, 2009, p. 192)

This same idea was explored in the Design field by Ferreira (Ferreira, 2003, 2005, 2008b). In a different context, lately, we have seen the consequences of Design combined with behavioural psychology (Norman, 2009) on digital products that drive users to become addicted to smartphones and social media, seeking small moments of pleasure through scrolling, posts, likes and comments – in an authentic contemporary version of the Skinner box (Kuang & Fabricant, 2019). If before, artefacts influenced people in a more passive matter, today's digital devices are designed to adapt to every interaction of the user, actively influencing behaviours, deciding what they see, read and listen to, and the quality of their experience (Norman, 2009).

Many authors have highly criticised this blind and almost cruel approach from Design (Assadourian, 2017; Dawson & Oliveira, 2017; Manzini, 2011; Silveira, 2016). They point to a necessary break on this paradigm and claiming the development of new Design skills and competencies to serve not the maintenance of the world as we know, but to assume an active position to help create the world we will live in tomorrow (Rocha, Ferreira, & de Azevedo, 2017; Souleles, 2017). Stebbing (2015, p. 24) supports that in this new paradigm “designers aspire to design for ‘quality of being’ rather than ‘quantity of having’”, seeking a sustainable consumption. Defending a circular use of resources, now known as finite, in replacement to the linear way of designing, authors posit a total contradiction between the two moments, defining a paradigm shift in Design activity (D. Camocho et al., 2018; D. G. Camocho et al., 2020).

In response to the contradictory moments, Davis (2018b) presents the idea of Transition Design, where the activity lays its foundations on examining complex social, economic, political and natural systems, promoting a “design-led societal transition toward more sustainable futures”. Multiple authors (Cross, 2011; Franqueira et al., 2012; Manzini, 2015; Margolin, 2014; Russ, 2019) acknowledges the designer to be suited to seek and provide answers to complex challenges. It is necessary for Design to engage “in informed, iterative speculation about the future, advocating short-, mid-, and long-term visions that emerge from local conditions” (Davis, 2018b). The Transition Design concept brings to attention the need to build into designers the ability to envision possible scenarios and consequences of their actions, exercising awareness towards the impact caused by them.

As in any other profound change in society, this is a long transition that shall take time to be consolidated, if ever. One can argue that most of the today's designers are still following the former path, giving that the current economic model is based on profit and growth demanding from Design a position regarding the support of this type of activity. Alongside, Design Education – especially on undergraduate courses (Rocha et al., 2018b) – still focus on the commercial track of the profession, delivering yearly to the market a fresh batch of designers with what we understand to have an outdated mindset and indicating that the shift is still far from happening (Norman, 2010). However, it also recognises Design Higher Education as a possible drive for a faster transition (Ferreira, 2020a).

1.3.1. Notes from the Design field

Leading Design and Innovation consultancies such as IDEO and Frog Design have raised the flag of Design for Social Impact and Sustainability. These companies dedicate part of their work to develop and discuss the importance of a shift in mindset from the Design industry. Frog Design launched in 2012 the Collective Action Toolkit, an open-source tool to empower communities with Design Thinking. "Part of frog's commitment to social impact the Collective Action Toolkit is a set of activities and methods that enables groups of people anywhere to organise, collaborate and create solutions for problems affecting their community." (Frog Design, n.d., p. 1).

IDEO has gone even further by founding a non-profit Design studio, ideo.org, dedicated to "design products and services alongside organisations that are committed to creating a more just and inclusive world" (ideo.org, n.d.-a). Having published one of the most popular toolkits on human-centred Design, the *Design Kit*, popularised by *The Field Guide to Human-Centered Design*, IDEO claims to have built a "community of over one million people around the globe who have used Design Kit's tools to bring more empathy, creativity, and experimentation to their work" (ideo.org, n.d.-b). IDEO also partnered with other organisations to build specific tools for niched areas of society. Partnering with Ellen MacArthur Foundation, they built and made available *The Circular Design Guide* (IDEO & Ellen MacArthur Foundation, n.d.), in an attempt to make accessible the Circular Design methodologies and help "understand, define, make, and release circular innovations". Evidencing the value of Design for the public sector (Koskinen et al., 2011), alongside Nesta and as a part of Design For Europe, IDEO co-created *Designing for Public Services* (Kershaw et al., 2016), The toolkit "offers ways to do things

differently by introducing the process of design thinking, and provides guidance on how to introduce this new approach into day-to-day work in the public sector.” (Design for Europe, 2016).

In the United States, intending to make "public services more effective and accessible for all New Yorkers" (NYC Opportunity, n.d.), the Service Design Studio of the NYC Mayor's Office for Economic Opportunity, created the *Civic Service Design Tools + Tactics*. The institution describes it as a Design-driven initiative to improve the experience of using public services in New York City. Attempting to clarify the benefits of Design, specifically Service Design, by distancing it from "how it looks" and emphasising the idea of Design as "how it works", the NYC Opportunity (2017), introduces the concept of Civic Service Design aiming to "develop solutions that are rooted in insights about the holistic experiences of those affected by public services. It considers people, processes, communications and technology as part of the solution". This public initiative adds to the previous examples as a small sample of the larger body of work being developed by the Design sector that makes evident the need for change to establish a new path for Design and designers.

The three mentioned initiatives clarify that the Design sector is leading the shift as the limited skills and competencies taught by the Design schools have drifted apart from the sector's needs (Rocha et al., 2018a). As the industry began dealing with outdated professional, it started to complement the education with the knowledge needed to tackle this type of issues, as put by Furniss (2015, p. 30), "[i]nstitutions are not producing the creative talent that is required, and is taking the situation into its own hands". Some of the initiatives have also taken the shape of non-formal Design Education as we will present in item 1.7.1.

1.4. Design and Sustainability

The relationship between Design and Sustainability has been closer to a definition of *Environmental Design* in the past. It was common practice to promote it as "eco" or "green" Design (Akama et al., 2014; Bhamra & Lofthouse, 2008), thus limiting the concept to natural resources and environmental impact concerns. Today, the most common definition of Sustainability in literature aggregates three fundamental dimensions: the already discussed Environmental dimension and the Social and Economical. The conventional representation of the relationship between the three dimensions demonstrate interaction, but no

interdependency (Cato, 2009, p. 36). By giving the same size to all the spheres (Figure 2), there is an assumption that all carry the same importance, which is not what is seen in reality.

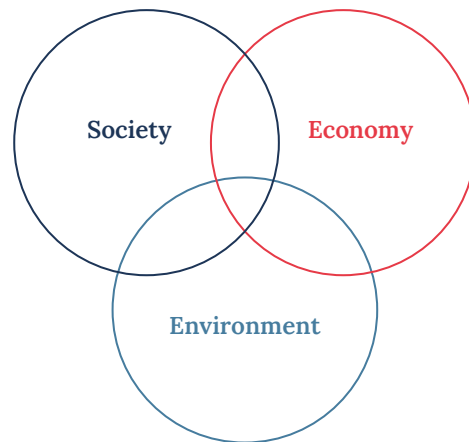


Figure 2: The conventional economic view of the interaction between the economy, society, and environment. Source: (Cato, 2009, p. 37)

To the UNESCO (UNESCO, 2015, p. 20) “Sustainability is understood as the responsible action of individuals and societies towards a better future for all, locally and globally – one in which social justice and environmental stewardship guide socio-economic development.”. As straightforward as it sounds, the desired balance (Manzini & Jégou, 2003) seems fragile and often requires compromise (Shedroff, 2009).

“The sustainability movement can be seen as a way to counteract the dominance of economic rationalism that only seeks to promote private interests and unlimited growth. As such, the literature often reflects the tension between market-driven Design vs. 'socially useful/responsive design' (Thorpe & Gamman, 2011). Pyla (2012, p.275) critiques that 'sustainable development's alleged balancing of economics and ecology often assumes the utilitarian and the economic take precedence over the ethical and the cultural'” (Akama et al., 2014, p. 11)

The weakness of the concept based on the three pillars of Sustainability is also criticised by Birkeland (as cited in Akama et al., 2014). The organisation of modern developed societies tend to merge Sustainability into an economic approach (Russ, 2019), placing the environmental and social instances in a position to minimise the harm caused "rather than planning for a positive contribution" (Birkeland as cited in Akama et al., 2014, p. 7). The environment might even be considered an adversary to the economy or as a luxury, when “more fundamental (economic) outcomes are not being met” (Russ, 2019, p. 4)

Often the purpose of development is assuring growth for organisations. This issue is addressed at the UNESCO's (2015) *Rethinking Education: Towards a global common good?*. The document exposes that Sustainability has been questioning the “contradictions in a dominant model of development focused on economic growth” (UNESCO, 2015, p. 21), faced the growing concern about climate change, degradations of natural resources and loss of life on earth. In the current scenario, natural capital is being transformed into other types of capital (Martin Stuchtey, 2019; Russ, 2019), fuelling the economy as it depletes the natural resources which it thrives from.

To address this unbalanced relationship, some authors (2009; Ferreira, 2020a; Ferreira, Souleles, et al., 2020; Marques, 2019) propose an updated version of the conventional model shown in Figure 3. They highlight the systemic relationship amongst the parts, considering a more realistic view of Sustainability, with no part being left outside as the previous diagram suggested. For Cato, “society nestles inside the environment and the economy is a part of society. In this view, both society and economy are dependent on the environment” (2009, p. 37).

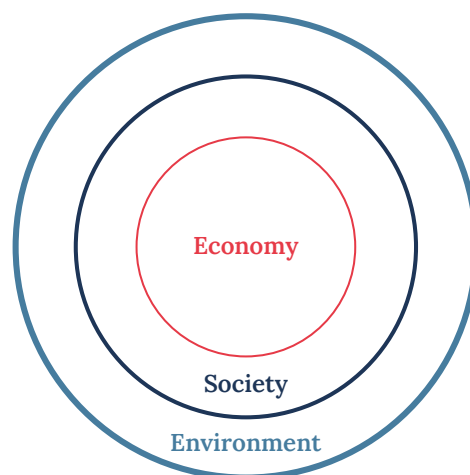


Figure 3: Re-imagining the relationship between society, economy, and environment. (Cato, 2009, p. 37)

While there seems to exist a standard agreement on the definition of Sustainability based on the economic, social and environmental dimensions, in a more complex framework Akama et al. (2014) defend an idea of six spheres (Figure 4). The authors suggest adding political, technological and spiritual to the three consolidated dimensions, as they identified in literature repetition of such spheres (Akama et al., 2014), in many cases.

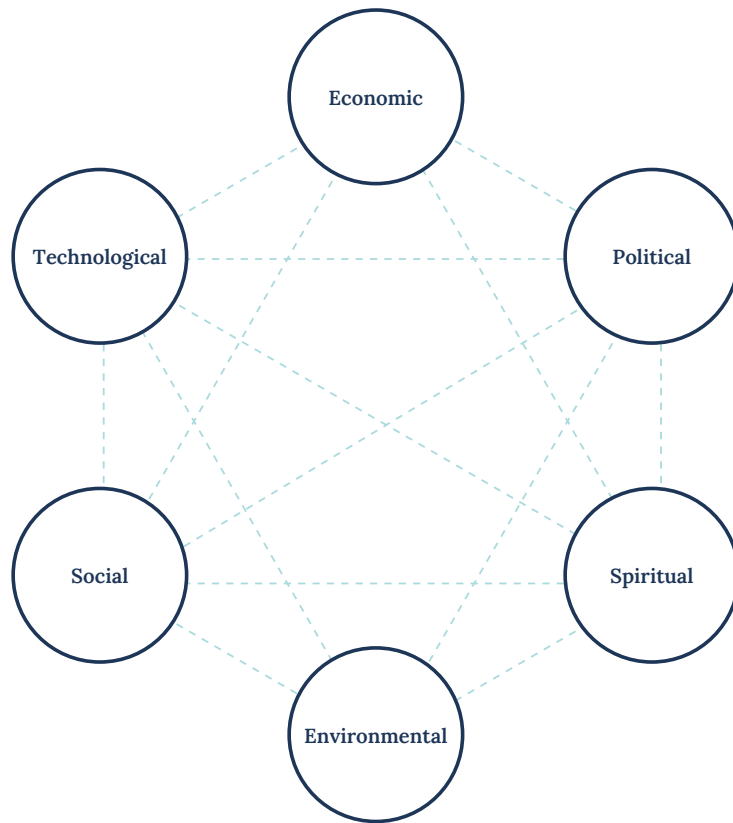


Figure 4: The six spheres of Sustainability proposed by Akama (2014), adapted by the author.

We recognise the significance of such pillars in a broader understanding of the context needed for the designer to successfully propose responses to problems. Particularly at a local level, political and technological background directly influence the solutions. As for the spiritual perspective of Sustainability, the author defines it “as an active everyday awareness and practice (Akama et al., 2014, p. 12) that “considers personal ways of finding meanings to life”.

At first sight, the spiritual sphere seems very abstract. However, it relates intensely with the sense of value embedded in human society's construction and addresses a fundamental search for meaning and purpose. The creation of value is crucial to the adoption of products and services, driving behaviour and promoting a change of habits, an approach intertwined in the Design activity.

“Design converts nature’s capital and man’s (human and financial) capital into ‘man-made’ capital by giving it form, by embedding meaning (by vesting the form with symbolic capital),

by defining societal values and, ultimately, by designing our perception of reality.” (Fuad-Luke, 2009, p. xix)

Promoting Sustainability is as much about projects and process that address the environmental, social and economic issues, as it is about building a fruitful ground that allows for a disruptive approach to be adopted without being perceived as a loss for society and human-kind (Fuad-Luke, 2009). In that sense, the well-developed skill of narrative-builder from the designer must be utilised. Fuad-Luke (2009, p. xxi) advocates for designers to assume a position of activists due to its ability to "catalyse societal transformations", readjusting our understanding of value and beauty and embracing "a multitude of truths – economic, political, social, ecological, ethical, technical, symbolic, institutional, philosophical and cultural" (Fuad-Luke, 2009, p. xxi). The author provokes designers to disrupt existing paradigms, creating new meaning, value and purpose that replace a new sense of awareness and perceived value regulation.

The United Nations (2015) has established five dimensions for sustainable development, the five Ps (Figure 5), as part of the Agenda 2030. Built on the three traditional pillars, People (society), Planet (environment) and Prosperity (economy) two new systemic dimensions; Peace and Partnership.

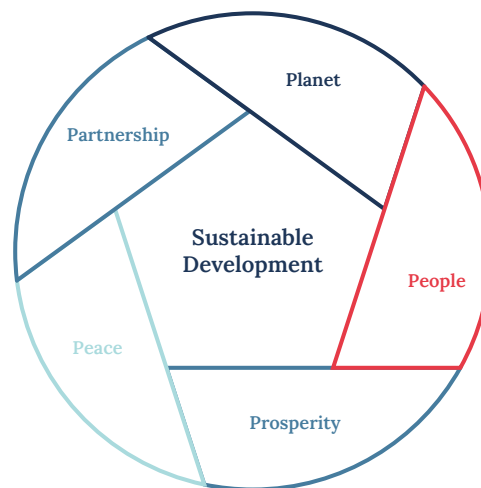


Figure 5: The five Ps for sustainable development (United Nations, 2015). Adapted by the author.

Although the Agenda 2030 “is a plan of action for people, planet and prosperity” (United Nations, 2015, p. 5) it recognises that:

1. “There can be no sustainable development without peace and no peace without sustainable development.” (United Nations, 2015, p. 6)
2. The implementation of the Agenda is envisioned through global partnerships, “based on a spirit of strengthened global solidarity.” (United Nations, 2015, p. 6)

1.4.1. Circular Economy

According to the Ellen MacArthur Foundation (Ellen MacArthur Foundation, n.d.), the Circular Economy is based on three principles, ‘Design out waste and pollution’, ‘keep products and materials in use’ and ‘regenerate natural system’. To break the established linear system – take, make and waste – built upon the idea of unlimited resources is a must-do. It also adds accountability on decisions about materials and fabrication processes as it broadens the responsibility of producers for their products beyond the sale to how the products will impact the world in every single stage of their life cycle.

The circular model has also been advocated by McDonough & Braungart (2002) in the book *Cradle to Cradle: Remaking the Way We Make Things*, Vezzoli & Manzini (2008) in *Design for Environmental Sustainability* and Camocho et al. (2018). Designing products to be discarded is unrealistic in a world where there are finite and limited resources, regardless of what we have become accustomed to believing. Thinking in that direction puts aside a holistic perspective to the project. McDonough & Braungart (2002, p. 8) claims for an intentional and intelligent system, capable of working on “regenerative production cycles” proving products that “make a positive impact on people and the nature.”

Circularity reinforces the need to rethink the current economic model based on products to one where possession gives room for sharing and renting. The *Sharing Economy* gained momentum after the 2008 economic crisis forced society to find better solutions to solve their economic issues (Akama et al., 2014; Caulier-grice et al., 2010), powering a model that devaluated consumerism in detriment to a sharing or a collaborative kind of consumption. In their studies, Manzini & Coad (2015a) observed many initiatives ranging from cohousing, community gardens, car-sharing, carpooling, fair trade initiatives, and production models that engage local communities, to name a few.

1.4.2. Planet-centred Design

'Planet-centred Design' is an uprising concept that questions people's centrality, frequently defended by Design Thinking enthusiasts that helped put the discipline in evidence in the early twenty-first century (Brown, 2009). The Human-Centred Design (HCD) approach situates people in the centre of the processes, being the primary source of insights for problem-solving through a deep phase of empathy which guides the process into a solution that makes sense for people but also is feasible, technologically speaking, and viable from a business perspective.

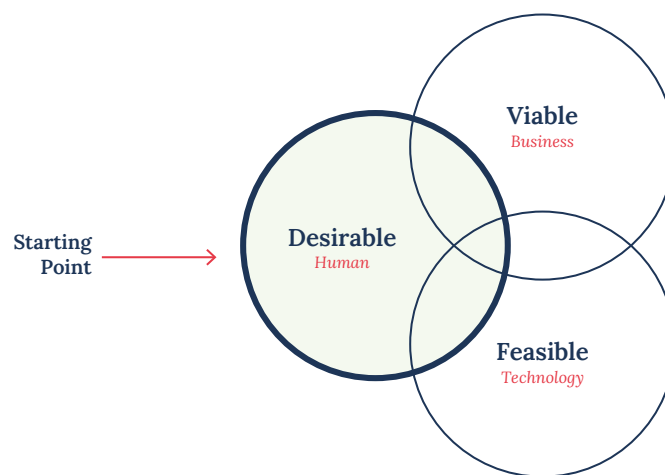


Figure 6: Human-centred Design approach. Adapted from IDEO.org (2015).

As HCD drives Innovation, it has become widely popular in the business world and allowed companies to redesign their processes based on Design Thinking (Martin, 2009; *Design Thinking and Innovation at Apple*, 2012; Yoo & Kim, 2015). The value of Design Thinking for business drove Stanford University to successfully establish the d.school, a transversal Design school accessible to every student at the university as a form to add a Design Thinking component to their graduation, independent of the course they are taking. The d.school five-step methodology (explored on item 1.9.1 of this chapter) has spread immensely and has been adopted by other Design courses worldwide. Whilst this Design approach drives Innovation that feeds the economy primarily if appropriately applied, it can also drive social improvement (Vezzoli et al., 2014).

Nevertheless, as the planet reached an extreme depletion of its natural resources, critics started to question the lack of a clear goal towards the HCD approach's environment as it is not figured as a core component. Chochinov (2007), reinforces the idea that if we do not care for the planet putting “climates before primate” we are doomed as “our anthropocentric worldview is literally killing us”. He questions the idea that Design should serve people, as we have more significant issues to address if we want to survive on earth.

In that sense, planet-centred Design demands a radical change in Design projects, as its outcomes aim not for economic growth, but to prioritise the ecological system, changing humans' role to actors, not the centre (Jackson, n.d.). Although agreeable, the shift to this approach is no small task, requiring significant effort from Design to become planet centred.

"It remains difficult to see how this can happen in the current economic paradigm. Designers need to create new forms of value and value exchange to combat the inequalities we currently witness. They also need to minimise the extractive processes that are so prevalent in what they do." (Jackson, n.d.)

Some authors posit that part of this shift requires significant effort in educating an economic system to transit to a new way of thinking, requiring clients to reframe their expectations, as it raises two critical issues. First, we must be able to transition Design Education, bringing to life designers that can act in favour of this mindset, which may not result in the same smooth user experiences, as for it to be in favour of the planet (Jeffcott & Ferreira, 2021). It is an approach that is likely to deprive people from luxuries acquired with modern developments, but which also relied on an inconsequential way of designing. To focus on reducing emotional, intellectual and physical labour, often conflicts with the planet's health. "Reducing travel and consumption, minimising energy and data use and focusing on local will all require smarter approaches to traditional design problems" (Jackson, n.d.).

Secondly, these new designers need to be an advocate for a better kind of Design. They must have the skills to communicate the needs for it and its benefits properly. It augments the responsibility of the designers from purely creative professionals to political agents towards change (Franqueira et al., 2012). We must evolve our understanding of Sustainability to avoid the dangerous path where an eco-friendly discourse can quickly impulse the consumption of more goods in return of a feeling of doing good by consumers' side (Jackson, n.d.; Jeffcott & Ferreira, 2021).

An essential part of a designer's job is to build messages, services and artefacts, going through a process that continually requires making strategic decisions. In the process of creating novelty designers many times participate in setting the standards for fabrication, such as materials, shapes, and often technologies, and at times define suppliers to collaborate with. Such decisions implicate a need to understand the environmental impact produced by their creations. Although it is common to relate environmental impact to the moment of the purchase and use of a product or service, Thackara transfers the majority of the responsibility to the designer, as the consumer is powerless if "great part of these decisions were wrong already during the process of the design" (Marques, 2019, p. 16).

Design is historically positioned as a tool for business development and growth through creating products that feed the economy of a society that understands value from consumption. Measuring the success of products to commercial thrive, ties the depletion of the resources "with global design success" (Chapman & Gant, 2007, p. 10), putting designers in an ironic situation (Marques, 2019, p. 19) as they "urge to make world a better place by changing people perception of wellbeing from product-based to artefact independent wellbeing".

As the world changes, designers come across the new challenges (Ferreira, 2008b). It is partially expected from them to make the presence of humans balance with the planet (Moreira, 2015). Alongside giving form to products, designers must reshape the idea of value and meaning for people" (Akama et al., 2014). Presenting, defending and defining "new patterns for consumption and production" (Marques, 2019, p. 16) to enable sustainable development. It is not enough to do less harm to the environment. Instead, it is imperative to learn how to "participate with the environment by using the health of ecological systems as a basis for design" (Reed, 2007, p. 674).

1.5. Design for Social Impact

All the dimensions of Sustainability have a social component to it (Akama et al., 2014) since they compose how society is structured. Still, it is common in the literature to approximate the social sphere to Design initiatives that separate social issues from market-driven goals. As society faces massive complex problems, Social Design rises as a discipline to tackle the challenges that require fast responses from "how problems and opportunities are identified

and framed, and how new solutions are generated, explored, prototyped, resourced and realised" (Armstrong et al., 2014, p. 20). There is a growing concern from society towards the impact of products and services (Davis, 2018b; Epstein & Yuthas, 2014; Heller, 2014), as they understand that not only government but business are also responsible for driving positive change. Changing the business attitude can increase profit and improve the world's conditions as a necessary outcome. Business might be in jeopardy if they do not change their *modus operandi* into a sustainable and impactful operation.

1.5.1. Social Design

Being more frequently used in the last decades, Social Design still lacks a unified definition (Lasky, 2013). Many authors have attempted to clarify the term in the literature. Armstrong et al. (2014, p. 15) defend Social Design as the result of a participatory approach to "researching, generating and realising new ways to make change happen towards collective and social ends, rather than predominantly commercial objectives". Although 'social' configures the relationship between people and society, it is commonly used to exemplify a problematic situation that weakens the social wellbeing. Other authors (Normoyle, 2019; Souleles, 2017) support that Social Design is commonly referred also as 'Social Conscious Design', 'Social Impact Design', 'Socially Responsible Design', 'Public-Interest Design', 'Design for Social Change', 'Transformation Design' and 'Humanitarian Design' and it is the practice of Design for the benefit of the public, in particular, to support communities in need (Normoyle, 2019). According to Souleles (2017, p. 3), "these terms make explicit the focus of the activities and the impetus behind them. They encompass a range of strategies informed by social responsibility and design-led social innovation."

It seems important to emphasise that not seeing Social Design as a specialisation, field or discipline (Armstrong et al., 2014) of Design, allows for a deeper relationship between social and Design. We believe it is impossible to untangle the practice of Design from the social fabric, as every creation from the discipline has some impact on society as it is made by and for it. Facing Social Design as a 'discursive moment' amplifies the possibility to reinforce the need for it to be seen as an intrinsic part of Design, etched to its core (Ferreira, 2008a; Manzini & Jégou, 2003; Margolin, 2014).

1.5.2. The Social designer

It goes without question that Social Design is more often a growing practice in the Design field. In recent years, Brown (2009, p. 42) observes a “migration of designers towards social and behavioral problems”. The relationship between the result of a Design process and people is unquestionably intertwined, especially in the light of human-centred Design practised and preached in the past decades. Akama et al. (2014) recall the evident influence of Papanek's (1971) work, soliciting the Design community to stay away from market goals and focus on social issues. Nevertheless, it is possible to go further and see evidence of socially-oriented Design work done in the UK back in the 1940 and 50 (Armstrong et al., 2014, p. 17) by Design studios and consultancies that besides the commercial potential also "aimed to maximise the civic benefits of design".

"The history of social Design shows that its formation has come through varied circumstances and exemplifies a range of approaches and political positions. It is notable, however, that it has received increased impetus at times of economic and social challenge such as austerity Britain of the post-war period and the oil crisis of the 1970s. Now we see social Design re-emerging against the background of the 2008 financial crisis and recession." (Armstrong et al., 2014, p. 17)

From Normoyle's (2019) viewpoint, designers must understand that social Design means acting actively in addressing and assessing Social Impact, in a way that allows for social change to be evaluated with objectivity, as expected from other disciplines.

"designers should, from the beginning of a given project, attempt to recognise and resolve to what extent, and to what level and capacity, they wish to adopt social design principles and practices into their design processes, and to be clear about any indicated social, cultural, economic, political or other societal intentions and implications they hope to address." (Normoyle, 2019, p. 5)

Furniss (2015) sees a growing engagement of designers toward social, environmental and political issues, approximating them to the role of social scientists and advocating for cases in a position of activists (Ferreira, 2020b; Fuad-Luke, 2009). Normoyle (2019) observes that not all designers may want to adopt Social Design processes into their projects, and instead simply promote social agendas aligned with their values and beliefs. She highlights that promoting a social agenda is not the same as affecting positive change in society. It is necessary to identify concerns and act to improve local, regional and global issues. According to her, designers should articulate Social Impact goals before implementing their processes.

Understanding and accepting the relationship between 'Design' and 'Social' gives problems to be solved a growing complexity that requires skills and competencies to tackle them properly. Designers are not anymore the sole responsible for the problem-solving process, as they start to rely upon a growing network of both non-designers and non-experts (Armstrong et al., 2014; Manzini & Coad, 2015a; Normoyle, 2019). The collaboration and participation of the community and affected groups are intrinsic to Social Design. It contributes to a more comprehensive understanding of the “project needs, expectations, and desired outcomes” (Normoyle, 2019, p. 10), and rely on related disciplines such as anthropology, social science, and more recently data and computer sciences, as well as strategic partnerships that may vary accordingly to nature of the problem.

1.5.3. Social Innovation

Nuclear to Social Design is the idea of Social Innovation as a direct outcome. As it happens to Social Design, Social Innovation also lacks a unique definition being addressed and defined in different moments in the literature. Manzini (2014, p. 1) defines it as a process of change by rearranging existing assets "to achieve socially recognised goals in a new way", a concept shared by Mulgan et al. (2007). Davis (2018b) and Deiglmeier et al. (2008) corroborate and add the notion that the novelty created should increase society as a whole rather than individuals. In an article for the Stanford Social Innovation Review, faithful to the definition of a novel solution that the value created in Social Innovation accrues society as a whole, Deiglmeier et al. (2008) list a total of ten recent Social Innovations that include charter schools, fair-trade and microfinance, to name a few.

At a later work, Manzini & Coad (2015a) expand the former definition acknowledging that Social Innovations “are innovations that are both good for society and enhance society’s capacity to act”. Despite the simplicity, this definition encompasses a key component of helping society be resilient in the face of challenges and position people as agents of change.

The idea of empowerment of society resonates with the concept of a bottom-up approach (Davis, 2018b; Norman, 2019), where the community and experts are contributors in the innovation process, not a mere beneficiary. It is a necessary shift from recommending solutions by the privileged experts to the marginal society (top-down) to a co-creative approach. This shift democratises the conversation about Innovation and contributes to the construction of more resilient communities. When dialoguing about collaborative

organisations, Manzini & Coad (2015a) perceives a more complex mixed-structure, where bottom-up is necessary but coexists with peer-to-peer and top-down initiatives.

"Even though collaborative organisations have been introduced as bottom-up innovations (that is, as innovations mainly deriving from actions "from the bottom"), a closer observation of their evolution from initial idea toward more mature forms of organisation indicates that their complex mechanism, and the initiative taken directly by the people concerned (bottom-up interaction) is always supported by information exchanges with other similar organisations (peer-to-peer interaction) and by different kinds of intervention from institutions, civic organisations, or companies (top-down interactions)" (Manzini & Coad, 2015b, p. 82)

Social Innovation expanded the frontiers of Design (Heller, 2014), allowing for the purpose to go beyond the needs of businesses and making Design accessible to a portion of the population historically marginalised. Social Innovation Design are Design initiatives that work on people rather than things. It requires an understanding of complex systems, its dynamics and relationships. The designer assumes a mediating role (Manzini, 2014) in the participatory approach necessary for Social Innovation to happen.

A challenge facing Social Innovation designers is the possibility of making this activity economically sustainable for it to be considered a viable path and support living, at times outside the traditional client-based model (Davis, 2018b). The author sustains that Design Education institutions that advocate for Design for Social Innovation as a career path "owe students examples of strategies for funding social and environmental initiatives." Such statement must be seen with caution as it fails to grasp our moment of paradigm shift. Supporting the same type of commercial relationships in Design that still stand today is agreeing that the need to change the bases of business do not apply to Design (Franqueira & Gomes, 2017). Rethinking the way Design is practised means rethinking how we position the Design business, just as much as we defend that businesses should reshape themselves.

The creative sector is pressured to demonstrate results regarding their activities' Social Impact (Gardiner, 2014), and designers are still not equipped to do so (Normoyle, 2019). Measuring Social Impact, or Social Impact Assessment (SIA), especially consequential of Design projects, has still to be appropriately incorporated into the Design process. The idea of the relationship between cause and effect of Design artefact and the improvement of people's lives has been discussed. However, the literature fails to present results beyond theoretical.

Normoyle (2019) argues that designers entering the world of Social Innovation and Social Impact rely on tools and toolkits that lack a deep structure to provide the competencies

needed to correctly measure and monitor Social Impact with the same criteria of disciplines such as social sciences. She alerts to the deficits of using such resources and claims that for designers to be able to present the results of Social Innovation, they must work with comparative metrics, crafting a process that has in mind the conditions from start to end, assessing the changes influenced by the Design intervention in comparison to the established short, mid and long-term impact goals.

“The first is to ensure that whatever social factors being examined and interrogated are not already occurring before a given design intervention is introduced; the second is to establish that social change does indeed occur as a result of implementing the proposed intervention, and that it does not happen without; the third is to eliminate any other explanations that could be identified as direct or indirect catalysts that affect change.” (Normoyle, 2019, p. 9)

Normoyle (2019, p. 13) proposes a blended methodology mixing Design and Social Science into a new perspective – “a revised process that accounts for more rigorous standards for measuring social impact in the design discipline” to be applied by “researchers, educators, practitioners, and students” to assess the Social Impact as the primary outcome of their professional endeavours.

1.6. Overview of Design Education

It is imperative to understand the role of Design Education in this paradigm-shifting moment and how it needs to be reconsidered as a critical driver for sustainable change. Particularly Higher Education has a high potential for impact and to assure that designers are inclusive and diverse in their practice (Jackson, n.d.).

1.6.1. The purpose of Higher Education

Education spread on many levels. People are influenced at home by the education, positions and values of their family. The experiences lived in life also help shape thoughts and actions. Schools are yet another essential part of education, where people are exposed to new knowledge helping define the path for a possible future profession. Higher Education (HE) is the last part of the formal educational path and, in Europe, is divided into three distinct and succeeding levels: the Bachelor-Master-Doctor system, as described by the European Consortium Accreditation (2014).

As for its purpose, the Danish Ministry of Science Technology and Innovation (DMSTI) (2005, p. 23) identifies four main ones for HE. “Preparation for the labour market; preparation for life as active citizens in a democratic society; personal development, and; the development and maintenance of a broad, advanced knowledge base”.

The DMSTI emphasises that while we must rely on laws and democratic institutions as a basis for democratic societies, they are alone not enough to function in a democratic culture. The society also must be “tolerant and accepts diversity and open debate” (Danish Ministry of Science Technology and Innovation, 2005, p. 24). It is argued that the role of education is critical in a democracy, as it depends on educated citizens to survive and be executed. Active citizens require a "broad education in a variety of fields as well as the nurture of democratic attitudes and values and the ability to think critically" (Danish Ministry of Science Technology and Innovation, 2005, p. 24).

In the context of this research, we examine more profound the role of Design HE in training a designer that understands its role as an agent of change (Ferreira et al., 2019; Rocha et al., 2018b), giving the current paradigm shift in Design educational models and the world, presented in previous sections. In that sense, it is vital to explore the relationship between Social Impact and Sustainability and the preparation of Design students for life as active citizens in society and the responsibility of Design HE in forging that outcome.

1.6.2. The contribution of HE for Social Impact

In 2017, The Organisation for Economic Co-operation and Development (OECD) made public a benchmarking report on higher education system performance that “presents an account of higher education today, the debate around the performance of higher education regarding its contribution to economic, social, cultural and environmental development” (OECD, 2017, p. 8)”. Amongst the appointments present in the document, it is of great importance for this research (Rocha et al., 2018b) the contribution of HE for Social Impact, thus incentivising society to invest in HE as live in a world which uncertain future relies on society's ability to be resilient facing new challenges. The OECD document explains that HE contributes to social cohesion, as graduates tend to be more engaged citizens (2018, p. 19), enabling members of society to work in cooperation as a way to thrive, thus contributing to the development of the social, cultural and environmental aspects of society.

Higher Education presents an opportunity to address the complex societal problems presented at the Agenda 2030 of the UN as a fundamental part of its curricula (Rocha et al., 2018b). The interaction and collaboration amongst students, academics and organisations for a common goal contributes to knowledge building, Social Impact and forges a path towards a more sustainable society. Equally, it takes advantage of Higher Education to lead the change and transit to the professional profile in demand.

“Higher education plays an important role not only as a source of product and/or process innovation but also in helping to find innovative solutions and adaptation to big societal challenges such as environmental degradation, climate change, ageing societies, obesity epidemic, mass migration, extremism, conflict, etc.” (OECD, 2017, p. 9)

In a polarised world where radical groups' resurgence and political manipulation, fuelled by the fake news phenomenon (Alemanno, 2018) are becoming widespread occurrences, HE poses as an essential piece for social engagement and critical thinking. It helps create partnerships between public and private sector organisation "to engage citizens, strengthen democracy and citizenship, address societal challenges, and generally contribute to the public good" (OECD, 2017, p. 22). Design itself plays an essential role in this whole dynamic since it is at the edge of both cause and possible solutions (Manzini, 2007), highlighting the importance of preparing local designers to contribute to their local territory and communities (Vezzani & Gonzaga, 2017).

1.7. Paradigm Shift in Design Education

Design as a profession is seen to be a key component in shaping the world of tomorrow and Design Education may behave as a shifting mechanism to enable such transitory pathway. Manzini (2011) and Fuad-Luke (2009) claim that Design students have in them a potential to play an active role in society towards a new momentum, while also building the competencies needed not to follow but to lead the Design field into the future, where he believes that doing Design based on societal challenges will become the new standard. The integration of Social Impact and Sustainability has become a standard agenda addresses by authors and researchers (Franqueira & Gomes, 2017; Papanek, 1971; Vezzani & Gonzaga, 2017) that believe in the importance of embedding real needs in educational programs as a way to provide students with an opportunity to deal with complex problems.

The idea of designers rethinking their actions to face real problems rather than being trampoline for consumption is not a new concept. Victor Papanek (1971) called for that direction in his book *Design for the real world*, first published in 1984. He lamented that Design Education still proceeded from the wrong assumptions as he believed that skills taught in Design schools "are too often related to processes and working methods of an age that has ended. The philosophy is an equal mixture of self-indulgent and self-expressive bohemian individualism and a materialism transmitting this biased information is more than half a century out of date" (Papanek, 1971, p. 285). Papanek's opinion is commonly shared by many authors (Ferreira et al., 2019; Ferreira, Souleles, et al., 2020; Leite, 2006; Manzini, 2011; Margolin, 2014; Prior et al., 2007) as they affirm that Design Education cannot seek the current path in training an overwhelming number of future designers repeating the same mindset and market indication.

Vezzani & Gonzaga (2017) corroborate and defend that we must immerse Design students in the problems for them to understand the complexity and abstraction that surrounds social sustainability and develop the ability to contribute and design for change. They argue for an approach where the projects developed during their educational path allow students to "become aware of their own knowledge, capacities and limitations; they make mistakes and learn from them", and that the possibility to engage in real problem-solving activities build the desired awareness of the importance and impact of Design in societal issues. It also values human interactions and drives solutions for "wellbeing and happiness" (Vezzani & Gonzaga, 2017, p. S938).

A real problem-based approach rises the complexity of the problems Design student must address and reveals that the current Design Educational system as it is now organised, is not equipped to tackle them. This issue adds to an extensive discussion (Assadourian, 2017; Bender, 2014; Furniss, 2015; Prior et al., 2007) over the need for education to evolve to better respond to a new social structure and challenges. Furniss (2015) empathises the inability of formal education to adapt quickly, questioning even if it is the ideal environment for creative people and highlighting that teaching is at least 50 years out of date.

The history of Design Education shows a tendency to replicate a model from the beginning of the twentieth century built in Europe under a particular circumstance and context, in a real example of colonisation of Design Education (Jackson, n.d.). Such replication takes shape without critically questioning its adequacy for local issues showing to be unable to evolve

(Cardoso, 2012; Couto, 2008; Freitas, 1999). The school has become an inadequate social institution (Silveira, 2016), failing to evolve and provide the professionals that society needs, as “universities react to society slowly” (Koskinen et al., 2011, p. 10).

In practice this gap between current and desirable is being filled with informal education, especially by graduate programs, particularly Master Degrees worldwide tackling topics such as Social Impact, Sustainability, and Social Innovation, as reported by Rocha et al. (2018b). In Portugal, there is one Master course in Design for Sustainability to be offered in the future but still waiting for accreditation by the Portuguese government as of the time of this dissertation (Universidade de Lisboa, n.d.).

At the undergraduate level, the usual approach in Design towards a Social Innovation and Sustainability outcome is supported by individual endeavours by professors that believe in its importance to the paradigm shift moment, as reported by Nunes (2017), Pinheiro et al. (2017), Vezzani & Gonzaga (2017), Ferreira & Sabino (2020) and Baptista & Sampaio (2015). That fragile and non-institutionalised, model reveals unsustainable the pedagogical projects reflecting in courses not yet prepared to meet the requirement to change the *status quo*.

Leaving the responsibility to raise awareness about the role of the designer as an active agent of change to graduate programs risks the path to be only followed by those who already are sensitive to the issue, driving Social Innovation, Social Impact and Sustainability to be perceived as a specialisation, rather than a core foundation. As observed by Rocha et al. (2018a) and Souleles et al. (2017), the set of competencies provided to Design students, at all levels, must be compatible with the need to guarantee their capacity to vouch for not only democratic values and culture but also resilience to face current and future emerging crisis scenarios.

Manzini (2011) critiques how the majority of Design proposals developed during the students' academic path generates an excessive amount of unused Design work, as it ends-up in the domains (physical or digital) of the teacher, thus being a "waste of students' and teachers' creativity, enthusiasm and expertise" (2011, p. 1). If waste was considered inevitable in the past, he also argues that "design school results and design student capabilities can become more socially effective and contribute to the solutions of the complex problems of contemporary society." Davis (2018b) defends that college programs must address Design in a different measure than of "those of function, appearance, and client satisfaction", focusing on

the potential that students projects have "for sustainable impact in complex systems", also recognising the "processes for making change as interdisciplinary and collaborative, not as individual authorship". Seeking a problem-based Design approach to teaching – as Design is a problem-based discipline (Lawson, 2005) – poses a promising driver for building a strong ethical professional. It allows students to develop awareness about their responsibilities and accountability for the impact of their creation at the same time as it provides the tools to increase their competencies to design proposals for a better world.

We understand that seeking Social Impact and Sustainability in Design Education should not be the merit of individual and isolated initiatives. Instead, it must be embedded in the core pillars that support a Design Educational program (Ferreira, 2020a; Rocha et al., 2018b), being the subject of intellectual discussion at a theoretical level and intrinsic of all projects (Vezzani & Gonzaga, 2017). It must be introduced in the Design brief (or problem statement) and scale in complexity as the student grows in experience and maturity, from first to last year, and in research activities (Ferreira et al., 2019; Sambade & Ferreira, 2017).

Design schools must bring to life professionals that are conscient of their role, impact and contribution to Sustainability and social change (Rocha et al., 2018a). We hope to accomplish with this Thesis a valuable contribution, allowing to get one step closer to changing this outdated system, by providing a comprehensive set of Design competencies that shall be focused on Design curricula to enable a Design Education that drives Sustainability and Social Impact, and that makes clear to designers their role and responsibilities. We envision such reality not only in graduate levels and relying on more than individuals endeavours as it is embedded in the core of basic Design Education, unleashing the power of "design schools, with their tremendous potential of students' enthusiasm and teachers' experience, represent a social resource: a potentially powerful and useful player in the transition" (Manzini, 2011, p. 1).

1.7.1. The role of non-formal education

Designers today work on organisational structure and social problems, on interaction, processes, services and human experiences. Many problems involve complex social and political issues (Dawson & Oliveira, 2017; Manzini, 2011; Norman, 2010). As universities struggle to rapidly respond to these needs, suffering "with regulations which makes hard to create new dynamics, pedagogic methods and peer validation" (Rocha et al., 2018b, p. 6),

and present outdated undergraduate Design courses, many initiatives start to take place to fill the growing gap, some provided by renown universities but not in a traditional way. This non-formal Design Education fills the void and provides specific skills to a better-trained designer to fit into companies that have drifted from the need of the nature of the designer provided by school benches.

Arguably the strongest player in this field is Coursera.org, "a leading online learning platform for higher education" (Coursera, n.d.). The organisation offers a portfolio of online courses from over 200 universities in the world to a community of 66 million people who can find thousands of courses in different areas. The presence of Design courses in a general sense is quite extensive, but few relate directly to Design for Social Impact and Sustainability. During our research, we were able to identify two courses that relate directly to our work, both free. The first is *Circular Economy - Sustainable Materials Management*, and it is offered by a consortium of seven institutions, including the Delft University of Technology. The second, *Design Thinking for the Greater Good: Innovation in the Social Sector*, taught by the author of the book with the same title, Prof. Jeanne M. Liedtka from the University of Virginia, which had over 22.000 members of the Coursera community already enrolled.

Acumen Academy proposes to be "The World's School for Social Change" with a very focused approach. The importance of Design for that matter is highlighted by a range of courses such as *Designing for Environmental Sustainability and Social Impact*, *Introduction to Human-Centered Design*, *Human-Centered Design 201: Prototyping*, and a master class on *Branding for Social Change*, amongst related courses like *Social Impact Analysis*. The organisation claims to "serve a community of social innovators and builders who are willing to embrace the challenge of solving the world's toughest problems" (Acumen Academy, n.d.) by providing the "practical tools, practices and resources needed to create new solutions for an interdependent world" (Acumen Academy, n.d.), one crucial and sensitive approach identified to be lacking at Design schools.

These manifestations of non-formal education "comes in the form of response to the pressure imposed by social context which has understood the need of designers equipped with different skills from the ones that being offered by traditional education" (Rocha et al., 2018b, p. 6), highlighting a clear opportunity not to be missed by universities as a crucial part of competency, knowledge and skill building to the society, as also presented by OECD (2017, 2018).

1.8. Active Learning

There is no agreement on the definition of Active Learning, as different authors have described it in various ways (Hartikainen et al., 2019; Prince, 2004). However, there is a presence of common elements allowing to identify a pattern for what Active Learning stands for. It includes different activation methods such as physical activities, social collaboration, exploration and deep processing (Hartikainen et al., 2019), having its roots in a student-centred and led by an instructor and focusing on the learning process, rather than the instructional one.

Approaching the theory in a bird's-eye view, it is possible to first identify different vocabulary for the learning strategies that directly contrast with what is known as *passive learning*, like lectures where students passively obtain information (Hartikainen et al., 2019; Prince, 2004). Besides active learning, the literature also introduces terms such as *collaborative learning*, *cooperative learning* and *problem-based learning (PBL)*. In short, Prince defines these approaches as follows:

Active Learning “is generally defined as any instructional method that engages students in the learning process.” (Prince, 2004, p. 223).

Collaborative Learning “[c]an refer to any instructional method in which students work together in small groups toward a common goal. (Prince, 2004, p. 223)

Cooperative learning “can be defined as a structured form of group work where students pursue common goals while being assessed individual. [...] While different cooperative learning models exist, the core element held in common is a focus on cooperative incentives rather than competition to promote learning.” (Prince, 2004, p. 223)

Problem-based Learning (PBL) is “[a]n instructional method where relevant problems are introduced at the beginning of the instruction cycle and used to provide the context and motivation for the learning that follows. It is always active and usually (but not necessarily) collaborative or cooperative using the above definitions. PBL typically involves significant amounts of self-directed learning on the part of the students.” (Prince, 2004, p. 223)

For the time being, we will continue using active learning as a broader definition to contrast with passive learning to deeper explore the approach. Later we will adopt a narrower

definition to define the learning approach to address our third research question “*What new active methodologies can be considered to promote a teaching-learning process that reinforces the construction of new competencies for designers?*”.

Bonwell & Eison (1991) posits that students prefer classes based on active learning rather than passive. Being the objective of education to promote long and life-learning than active learning strategies are adequate as they promote discussions rather than passive lectures. Hartikainen et al. (2019, p. 2) advocate that active learning emphasises "students' self-construction of knowledge, and students' responsibility for their own learning". Most changes are required to come from the teacher's side, as they are responsible for adapting their methods from content to student-centred (Ferreira, 2020b; Hartikainen et al., 2019). Although it encourages autonomy and pro-activeness from the students it does not mean that the educational process is something that the students do alone, since the guidance in the process is necessary (Cross, 1982; Hartikainen et al., 2019).

However, research has shown that passive learning methodologies dominate higher education classes (Bonwell & Eison, 1991). This reality is not particularly accurate for Design. Design Education naturally follows a project-based learning (PjBL) approach, where most of the core disciplines, and consequently the professional life of a designer, tackle the solution of a project usually materialised through a Design brief. While it is not uncommon to find professors' initiative to integrate an outside partner figuring as a Design client, the usual type of projects in educational Design briefs are in its majority a fictional project.

In Design Education, the projects are usually proposed by a professor as a method for students to learn the Design competencies necessary. Thus, we see in Design Education a fertile ground for such a change as it is already somewhere in between passive and active learning, with both approaches coexisting. Also, being keen on experimentation and risk-taking are vital characteristics of Design as a discipline. A more student-centred approach has been connected to better learnings and the development of working life skills and competencies (Hartikainen et al., 2019), a significant positive outcome that is initially related to our research.

1.8.1. Problem Based Learning

Early in this chapter, we have established that society faces a growing number of challenges, and we argued that Design must play a role as an active agent of change. In our understanding, this implicates a shift in how Design Education must train future designers to tackle complex and wicked problems. We also question how Active Learning Methodologies might help build the competencies in need for this shift in paradigm to happen. Problem-based learning has shown to be a viable approach as it embeds authentic problems in the learning principles (Jonassen, 2011). Hence, while solving problems, students are prompted to learn from it.

PBL is defined as, problem-focused, student-centred, self-directed and self-reflective (Jonassen, 2011), where learning is the outcome of working to resolve a complex, ill-structured problem (Ertmer & Glazewski, 2016). The PBL approach has shown to "promote long-term retention of knowledge and skills acquired during the learning experience or training session" (Strobel & van Barneveld, 2009, p. 55), exhibiting better results than traditional methods.

Beyond presenting better and longer-term retention to knowledge, contemporary research has shown that PBL also outreaches passive learning methods when transferring problem-solving skills to real-life professional situations and building autonomy, collaboration and a lifelong learning mindset (Ertmer & Glazewski, 2016; Jonassen, 2011).

"Problem-based learning (PBL) is currently advocated as a powerful means for facilitating students' attainment of the high level competencies and transferable skills increasingly being demanded by government, commerce, and industry" (Ertmer & Glazewski, 2016, p. 89)

The conjunction of two theories of learning explains the PBL approach: situated learning and cognitive apprenticeships (Jonassen, 2011). Situated learning accounts for the process of learning within real social context while facing problems that occur naturally in a community. By engaging with the community, students are invited to work collaboratively with "individuals with different roles and experience" (Jonassen, 2011, p. 158), allowing them to learn content with context and meaning and requiring them to immerse in the activities of the community. In cognitive apprenticeship, students are stimulated to think not as students but as a master. "Cognitive apprenticeships make explicit the decision making required to perform like a master" (Jonassen, 2011, p. 160), which means that students are embedded in a problem-solving culture and learning from activities that simulate an authentic

apprenticeship, while the teachers pose as masters. Masters that teach knowledge and skills in multiple contexts, explaining the reasoning of processes, helping students think critically about the content they are receiving and providing guidance and feedback along the way (Jonassen, 2011).

However, an approach like PBL is not easy to implement in the classroom (Ertmer & Glazewski, 2016), presenting challenges like building a collaboration culture, adapting to new and unfamiliar roles and “scaffolding student learning and performance.” (Ertmer & Glazewski, 2016, p. 91). These challenges – just as in other student-centred approaches – bring students and teachers an uncomfortable feeling that needs to be overcome in an open-ended learning environment.

1.8.2. Design as an active learning approach

Design Education has broadly been established as preparation of students for professional life (Cross, 1982). Although, there has been a crescent movement to explore the methods of Design in general education to approach problem-solving. Examples can be found on first, second and third cycles of education, at fields not necessarily related to Design as a specialist education (Cross, 1982; d.school, n.d.; Nora Fleming, 2018), which means approaching Design as a way of thinking that is transversal to other professions and beneficial to society, creating a third culture view alongside science and humanities (Cross, 1982).

Cross (1982) articulates the term *designerly way of knowing* in a homonymous paper to explain how designers function. He affirms that “there are things to know, ways of knowing them, and ways of finding out about them’ that are specific to the design area.” (Cross, 1982, p. 223). He relates how designers build knowledge of the processes and the products of Design.

Design problems are usually defined as wicked problems (Buchanan, 1992), meaning that they are ill-defined and structured. For problems of such nature, not all the information is available to the ones to address them, which implies in need to deal with uncertainty and be able to adapt as the process evolve.

“In order to cope with ill-defined problems, the designer has to learn to have the self-confidence to define, redefine and change the problem-as-given in the light of the solution that emerges from his mind and hand.” (Cross, 1982, p. 224)

In that sense, processes of Design – in opposition to science – are related to seeking a fast and satisfactory solution, synthesising patterns that indicate the best way to proceed, as rarely the solution is amongst the available data or are to be found in a prolonged analysis of the problem. The processes of Design are the approach designers use to build their knowledge. Designers rely on the way they design (process) to explain how to achieve the expected results. This inability to externalise their knowledge explains why “Design Education is forced to reply so heavily on an apprenticeship system of learning” (Cross, 1982, p. 224).

The second path that designers take to construct their way of knowing comes from designing products or “knowledge that resides in object”. Designers learn from the outcomes as much as they learn from the process itself. Being able to read from and write in the material culture allow designers to understand the messages cast by objects and "create new objects which embody new messages" (Cross, 1982, p. 225).

The designerly way of knowing embodies a clear relationship to what we have described as Active Learning characteristics, especially with PBL, as we can see in Design vital elements of both *situated learning* and *cognitive apprenticeships*. Just as in situated learning, Design builds knowledge from the context of authentic problems and engaging in a relationship with the community. As for the cognitive apprenticeship Cross (1982, p. 222) arguments that:

"Traditionally, design teachers have been practising designers who pass on their knowledge, skills and values through a process of apprenticeship. Design students 'act out' the role of Designer in small projects, and are tutored in the process by more experienced designers. These design teachers are firstly designers, and only secondly and incidentally teachers."

1.9. From Design knowing to Design Thinking

As of this point, we have established a clear relationship between active learning, namely problem-based learning, with the way designers act, make decisions towards problems and build knowledge. Nevertheless, there is still the need to ascertain a plausible framework to be the basis for a structured understanding of Design. In that sense, Design Thinking adds two particular benefits. It poses as a problem-solving mindset and provides a clear picture of the Design process that allows Design Education to build upon. Next, we aim to discuss and explore the two cited benefits.

It is common to find many different definitions of Design Thinking as the term was widely adopted not only by the Design and creative industry but also by many businesses as a mindset for Innovation and organisational challenges (Howard, 2015). There seems to be agreement on some level when we face Design Thinking as a problem-solving framework that relies heavily on a human-centred approach, seeking meaning and insights from people's behaviour (Brown, 2009; Plattner et al., 2011). Alt & Pinheiro (2011) reinforces the human centricity of Design Thinking, claiming it to be about people addressing wicked problems through the lens of those facing the challenges and issues.

One powerful, and perhaps purposefully hidden side-effect of the popularity of Design Thinking, and its human-centred approach was re-positioning the designer – at least in theory – as a thinker, creative and innovator (Rocha et al., 2018a). A welcome outcome that contrasts with the criticised approach (Margolin, 2014; Shedroff, 2009) that dedicates merely to visual and aesthetics where Design generated little to no positive impact in the world and on people.

In education, Vezzoli et al. (2014) point to leading Design institutes that have been pursuing Design Thinking training to address many real-world problems by developing competencies such as macro perspective, system thinking, holistic perspective, process innovation and co-creation facilitation. The author elucidates, "once a designer possessed design thinking capabilities, he or she could take on various types of design works such as service design, system design, organisational design, business innovation, and even social design." (Vezzoli et al., 2014, p. 476)

Two of the institutions cited by Vezzoli et al. (2014) are the d.school at Stanford University and the Hasso-Plattner Institute in Postdam, Germany. Since their establishment, these schools have introduced the Design Thinking methodology to problem-solving from a human-centred perspective to students from many distinct areas such as medicine, business, engineering and humanities (Plattner et al., 2011).

In their work *Design Thinking: Understand – Improve – Apply*, Plattner et al. (2011) seek to explore the Design Thinking approach from a scientific perspective publishing the result of HPI Stanford Design Thinking Research Program. "The HPI-Stanford Design Thinking Research Program is a rigorous academic research applied to understanding the scientific basis for how and why the innovation method of design thinking works" (Plattner et al., 2011,

p. xvi). The study attempted to find evidence to support an approach that long has been considered relevant but lacked understanding and scientific basis.

The program was constructed with a multidisciplinary approach, where researchers from different backgrounds explore Design Thinking to research questions, such as, *What are people really thinking and doing when they are engaged in creative design innovation? How can new frameworks, tools, systems, and methods augment, capture, and reuse successful practices?* and *What is the impact on technology, business, and human performance when design thinking is practiced?* (Plattner et al., 2011, p. xvi)

One of the key findings of the research program was the four rules of Design Thinking (Plattner et al., 2011, p. xv):

- The Human Rule: The success of Innovation through Design Thinking is tied to a human-centred approach. It is “imperative to solve technical problems in ways that satisfy human needs and acknowledge the human element”.
- The Ambiguity Rule: Excessive constraints and fear of failure are players against Innovation and discovery. “Innovation demands experimentation at the limits of our knowledge, at the limits of our ability to control events, and with freedom to see things differently”.
- The Redesign Rule: "All design is redesign" (Plattner et al., 2011, p. xv). Designers must understand what has worked in the past and how problems have been addressed, then apply tools to "better estimate social and technical conditions we will encounter 5, 10, or even 20 years in the future”.
- The Tangibility Rule: Prototypes and models are communication devices. By making ideas tangible, prototypes enable and facilitate feedback as communication. The authors classify the "make it tangible" rule as one of the most significant findings of the research program.

Based on what has been presented, it is safe to classify Design Thinking is a mindset for creativity, Innovation and experimentation with a robust human-centred approach.

However, one crucial factor of success for Design Thinking was its ability to communicate the Design process, which allowed it to be replicated, adapted and taught. In that sense, we analyse two of the principal and more popular Design Thinking models. The first being the

five-step process used at the d.school and the second the framework designed by UK's Design Council called Double Diamond.

1.9.1. The d.school framework

Arguably, the most popular Design Thinking framework originates from the d.school at Stanford, being especially pertinent to our research due to that it has been used for educational purposes of teaching Design Thinking. Their program is designed to "unleash creativity", by enticing radial collaboration from students and faculty in any course and background while working in real-world problems from non-profit, corporate and government organisations (d.school, n.d.).

The model proposed and applied by the institution composed of a five-step process (Figure 7). The steps (or modes) identify the components and moments in Design Thinking: empathise, define, ideate, prototype and test (Doorley et al., 2018).

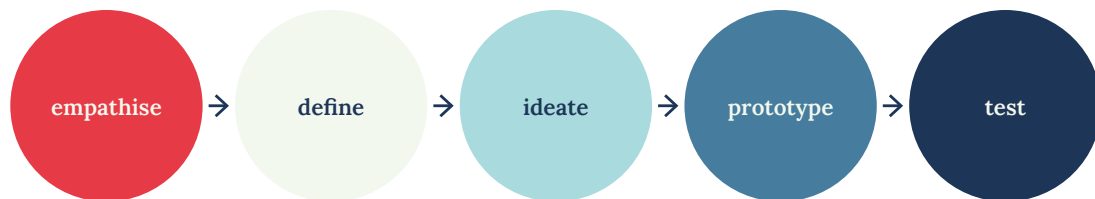


Figure 7: d.school's five-step process. Adapted from Doorley et al. (2018, p. 2).

As problems designers are trying to solve are rarely their own, it is necessary to build empathy with the user and learn about their values expectations. Empathy is built with observation, engagement and immersion (Doorley et al., 2018).

Building from the empathy model, the designer clearly identifies or defines the problem to be solved. Based on the users' understanding and their environment, a problem statement is then created (Doorley et al., 2018).

The ideation phase is dedicated to generating a large number of Design proposals as diverse and radial as possible, setting the field for prototyping and testing (Doorley et al., 2018).

Prototypes are models that materialise the ideas and allow for interaction with the team of designers, stakeholders and users. Prototypes serve to gain empathy, explore, test, and inspire others (Doorley et al., 2018).

By testing the prototypes, the Design team can gather meaningful feedback that enables iteration that help refine the solutions, learning from the users (Doorley et al., 2018).

It is essential to recognise that although Design Thinking is graphically pictured as a linear (or circular) process, "while the stages are simple enough, the adaptive expertise required to chose [*sic*] the right inflection points and appropriate next stage is a high order intellectual activity that requires practice and is learnable" (Plattner et al., 2011, p. xiv). See Figure 8.

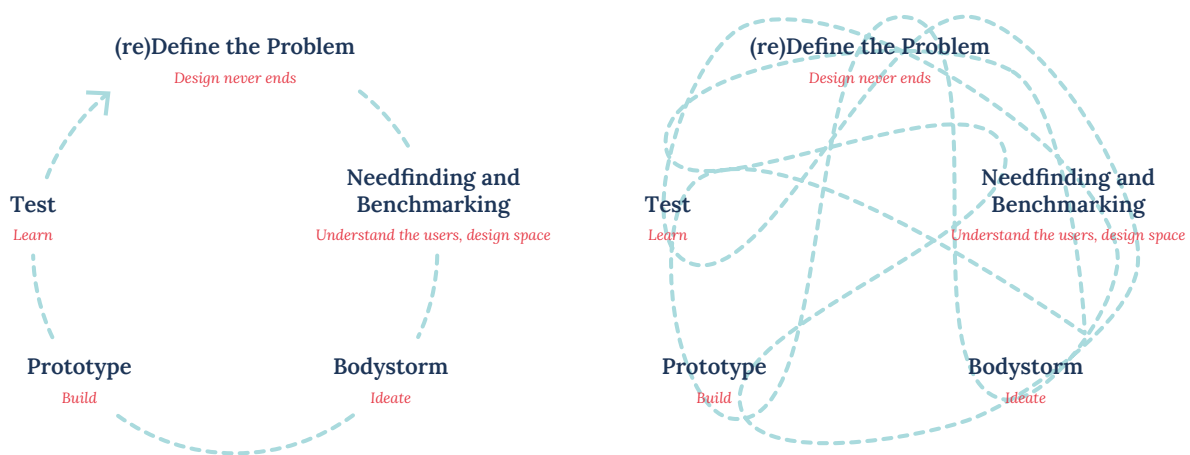


Figure 8: Design Thinking process: *Expectation vs Reality*. Adapted by the author from Plattner et al. (2011, p. xiv).

1.9.2. Double Diamond Framework

The second Design Thinking model we analyse in the one proposed by UK's Design Council called the Double Diamond. This framework is especially relevant as it was thought to be an attempt from the institution to answer the "How do we describe the design process?" (Ball, 2019). The pursue for the answer rose from the idea that in order to promote better positive impacts of adopting Design as a strategic approach, a clear message about the discipline ought to be communicated (Ball, 2019), which still failed to occur. A team of specialists with different skills and experiences worked to define Design, it is processes and methods, culminating in the model now known as the Double Diamond. Since then, the framework has

become an influential description of the Design process and "is used and referenced worldwide" (Ball, 2019).

A more comprehensive explanation of the work behind the development of the framework can be found in the article *The Double Diamond: A universally accepted depiction of the design process* written by Jonathan Ball (2019) for the Design Council website. Here we will be limited to present the model's structure, which "is based on four distinct phases that the team, deliberately seeking a memorable device, named Discover, Define, Develop and Deliver" (Ball, 2019). The graphic representation of the framework (Figure 9) resembles two diamonds side-by-side, explaining the origins of the name.

"This representation of the Double Diamond remains unchanged today. Two diamond shapes starting with the initial challenge or problem statement to the left, moving through a definition of the problem to be addressed in the centre and ending with the solution to the right. The diamond shapes represent how divergent and convergent thinking fit within each stage." (Ball, 2019)

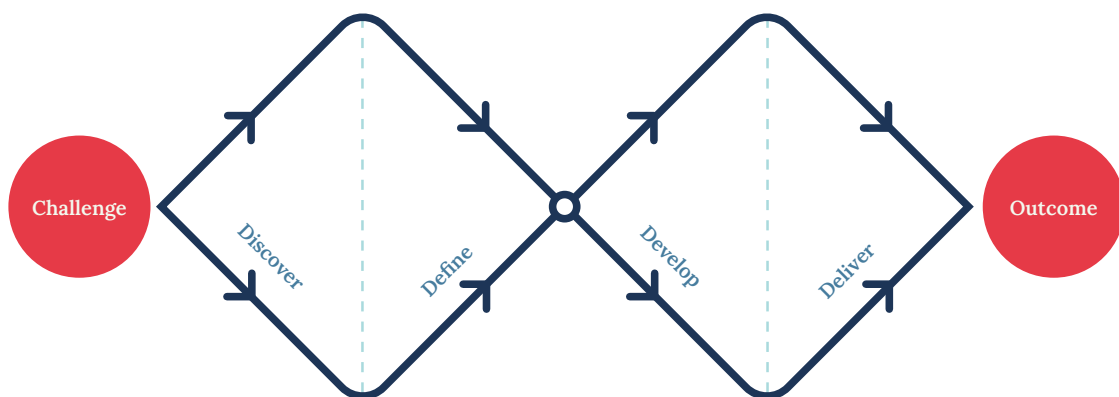


Figure 9: Simple representation of the Double Diamond. Adapted from Ball (2019)

Discover is the first phase of the process which starts by questioning the challenge broadly, leading to research and identification of users' needs (Ball, 2019).

With the information from the research at hand, the second phase, Define, deals with making sense of the data and creating a Design brief that frames the challenge, according to what has been discovered (Ball, 2019).

The following moment deals with ideation, developing, testing and refining potential Design solutions (Ball, 2019).

Deliver, the fourth and final phase, encompasses choosing one of the solutions that have been tested and work to be further developed and prepared for launch. (Ball, 2019)

Just as we have established for the d.school framework, it is important to reinforce that contrary to what the arrows on the diagram in Figure 10 may suggest, the process here is also not linear. Many variables define the project's course and the need to reframe the challenge and go back steps for further ideation or even testing in the early stages. The nature of the project and experience of the Design team allows the manipulation of the model to fit each case. Finally, in "an ever-changing and digital world, no idea is ever 'finished'. We are constantly getting feedback on how products and services are working and iteratively improving them." (Design Council, 2015b)

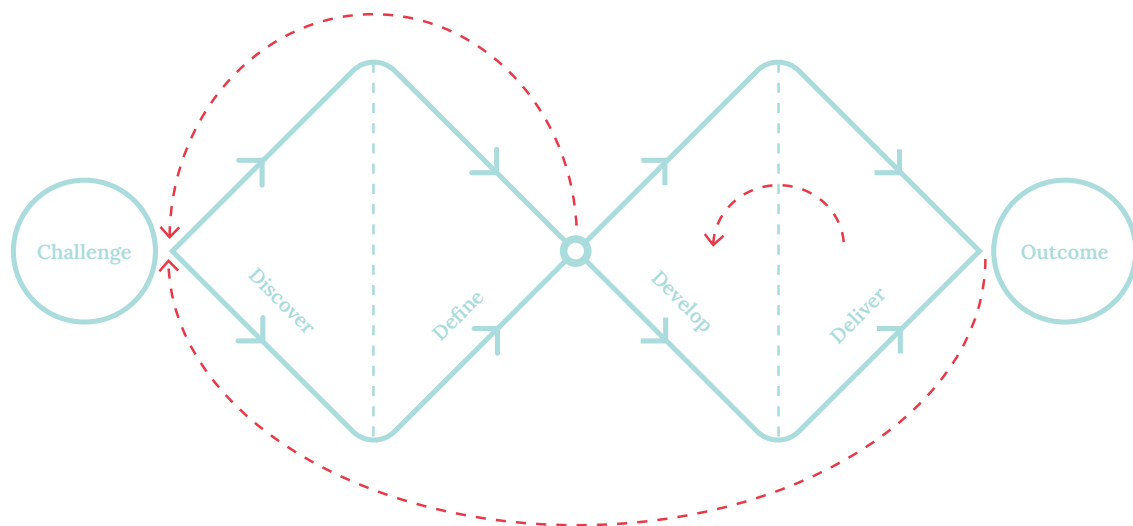


Figure 10: The non-linearity of the double diamond. Adapted from Ball (2019)

Alongside the process materialised in the shape of the Double Diamonds, the Design Council has defined four core Design principles to guide problem-solvers in the path to be as effective as possible. These principles are: Put people first; communicate visually and inclusively; Collaborate and co-create; and iterate, iterate, iterate (Design Council, 2015b).

1.9.3. Convergent and divergent thinking in problem-solving

Both frameworks that we presented in the previous items have no intention to create a new Design process but rather seek to systematise the steps to address the lack of visibility (Ball, 2019) of the Design process and help communicate and engage the Design and the non-Design community. It is noted and expressed that the kite shape adopted by the Double Diamond framework can be traced in as far back as the 1960s (Ball, 2019). Attempts to systematise the creative process of Design have been made by many authors (Ball, 2019; Santos, 2018; Tschimmel, 2010), continually relying on cycles of divergent and convergent thinking (Figure 11), in an iterative process.

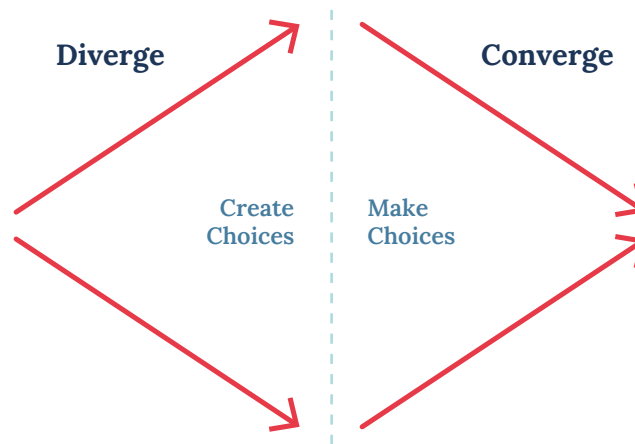


Figure 11: Convergent and divergent thinking, adapted from Brown (2009, p. 41).

Divergent thinking accounts for the first half of the creative process where the goal is to achieve a high quantity of different options and new possibilities to address a particular problem or challenge (Brown, 2009; Chevallier, 2016; Lubart & Thornhill-Miller, 2017; Santos, 2018; Tschimmel, 2010). In Design, this phase relies enormously on the insights gathered at the research process (Brown, 2009). Generating a significant amount of ideas increase the possibilities to be innovative (Lubart & Thornhill-Miller, 2017). The authors attribute this outcome to the nature of the sequence of ideas, where the first are usually more common, while the unconventional ones come later in the sequence, "once the common, shared ideas have been exhausted." (Lubart & Thornhill-Miller, 2017, p. 283).

On the other hand, convergent thinking calls for thinking critically (Chevallier, 2016) and deciding for the best solution amongst the existing alternatives, giving the challenge's constraints (Brown, 2009; Lubart & Thornhill-Miller, 2017). Whilst convergent thinking is often associated with finding the one right answer, Lubart & Thornhill-Miller (2017, p. 283) invite problem-solver to instead, “consider the more general sense of convergence in which various elements are brought together to lead to a single response”. Integrating and synthesising ideas during the creative process opens a space for the innovative novelty to rise.

Comparing both frameworks under analysis, we can identify the divergent and convergent thinking as follows:

Table 1: Comparison of stages in divergent and convergent thinking for the d.school and Double Diamond frameworks.

	d.school framework	Double Diamond
Divergent Thinking	Empathise Ideate Prototype	Discover Develop
Convergent Thinking	Define Test	Define Deliver

1.10. Overview on competencies

One of our main questions of research “*What are the set of skills needed to the designer in a paradigm shifting world?*”, enquires how Design Higher Education is currently preparing future designers to face the increasing complexity and crisis that society faces nowadays. As we have laid in item 1.5.2 of this Thesis, Design faces a growing pressure to be an active agent towards change, requiring skills beyond what Design Education is now providing. In Chapter 5 we present a more concrete answer to that question. Before moving forward with our research, it became necessary to properly understand the definition of 'skill' and 'competency'.

1.10.1. Clarifying the difference between Skills and Competencies

As our research evolved, we understood that the meaning attributed to a 'Skill', was not enough to define the capacity needed to answer our research question. We comprehended that designers must not only gain new skills but rather develop a new range of competencies.

Often, in the literature, there is a misuse of the terms 'Skill' and 'Competency' adopting them as a synonym (UNESCO, 2015), while there are apparent differences between the two terminologies. Skill is considered the ability to fulfil a particular task (Sanghi, 2007), and many authors frequently refer to it as a component of Competency. While there is not a unified definition for Competency, there seems to be an agreement (Bacigalupo et al., 2016; Draganidis et al., 2006; Sanghi, 2007; Tripathi et al., 2010; UNESCO, 2015) that a Competency is broader in scope, being composed usually by a “cluster of skills” (Earnest & Melo, 2001, p. 2), that blended compose a fine-tuned whole.

While the literature agrees that a Competency is composed of other parts, there is no full agreement on the parts itself. For Earnest & Melo (2001, p. 2) a Competency is “a cluster of skills consisting of cognitive (intellectual) skills, practical skills and social skills/attitudes, skilfully weaved together into a whole.” Tripathi et al. (2010, p. 214) describe as "a combination of skill, attitudes and behavior that an individual or an organisation is competent at, that is, the ability to deliver; perform" a set of tasks, with affluence. Closely relating a Competency to a professional component, Draganidis et al. (2006, p. 2) approached the term as a “specific, identifiable, definable, and measurable knowledge, skill, ability and/or other deployment-related characteristic (e.g. attitude, behaviour, physical ability) [...] necessary for, or material to, the performance of an activity within a specific business context”. In the same setting, Ernest (as cited in Tripathi et al., 2010, p. 214) sees a Competency “as a statement which describes the integrated demonstration of a cluster of related skills and attitudes that are observable and measurable necessary to perform a job independently at prescribed proficiency level”. At least, three authors Dranganidis & Mentazas (as cited in Tripathi et al., 2010), Parry (as cited in Sanghi, 2007) and (Sanghi, 2007) closely define a Competency as a cluster of Knowledge, Skills and Behaviour (or Attitude) necessary to effectively perform a professionally. Sanghi (2007), adds a fourth element, ability, to his definition.

Table 2 intends to summarise parts identified in each of the definitions studied to provide visual organisation and allowed us to choose a definition of Competency to be followed by this research.

Table 2: Summary of parts of a Competency (Draganidis et al., 2006; Earnest & Melo, 2001; Sanghi, 2007; Tripathi et al., 2010).

(Earnest & Melo, 2001)	(Tripathi et al., 2010)	(Draganidis et al., 2006)	Ernest, (1989)	(Dranganidis & Mentazas, 2007)	(Parry 1996)	(Sanghi, 2007)
Cognitive / Intellectual Skills	Skills	Skills	Skills	Knowledge	Knowledge	Knowledge
Practical Skills	Attitude	Abilities	Attitude	Skills	Skills	Skills
Social Skills	Behaviour	Behaviour		Behaviour	Attitude	Attitudes
		Physical Ability				Abilities
		Attitude				

In the context of this research, we understand a Competency as a set of *skills*, *knowledge* and *attitude* that crafted together allow to perform professionally proficiently. For that, it is necessary also to define the parts of the Competency:

- Skill: Building blocks necessary to perform a task with purpose and in a non-reflexive matter to accomplish a physical or mental task. (Heimlich & Ardoin, 2008; Spencer & Spencer, 1993)
- Knowledge: “Information a person has in specific content areas.” (Spencer & Spencer, 1993, p. 10)
- Attitude: “A hypothetical construct of one’s disposition to respond – favourably or unfavourably – to an object, person, institution or event. An attitude cannot be directly observed. (Ajzen, 2005)

1.10.2. General Competencies for the 21st century

Three reports published recently, two by the World Economic Forum (WEF) (Leopold et al., 2016, 2018) and a third by the OECD (2018), analyse the future of jobs and education respectively, addressing the skills and competencies necessary to future generations. Although focusing on different perspectives, both reports agree on many grounds as they elucidate a moment of profound transformation and envision uncertainty as a decisive factor for the future forcing transitions between jobs for millions of workers that must proactively

"investment in developing a new surge of agile learners and skilled talent globally" (Leopold et al., 2018, p. v). These ideas in the Design realm were also underlined also by Ferreira (2020b).

The report *The Future of Jobs* was first published in 2016 (Leopold et al., 2016) and updated with new data and conclusions in 2018 (Leopold et al., 2018). The documents that society faces the beginning of the fourth industrial revolution, where technology plays a big part. Fundamental transformations will affect jobs, threatening some that will suffer from redundancy while others either grow rapidly, change or emerge. In 2016, the time of the first publication, the most demanded occupations did not exist ten or five years before. Also, it was expected that 65% of the children in primary school would work in a job type yet to be created (Leopold et al., 2016). These significant transformations call for a set of skills that are not being addressed by teaching institutions, which calls for measures and action also from businesses.

“While much has been said about the need for reform in basic education, it is simply not possible to weather the current technological revolution by waiting for the next generation’s workforce to become better prepared. Instead it is critical that businesses take an active role in supporting their current workforces through re-training, that individuals take a proactive approach to their own lifelong learning and that governments create the enabling environment, rapidly and creatively, to assist these efforts” (Leopold et al., 2016, p. v)

Regardless of responsibility, the change in motion must be addressed to provide the necessary set of skills to face such changes driven by a variety of reasons ranging from the shifting nature of work (flexible work), climate change and consumer ethics and privacy issues to technological drives such as mobile internet, big data, the internet of things and artificial intelligence, to name a few (Leopold et al., 2016). Some impacts have already been felt while others are expected to impact the current industry in the coming years.

Aiming to provide a direction for skills development, the report's 2018 update identifies skills' demand trends. The document points to a fall in demand for physical and manual skills and growing demand for analytical thinking and Innovation and active learning (Leopold et al., 2018). The top ten trending skills demand for 2022 listed by the report are:

- Analytical thinking and innovation
- Active learning and learning strategies
- Creativity, originality and initiative

- Technology design and programming
- Critical thinking and analysis
- Complex problem-solving
- Leadership and social influence
- Emotional intelligence
- Reasoning, problem-solving and ideation
- Systems analysis and evaluation

With a focus on education, a second report called *The Future of Education and Skills Education 2030*, published by the OECD (2018) also argues that the uncertainty of the future calls for citizens that are open and ready to face such scenario. As stated by the first WEF report, many job types people will perform in the future still do not exist (Leopold et al., 2016). Schools must prepare the future generation to be ready and flexible to deal with "technologies that have not yet been invented, to solve problems that have not yet been anticipated" (OECD, 2018, p. 2).

Basic skills that fit well-bounded problems will no longer be enough, and a need for a broad set of knowledge, skills, attitudes and values was identified. Curiosity, imagination, resilience and self-regulation will play an essential part in helping future generations deal with the unstable scenario that the researchers have envisioned.

“Future-ready students need to exercise agency, in their own education and throughout life. Agency implies a sense of responsibility to participate in the world and, in so doing, to influence people, events and circumstances for the better.” (OECD, 2018, p. 4)

The OECD report identifies three categories of competencies, the *Transformative Competencies*, as named by the document. Those competencies address “growing need for young people to be innovative, responsible and aware” (OECD, 2018, p. 5), being the categories: *Creating new value*; *Reconciling tensions and dilemmas*; And *Taking responsibility*. Although the study fails to provide a consolidated list of competencies, it was possible to identify core ones within the description of each category.

Creating new value calls for an urgent movement towards more sustainable and inclusive development, preparing future generations to deal with the growing number of complex

challenges. Creativity, collaboration, adaptability, curiosity and open-mindedness are some of the competencies to be constructed (OECD, 2018).

As the world faces growing inequality, it becomes imperative to reconcile perspectives and interests. The *Reconciling tensions and dilemmas* warn to the need for "people to become adept at handling tensions, dilemmas and trade-offs, for example, balancing equity and freedom, autonomy and community, innovation and continuity, and efficiency and the democratic process" (OECD, 2018, p. 5). It reinforces that individuals must act in an integrated way, as they recognise "the interconnections and inter-relationships between contradictory or incompatible ideas". System Thinking is called for a core competency here.

The last groups of the competencies in the Transformative Competencies model is the *Taking responsibility* category. Classified as a prerequisite to the previous ones, when dealing with uncertainty and the creation of novelty calls for the capacity to "capacity to consider the future consequences of one's actions, to evaluate risk and reward, and to accept accountability for the products of one's work" (OECD, 2018, p. 6). Hence, a sense of responsibility is paramount, which requires the development of abilities and values such as self-control, self-efficacy, responsibility and accountability, critical thinking, problem-solving, ethics and adaptability.

1.11. The gap of knowledge and opportunities for research

Throughout the literature review, it has become evident that society is going through radical changes and facing growing complex challenges that are affecting and defying our current *status quo*. As presented, the claim for change echoes amongst many scholars and authors that dedicate researches to find ways to lead the path and contribute to a new paradigm to be established. At the same time, we see initiatives from the professional field of Design, namely from well-established Design studios that start to understand the active role of Design in imagining and delivering a new approach and mindset for Design. The Design field adapted faster and has contributed to a structured approach to Design that helped establish a clearer understanding of the strategic role of the profession. It also gave birth to many initiatives and methods to address the risen complex problems.

The given situation has raised the issue of rethinking Design Education as a core driver to achieve change as it is not possible to keep training designers the same way we have

traditionally done, focusing mainly on the economic aspect of Design. A consensus amongst the consulted authors is that a dramatic shift in Design Education must occur regardless of what needs to be done. However, unlike the Design field, Design Education fails to adapt fast being tied to regulations and bureaucratic procedures. We have identified evidence of this change happening in non-formal education and specialised graduate courses like Master Courses, which start to tackle Social Innovation and Sustainability.

We understand that the change in Design Education must be focused on building the right set of competencies needed for designers to address complex societal problems and become agents of change. It is also within the responsibilities of Design Education to guide and potentiate the change by providing an environment to criticise the current paradigm and promote a shift in Design practice. The literature has already discussed the competencies for a paradigm-shifting world (Leopold et al., 2016; OECD, 2018), identifying what future generations should focus on to fit the needs of the current century.

Nevertheless, the literature review presented two main gaps posing as opportunities for our research, which we aim to address in the present Thesis. First and foremost, it is crucial to identify the specific competencies needed for the designer to become an active agent of change. Competencies that will allow for a transformation in the way Design must be taught and practised, promoting Innovation, sustainable development and Social Impact. A lack of a clear set of competencies weakens Design Education's ability to solve the issue, as it fails to provide a path to help build educational programs to address the problem.

Secondly, merely identifying the competencies might still not potentiate the adoption of change by Design Education. Therefore, we have acknowledged an opportunity to propose a new framework built on the top of the competencies, facilitating Design educators to identify methods and tools to promote learning that will not only assure to tackle the complex challenges faced by society but additionally contribute to building a designer that is competent both technically and intellectually to thrive and lead the change in an adaptive fashion. Figure 12 illustrates the gaps in the literature that poses as opportunities for our study.

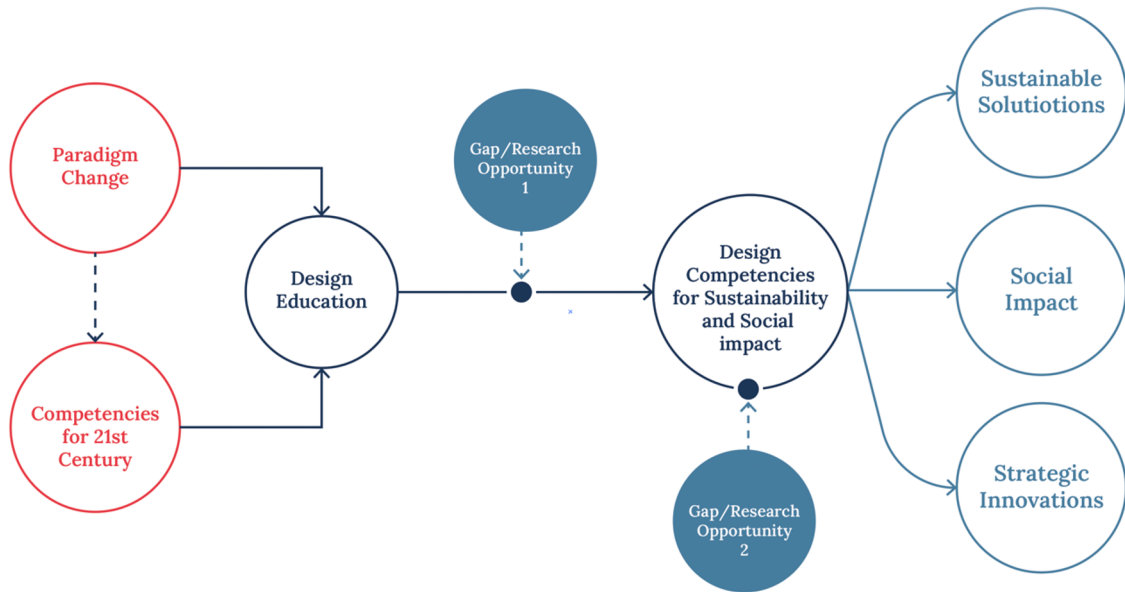


Figure 12: The opportunities for research identified during the literature review.

Linearly, the first opportunity deals with how Design Education shall be addressed (gap 1) to generate the expected outcome, or Design competencies (gap 2). In reality, our research aims first to identify the set of competencies that will be framed as our research's primary outcome. In the sequence, we will focus on building a framework based on the identification of methods and tools that potentiate the development of such competencies, and that can be adopted by Design Education to transition to a new moment successfully.

Based on the present analysis and the identified gaps, we were able to frame our research questions and hypothesis which guided the Design of our research which we introduce in the next chapter.

1.12. Chapter summary

This chapter accounted for the theoretical framework of our study. Starting from the scenario of a paradigm-shifting world, we defined our strategy towards the literature review to have a clear understanding of the state of the art regarding the topic and subtopics related to our research. The overview of Design made clear that although there have been initiatives from the sector to transition to a more aligned practice with the challenges faced by society, the *status quo* is still attached to a practice that values the economic aspects. We also explored the

relationship between Design, Sustainability, and Social Impact to understand how designers can adapt their practice for a more sustainable performance.

Since our research is based on the exploration of how Design Education can foster a designer to act as an agent of change, we overviewed the current moment of Design Education. A clear correlation between Higher Education and Social Impact was made, which reinforced our belief in Design Education's contribution to potentiate positive societal changes. Whilst change must occur, Design Education still struggles to adapt or scale to a new reality (Ferreira et al., 2019), lacking structure to bring to life the necessary professional profile in need. On the other hand, non-formal educational players start to address the needs uncovered by universities. Regarding the learning methodologies that could lead Design Education into the desired transitional path, PBL has shown to be a promising approach. Not only it relies on real problems to build the knowledge, but it also conjugates with Design as a problem-solving activity. In that sense, we explored how PBL and Design Thinking pose as a project framework to support academic projects that solve real problems to help build competencies to tackle complex problems.

In the following part of the chapter, we introduced the concept of competencies, presenting a definition that will define the term throughout this Thesis, based on skills, knowledge, and attitude. This section also analyses a group of publications that address the future of jobs and education regarding the skills and competencies necessary to future generations. Finally, we identify two gaps in knowledge and opportunities of research explored during this study.

Chapter 2

Conceptual framework and research design

2.1. Introduction

This chapter defines the conceptual framework of the study. It introduces research nature followed by concepts regarding the structure of the research following the research onion framework and describe our approach. It states the research questions and hypothesis and presents the layout and overall scheduling of the study.

The research's main objectives are understanding the designer's role as an agent of change and the necessary competencies for an approach towards a more ethical and sustainable society. Such appreciation might fail to be perceived by society as Design has become, for many, a synonym for beautification. However, this mindset is not embedded only in society in general. It also could be found in the minds and ways of doing of designers themselves. This professional attitude must be addressed and shifted for Design to contribute to reflect upon a positive impact in our future.

Design Education is where designers learn how to design and where they become designers. The type of ideological discussion and projects they are exposed to during their academic lives shape the professional they will become after leaving school. At Design schools, students learn the competencies needed to solve problems faced in the following years of their practice. As problems and challenges are changing, the world is now in a paradigm-shifting moment

(Ferreira, 2008a). Designers are starting to deal with more complex issues, that are often unnatural to the more traditional Design approaches taught at Design institutions.

This research addresses how Design Higher Education (HE) must adapt its practice to prepare future designers to respond to society's crises. Design schools must understand the new Design competencies that must be developed to foster the necessary mindset for Design to drive change actively. We understand and acknowledge that the set of competencies that equip designers today are still valuable, but they are not enough anymore. A set of new Design competencies are required and must be seen as pillars to the raise of a new type of designer.

Furthermore, this study roots itself in our practice in public higher education in Brazil. This is particularly important since public higher education in Brazil is completely free of charge for students accepted by the institutions, regardless of their income. Students in social-economic vulnerable situations can even be granted scholarships to cover the necessary costs of transportation, housing and food (Instituto Federal Fluminense, 2016).

According to a ranking published by the newspaper Folha de São Paulo, eighteen out of the twenty top-ranked universities in Brazil are public institutions (Folha de São Paulo, 2019), putting public higher education in the centre of preferences by students all over the country. The opportunity to study for free in public education is a privilege of a small part of the population but financed by them all via taxes. This particular situation creates a social debt since most of the population pays for a small number of students to attend the university.

We discuss how Design HE can help minimise this social debt by adopting learning strategies and approaches that address social and environmental challenges to tackle this issue. Thus, it is of the purpose of this research to support Design HE finds the necessary tools to promote the environment for learning and giving back to society at the same time.

Regarding its methodology, this study is mainly based on the model developed by Saunders & Bristow (2019). The authors argue that before thinking about how data will be collected data in research – which is in the central core of the process – one must first explain their choices. They use an onion analogy, driving the researcher to explore the layers from the periphery to the core. Though we do follow the structure proposed by them, we examine the work for Creswell & Creswell (2018), Leavy (2017) and Morgan (2007), to expand the definitions of the terms applied by this study.

Saunders & Bristow (2019, p. 130) propose a six-layer model (Figure 13) for the Research Onion Framework. Working from outer to inner segments, the layers are:

- Philosophy
- Approach to theory development
- Methodological choice
- Strategy
- Time horizon
- Techniques and procedures.

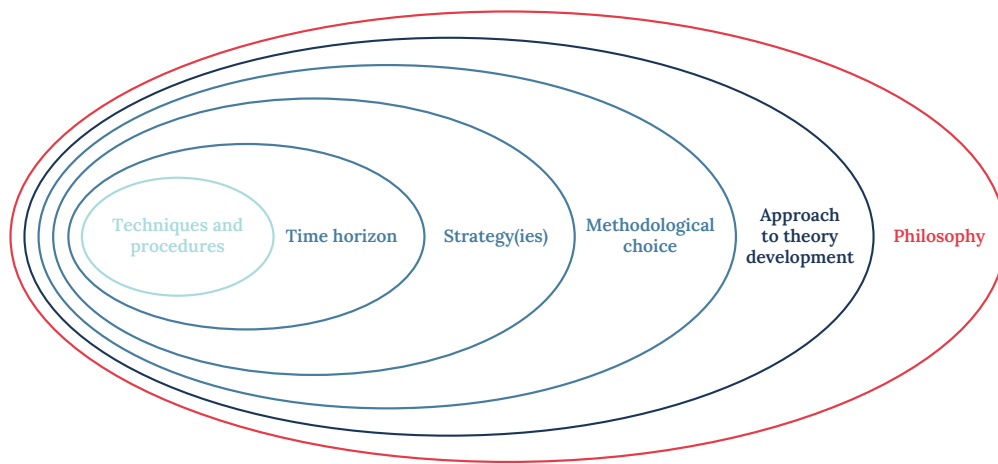


Figure 13: The research onion. Adapted from Saunders & Bristow (2019, p. 130).

Nonetheless, before presenting and describing our decisions for each layer from the model, we first defined the nature or purpose of the research.

2.2. Research Nature and Purpose

The nature of research can be of many types. Consulted authors (Creswell & Creswell, 2018; Leavy, 2017; Saunders et al., 2009) agree on three primary research purposes, which can be classified as *exploratory*, *descriptive* and *explanatory*. Leavy (2017) adds that social research can also be conducted in the form of *community change or action* and *evaluation and evoke, provoke, or unsettle*.

Our study is mainly *exploratory* as it is set to explore the topic of Design Education for Sustainability and its potential to drive change, also opening the possibility of future research to complement our finding in the field, as it was not in our intentions to cover all instances in the topic during the present work. Robson (as cited in Saunders et al., 2009, p. 139) exposes the value of an exploratory study when one wants to unravel "what is happening; to seek new insights".

Exploratory research calls for a predisposition to be flexible and adapt to change (Saunders et al., 2009). Exploring complex problems often reveals new data that can shift the research direction, particularly when starting broad and narrowing the focus as the study advances. This behaviour was noticeable in our path. As we moved forward with the research, our outcomes became not only clearer but also more focused.

Elements of *community change or action research* (Leavy, 2017) can be identified in our investigation, as we have recognised the need for change in society. In the earlier chapters, we have established that the paradigm shift in the world requires what we believe to be a need for the Design Educational community to respond and adapt to the new direction, acting towards a change of practice and mindset.

There is also the presence of elements of an *explanatory* study. That is justified as we aim to understand via a participatory experiment what are the results of the manipulation of Design Education (independent variable) in society, especially the potential impact on social change and Sustainability (dependent variables).

2.3. Philosophy

Research paradigm or worldview (Creswell & Creswell, 2018; Leavy, 2017) addresses the philosophical dimensions of a study – what we believe (Leavy, 2017; Morgan, 2007) – and how it guides our research process. According to Leavy (2017), the philosophical substructure comprises two belief systems, *ontology* and *epistemology*, defining the *research paradigm* (Figure 14).



Figure 14: The components of a paradigm. Adapted from Leavy (2017, p. 25).

Ontology is the assumptions and philosophical beliefs about the nature of social reality”.
(Leavy, 2017; Saunders & Bristow, 2019)

Epistemology is a philosophical belief regarding the assumptions, construction, and validation of knowledge through research. Epistemology concerns the research process, the researcher's role, the relationship with the participants and the strategies to communicate the research findings to others. (Leavy, 2017; Saunders & Bristow, 2019)

The philosophical assumptions (ontology and epistemology) are of two natures, *objectivism*, and *subjectivism*, and are concerned about how social reality is perceived. The former sees the nature of social reality the same way they see the natural world, “exist independently of how we think of them, label them, or even of our awareness of them” (Saunders & Bristow, 2019, p. 135). While the latter affirms that social reality is the result of people's perception and actions (Saunders & Bristow, 2019).

In our research, we adopt the subjectivism approach. Ontologically, we agree that the social world is constructed based on multiples realities, dependent on context. Subjectivist investigations reach for different opinions and how they help build distinct social realities and are aware of the need for continuous adjustment in the research process. For them, "social phenomena are in a constant state of flux and revision” (Saunders & Bristow, 2019, p. 137). Epistemologically, our research values opinions rather than facts as accepted knowledge, and meaning is attributed according to individuals and context. Subjectivism is also highly value-shaped, as researchers “openly acknowledge and actively reflect on and question their own values [...] and incorporate these within their research” (Saunders & Bristow, 2019, p. 137).

2.3.1. Pragmatism philosophy

Saunders (2009) argues that it is unlikely for a research question to fit in only one philosophical domain or paradigm. When these borders are significantly blurred where not a single method is enough to answer the research questions, the pragmatism philosophy is defended as a fit, favouring mixed methods (Creswell & Creswell, 2018; Leavy, 2017; Saunders & Bristow, 2019).

The pragmatic philosophical belief derives from the work of Charles Sanders Peirce, William James, John Dewey and George Hebert Mead in the late-nineteenth–early-twentieth century (Creswell & Creswell, 2018; Leavy, 2017; Saunders & Bristow, 2019). It is concerned with what works to solve a problem, meaning that pragmatists worries last with siding with a research method and first with using all available approaches to understand the issue at hand (Creswell & Creswell, 2018).

In a pragmatic practice, researchers are given the freedom of choice, not being committed to any particular system, rules or theories (Creswell & Creswell, 2018; Leavy, 2017), therefore allowing for the use of different tools during the research course.

“Researchers value utility and what works in the context of a particular research question. Pragmatists “focus on the outcomes of action” (Morgan, 2013, p. 28), suggesting that whichever theories are useful in a particular context are thereby valid. Any of the methods and theories reviewed in this text may become a part of a pragmatic design.” (Leavy, 2017, p. 26)

For that, pragmatists reject the idea of choosing from one of the two extremes of research methods and results. Nevertheless, it is crucial to critically understand how we can use what we have learned from tools and techniques under one circumstance and lever it to use the acquired knowledge in different situations, a concept Morgan (2007) calls *transferability*.

As presented earlier – for pragmatists – research always occurs in a context, which is particularly relevant to our study as it relies heavily on the moment and social context presented in the previous chapters of this Thesis. Thus, a pragmatic philosophy offers proper guidance, as it allows for abductive, intersubjective and transferable approach (Morgan, 2007) to our research.

2.3.2. Approaches to theory development

Melles (2008) emphasise the relevance of pragmatism in the Design field as it is appropriated to deal with wicked problems. As they are ill-defined, it seems unjustified to adopt a polarised approach and instead rely on an *abductive* approach (Morgan, 2007; Saunders & Bristow, 2019), moving back and forth from *induction* and *deduction*, combining both systems into one “first converting observations into theories and then assessing those theories through action” (Morgan, 2007, p. 71).

Due to its flexibility (Saunders & Bristow, 2019), the abductive approach is suitable for our research. Though it fits other research philosophies, abduction is very likely to be applied at pragmatic studies, building on the idea that except for inside the literature, research can rarely be pure inductive or deductive (Morgan, 2007; Saunders & Bristow, 2019). Thus, emphasising the potential of seeking points of connection and exploring the relationships between different methods and data acquired, for the research in motion.

2.4. Methodological choice

There are three main methodological choices attributed to research (Creswell & Creswell, 2018; Saunders et al., 2009), two naturally sit on opposite sides – qualitative and quantitative research – and one in the middle, mixed methods research, which incorporates methods from both qualitative and quantitative types of research (Muratovski, 2015). Creswell & Creswell (2018, p. 44) though encourages researchers to not take a rigid or dichotomic viewpoint to the two opposing approaches, claiming that they represent instead “different ends on a continuum”, where the mixed method lies in the middle.

The inductive approach usually characterises qualitative research; it explores and understands, in-depth, the meaning people ascribe to social issues. The conclusions may follow a flexible structure to report the complexity of situations. When the research's nature is exploratory or descriptive, these types of methods are generally appropriate (Creswell & Creswell, 2018; Leavy, 2017). The data analysis usually generates (and uses) non-numerical data (Saunders et al., 2009).

In contrast, *quantitative research* relies on a deductive approach and aims to either confirm or discredit existing theories by exploring the relationship among variables. The results are

statistical data and are presented in a stricter structure as numerical information. The findings from this type of research are usually replicable and generalisable. (Creswell & Creswell, 2018; Leavy, 2017; Saunders et al., 2009)

The *mixed methods research* integrates forms of data from qualitative and quantitative research approaches (Creswell & Creswell, 2018; Leavy, 2017; Morgan, 2007; Muratovski, 2015). Researchers believe that combining both methods in the same study allows for additional insights to those acquired by qualitative and quantitative individually and a more comprehensive understanding of the phenomenon under analysis. The mixed-method is essentially problem-centred (Leavy, 2017), making it an asset to address the complexity and create a welcoming analogy to Design itself. Researches of this nature are structurally different, "just as each project will follow a different plan" (Leavy, 2017, p. 135).

Referring back to our research philosophy, our study's methodological choice is essentially a *mixed-method*, as pragmatism favours this approach (Creswell & Creswell, 2018; Leavy, 2017; Saunders et al., 2009).

"As a philosophical underpinning for mixed studies, pragmatism conveys its importance for focusing attention on the research problem in social science research and then using pluralistic approaches to derive knowledge about the problem." (Creswell & Creswell, 2018, pp. 52–53)

Mixed method research is useful to explore multiples angles to answer the research questions and allow for the appearance of potential and unexpected outcomes, and permit to better "evaluate the extent to which your research findings can be trusted and inferences made from them" (Saunders et al., 2009, p. 153).

Additionally, we adopt an additional perspective defended by Leavy (2017). The author advocates in favour of not three, but five primary methods of research. She includes, besides the three already mentioned ones, arts-based research and community-based participatory research. Though mixed-methods mainly support our study, it presents an opportunity to explore, in a smaller fraction, a community-based participatory approach as well.

While most authors place this method as a sort of qualitative research, the community-based participatory research (CBPR) is especially pertinent "when the aim is to promote community change or action" (Leavy, 2017, p. 179), giving it goals and issues "that go beyond the qualitative research design guidelines", she concludes. CBPR brings to the process key

stakeholders of the community where the problem is identified, as they participate in the research process more actively.

2.5. **Strategy**

Saunders et al. (2009) emphasise the need for a clear research strategy, according to the study's nature and purpose in question. While some strategies belong to a deductive approach, others are adequate to inductive. Though the authors reinforce that the most important is to define a strategy that "will enable you to answer your particular research question(s) and meet your objectives" (Saunders et al., 2009, p. 141). By adopting an abductive approach, our research allows for flexibility in the choice of the strategy.

After the literature review, it became clear where the academics stand regarding the need for change in Design Education. Many authors' opinions favour a shift in paradigm due to the growing number of complex problems faced by contemporary society. Though it was clear what needs to change, it is still not clear two fundamental points. The first was to understand if this evident need for change was an opinion shared by the educational community, in particular by the students. The clarification was necessary since students' views can be seen as a mirror of how Design is posed and discussed within the academic boundaries. The second fundamental issue was understanding how Design Education through its practices could act as a driver for sustainable change in the Design approach itself and society, generating a positive impact in the long haul. Our strategy to address the given scenarios was to conduct qualitative and quantitative research to collect the needed information, using surveys and active research elements.

Surveys are considered the most used quantitative method in the social sciences (Leavy, 2017). It allows for collecting data from larger numbers of participants and drawing more generalised conclusions from standardised data, including statistics figures, enabling easy comparison (Saunders et al., 2009).

Surveys are traditionally "used for ascertaining individuals' attitudes, beliefs, opinions, or their reporting of their experiences and/or behaviors" (Leavy, 2017, p. 89). With that said, the surveys' data are usually subject to one's opinion, thus subjective. The administration of surveys allows researchers to "suggest possible reasons for particular relationships between variables and to produce models of these relationships" (Saunders et al., 2009, p. 144).

The nature of our research topic also presents an opportunity to explore Participatory Action Research as a source of qualitative data (Creswell & Creswell, 2018). This strategy allows for the community affected by the study's problem to participate actively in the research process. It is also oriented to improve practices directly by the participants themselves (Kemmis et al., 2014). Participatory research is highly oriented by community action to solve problems and foster change-making, as it affects and engages the community directly and actively.

Besides being academic pertinent, the adoption of a participatory action research strategy in our study is a testimonial of our personal belief that the solution to complex problem passes by the community's involvement. This attitude embodies a commitment to disrupt the sense that the researcher detains the knowledge and makes social actors a crucial collaborative partner, "increasing citizen voice and power" (Kindon et al., 2007, p. 11).

2.6. Time Horizon

There are two primary ways of limiting the time horizon in research. A cross-sectional study allows for the researcher to take a 'snapshot' of one moment in time. A longitudinal study will collect data from several moments to measure how change occurs over time (Leavy, 2017; Saunders et al., 2009). For Saunders (2009), most researches are cross-sectional since the majority of academic studies are necessarily time-constrained, just as it is for our work. Cross-sectional studies are also closely related to the survey strategy (Creswell & Creswell, 2018; Leavy, 2017; Saunders et al., 2009) adopted by us.

Regarding the layer Techniques and procedures, we address these items in Chapter 3, where we introduce the instruments designed to collect the necessary data for our research.

2.7. Research Questions

Research questions are key components of a research project. They are central questions that the researcher seeks to answer and explore (Leavy, 2017). Creswell & Creswell (2018) state that mixed methodology studies should contain at least three questions: a qualitative, a quantitative, and a mixed question.

This mixed-methods question represents what the researcher needs to know about the integration or combination of quantitative and qualitative data. This configuration is necessary

because mixed methods do not rely exclusively on either qualitative or quantitative research but on both forms of inquiry." (Creswell & Creswell, 2018, p. 241)

Research questions are related to the research's objectives and must be reachable (Leavy, 2017). "[T]hese are questions that can be directly answered through research. You will ultimately design a project that is well suited for addressing the research purpose and answering the research questions." (Leavy, 2017, p. 68)

For this research, we have four main questions that we aimed to answer in our study:

1. What is the set of competencies needed for the designer in a paradigm-shifting world?

First and foremost, we wanted to understand, given the current moment of society, the core set of competencies that designer must develop to tackle complex problems and face a growing crisis while remaining relevant as a profession.

2. How can Design Education contribute to generating Social Impact?

Acknowledging the need for change and identifying how designers should evolve, we aimed to understand the role of education in promoting a mindset that reinforces the need for Design to act towards Social Innovation, thus enabling Social Impact as a consequence of their academic path.

3. What active methodologies must be considered to promote a teaching-learning process that supports the development of new competencies for designers?

We discussed the possibilities for Design Education to embrace a problem-based approach as a gateway to building the competencies identified in our first research question.

4. How can designers become more socially responsible agents, aware of the importance of their civic action and active role towards Innovation, social wellbeing, and Sustainability?

Lastly, we aimed to discuss how Design Education can create the necessary awareness in the future Design community, helping designers understand their role in society beyond supporting business and economic growth.

2.8. Hypothesis and Research Variables

Based on our research questions, we formulated our hypothesis, which presumed that *“A new co-design competencies framework is needed in Design Education to foster the competencies necessary for designers to respond to complex problems and become agents of change.”* With that hypothesis, we assume that Design Education is a crucial factor in achieving the expected results in future designers' mindset. We were also able to identify the variables – independent and dependent – of our study and how they relate.

For this study, a new design competencies framework applied in Design Education assumes the value of the independent variable. Independent variables are those that affect the outcomes of a situation or scenario. "They are described as ‘independent’ because they are variables that are manipulated in an experiment and thus independent of all other influences” (Creswell & Creswell, 2018, p. 109). For the present research and based on our hypothesis, we defend that a change in Design Education based on that new framework will produce the desired mindset towards designers to become agents of change.

However, Design Education is a broad subject and can be manipulated in many forms. Here, we focus on understanding how a new set of Design competencies and Design methods promoting Active Learning can significantly change Design Education for the desired outcome. As we identified in our first research question, designers must develop a new set of competencies that will allow them to become agents of change and that Design methods and Active Learning can help build these competencies.

The dependent variables are the “outcomes or results of the influence of the independent variables” (Creswell & Creswell, 2018, p. 109). For our study, these variables are Sustainable Solutions, Social Impact and Strategic Innovation. We believe that a shift in Design Education towards Sustainability can foster change in Design students to generate the expected outcome in their future practice.

In order to validate our hypothesis and prove the dependent relationships between the variables, it was necessary to collect and analyse data using a mixed methodology approach. The design of our research is presented in detail in Chapter 2.

2.9. Conceptual model development

Based on our hypothesis and variables, we designed a conceptual model shown in Figure 15. Design Education is crucial to fostering sustainable solutions, Social Impact, and Strategic Innovation through manipulating Design methods and using an active learning approach. However, the learning practices' immediate outcomes are related to developing a set of proper competencies to build the necessary mindset.

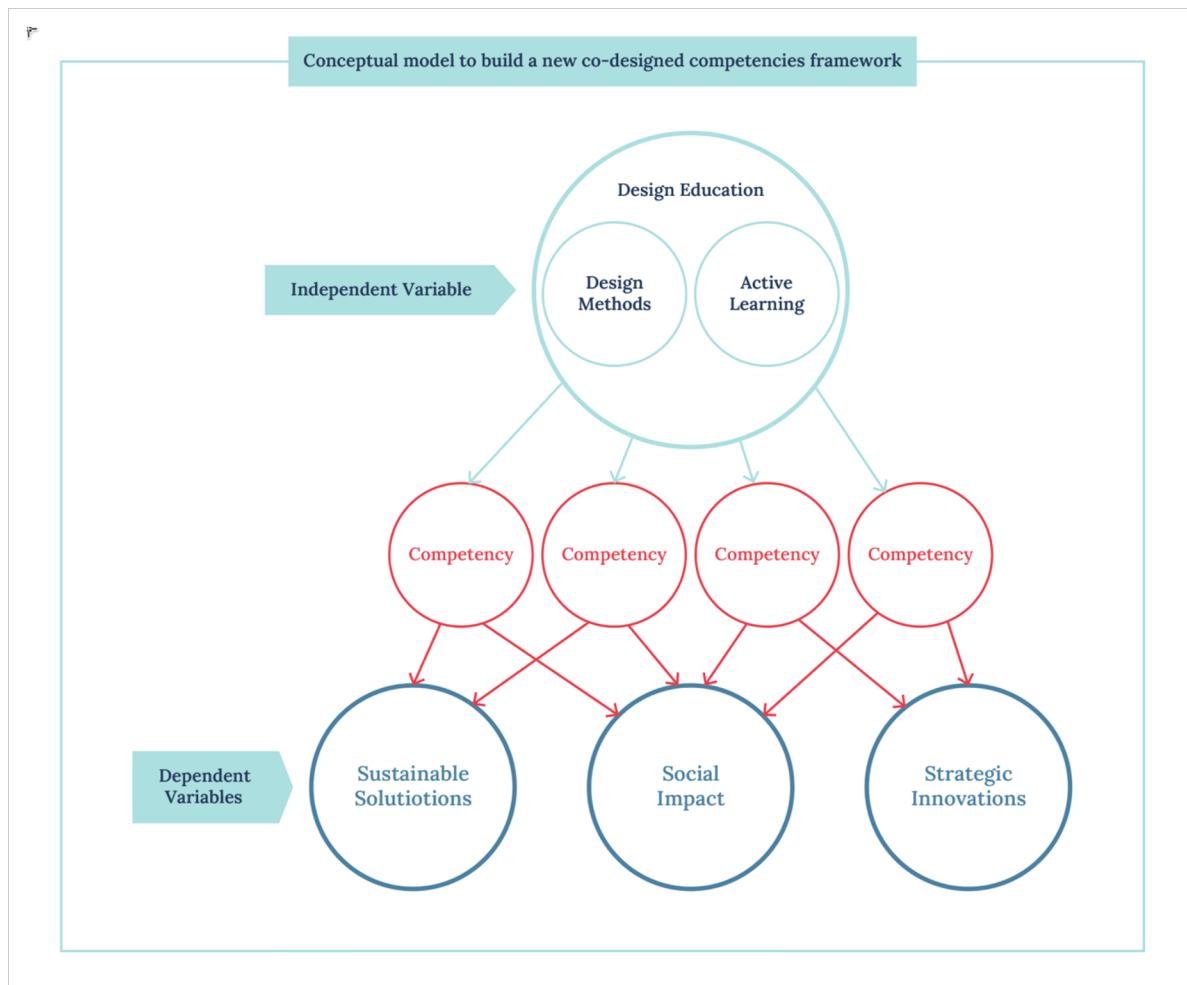


Figure 15: Research's conceptual model and variables.

The conceptual model highlights the development of specific competencies as the necessary means to achieve the desired results. Competencies are crucial in the development of professional attitude and practice. Design Education is still focused on developing Competencies attached exclusively to market needs, leading to unsustainable habits and contributing to consumerism, obsolescence, commerce and waste (Chochinov, 2007; Margolin, 2014; Rocha, Ferreira, & de Azevedo, 2017; Stebbing, 2015). Identifying the core

competencies to tackle wicked problems and Sustainability issues relates directly to our first research question and are crucial for our Thesis.

Our conceptual model considers that Design students enter their educational path with an initial mindset. This mindset is unique for each student, and it originated from their previous education, cultural and historical background. Design students must first develop a perspective that acknowledges the impact their actions have (*Figure 16*) to become agents of change.

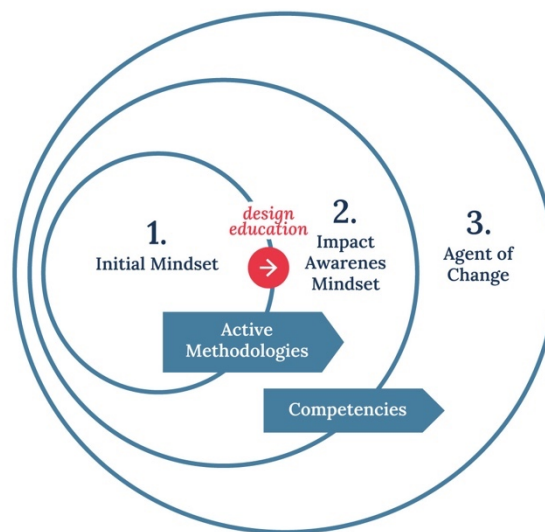


Figure 16: Designer's mindset path to becoming agents of change.

The impact awareness mindset must be built during their formal education, evidenced by the type of project and problems students are exposed to. Hence, Design Education is a critical factor in the transition of mindsets. Without a shift of purposeful direction in Design Education, designers as agents of change are a product of chance and individual endeavours. However, the world has already given enough evidence that we cannot wait anymore.

2.10. Research structure

Our research was designed with three research moments. The first moment comprised the Research Project's definition, which contained the Theme, Title, Research Questions and a preliminary literature review to validate the study's relevance. Additional to the Research Project we conducted during this initial phase, a second and more comprehensive literature

review. Although the supplementary literature review formally belongs to the first research moment, in reality, it was a continuous process that was kept in motion throughout the entire study.

Besides the literature review, we conducted a benchmark analysis on Design Education that culminated in the publication of the paper *Benchmarking Higher Education in Design for Social Innovation and Sustainability: State of Art and future challenges* (Rocha et al., 2018b) presented at the Design Doctoral Conference in 2018. Furthermore, we ran preliminary questionnaires and interviews with the Chief Academic Officer and a group of students of the MA in Design for Social Impact of the Paris College of Art (see Appendix 9:). While the interviews did not provide data directly used in this research, it was crucial to understanding the context of Design Education focused on Social Impact. The information acquired during these interviews also helped us build our research instruments.

The result of the first research moment was a comprehensive state of the art that showed the path worth seeking by evidencing the gaps in knowledge and research opportunities. Figure 17 illustrate the first research moment.

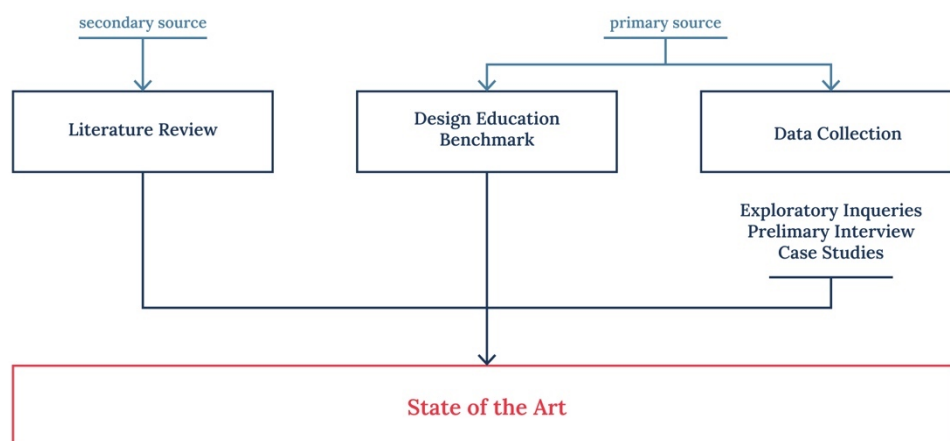


Figure 17: First research moment. Source: Author.

The second moment of research was headed by our hypothesis's statement, as stated on item 2.8, which allowed us to define the instruments to use for the data collection from a broader

audience. We used a mixed methodology approach with a combination of qualitative and quantitative methods.

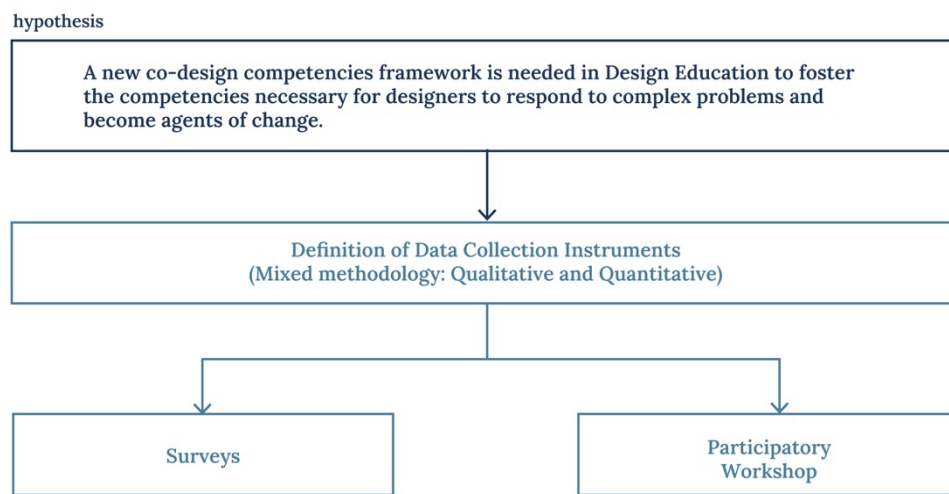


Figure 18: Second research moment. Source: Author.

During the third and final research moment (Figure 19) the data collected during the second research moment, together with the information from the first research moment, were analysed, resulting in this research's primary outcome, the Design Competencies Framework. Finally, we validated our findings and reflected on the results we have accomplished, allowing us to conclude and envision future research, thus consolidating the present work's knowledge contribution.

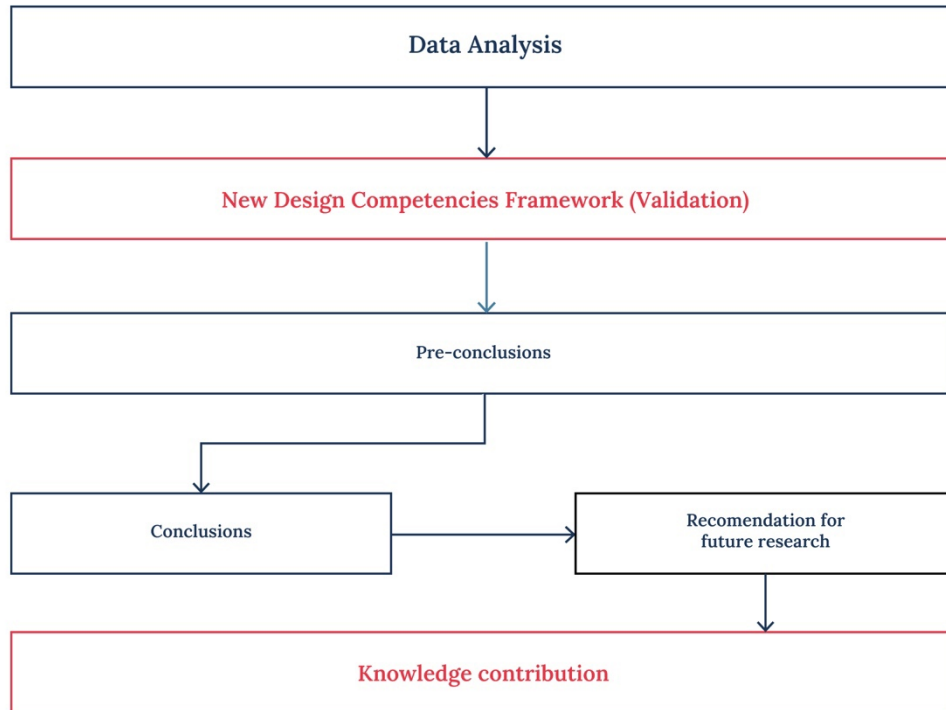


Figure 19: Third research moment. Source: Author.

2.11. Research timetable

The present research occurred during the path of four and a half years. The last year was dedicated to treatment and analysis the data and writing the final document in the form of a PhD Thesis that summarises the research process, findings, and outcomes.

The scheduled chronogram for the research is presented in Figure 20. Besides the main activities described in item 2.10, for the scheduling, we account for other activities that occurred parallel to the research, such as dissemination of the research results and project management. Throughout the investigation, we published seven peer-review papers that contributed to disseminating our findings and ensured our study's validation (see Appendix 10:). Ongoing project management was needed to accommodate necessary changes due to the rescheduling of activities and changes in the research course due to our findings' evolution.

Task	Discription	1st Year	2nd Year	3rd Year	4th Year
1	Literature review				
2	Initial data collection				
3	State of the art				
4	Definition of data collection instruments				
5	Data collection				
6	Competencies Framework Design				
7	Data treatment and analysis				
8	Conclusions				
9	Dissemination of the research project and results				
10	Thesis writing				
11	Research project management				

Figure 20: Research Gantt chart. Source: Author.

2.12. Chapter summary

This chapter defined the methodological decisions for our research. The conceptual structure was built mainly the research onion framework developed by Saunders & Bristow (2019), which comprises a study in six universes: *philosophy*, *approach to theory development*, *methodological choice*, *strategy*, *time horizon*, and *techniques and procedures*. Based on this framework, we have designed an *exploratory* study with *exploratory* and *community change or action research* elements. Following a pragmatic philosophy with a mixed-method research methodology, the study relies on the abductive approach to theory development. The data collection strategy was to conduct qualitative and quantitative research using surveys and elements of active research. This section also accounts for exploring the research questions, hypothesis and variables, and the research structure and scheduling.

Chapter 3

Data collection

3.1. Introduction

In the last chapter, we presented the conceptual framework and research methodology applied to our research. Five layers of the Research Onion Framework (Saunders & Bristow, 2019) were already covered and discussed. In this chapter, we start by introducing the model's sixth layer, *Techniques and Procedures*. We define the sampling strategy for this study and the Design of chosen instruments to collect the necessary data based on our mixed-methodology approach.

3.2. Techniques, Procedures and Instruments

In general, and due to limitations, researchers cannot collect and analyse all the available data (Saunders et al., 2009). In those cases, sampling techniques allow reducing the amount of data to collect by involving in the study a representative sub-group rather than all elements. This approach is valid whenever it is impractical to survey the whole population, when there are budgets and time constraints and when, although a researcher might have all the data, there is an urge for quick results. Saunders et al. (2009) divide the sampling techniques into two distinct types, probability or representative sampling and non-probability or judgemental sampling.

For our study, we will use the non-probability technique based on convenience. This technique is adequate when the research questions do not demand to address objectives that require "statistical inference about the characteristics of the population" (Saunders et al.,

2009, p. 213). The authors highlight that it is still possible to draw generalisations from a non-probability sample, just not statistically.

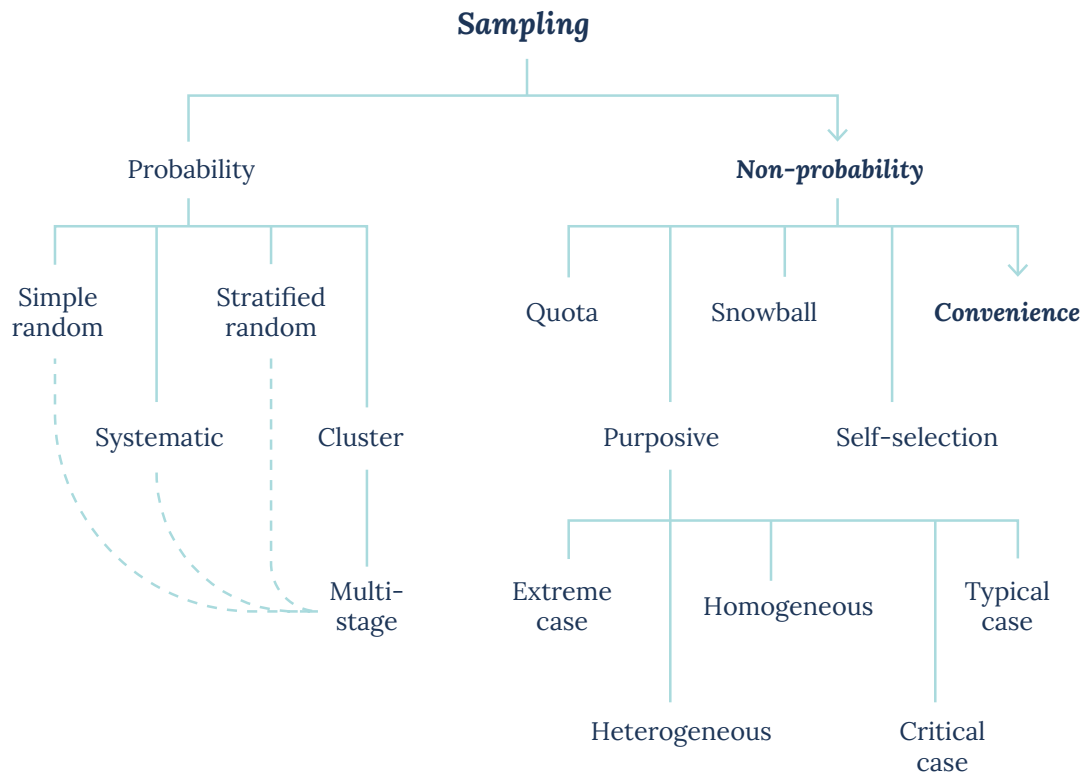


Figure 21: Sample Techniques highlighting, in bold and italics, the choices for this research. Adapted from Saunders et al. (2009)

In our study sampling, we used the convenience technique due first to budget limitations of self-supported research and our work theme. As we developed our Thesis in Design, and more specifically in Design Education, being inside a Design school (IADE – Universidade Europeia) presented an opportunity to build part of the study inside the institution, taking advantage of the proximity with undergraduate Design students. Secondly, the author of this study is also a Design professor with close a relationship with his original institution in Brazil, where he holds a teaching position in the Graphic Design department. Third, since the

second year of this study, we are part of DISCERN⁴ an international project focusing on Social Innovation with universities' participation outside Portugal and Brazil that allowed us to access a more diversified number of students. Lastly, for the final year of this study, the author also held a Lead Teacher position in a UX/UI Bootcamp and was involved in the training of students from three different cohorts in a 9-weeks intensive Design course. Though the Bootcamp does not categorise as an undergraduate course, the project-based methodology adopted played a critical part in addressing one of our research questions, *"What active methodologies can be considered to promote a teaching-learning process that reinforces the construction of new competencies for designers?"*.

Convenience sampling implicates “selecting haphazardly those cases that are easiest to obtain for your sample” (Saunders & Bristow, 2019, p. 241), which implicates limitations. One of them is that generalisations are hard to draw. Also, there is a higher risk of bias and influences beyond the researcher's control, which might also pose as an obstruction for generalisation. To minimise these limitations, we aimed to get our sample as heterogeneous as possible, targeting data from international institutions in diverse contexts and realities.

The pragmatic philosophy and abductive approach allowed the research to evolve organically, using and adapting research techniques adequate to the moment of the research in which we were exploring at a given moment.

Surveys were set to be one of our primary sources of data from the participants in our study. We used mainly questionnaires to acquire data and draw statistic numbers out of the collected answers. Questionnaires are considered the primary tool for data collection in survey research (Leavy, 2017; Saunders et al., 2009). It is a useful tool to perceive generalisation as the respondents are required to answer “to the same questions in a predetermined order” (Saunders et al., 2009, p. 360), providing uniformity and efficiency to collect data from a large sample.

Questionnaires are especially advantageous in the early stages of research. Leavy (2017, p. 89) defends that,

“Although we often think of coding as occurring during the data analysis stage, in survey research the first phase of coding focuses on the format and content of the survey questions or

⁴ DISCERN – Design for Social Change, Sustainable Innovation and Entrepreneurship (Rocha, Ferreira, Souleles, et al., 2017)

survey items (Vogt et al., 2014). In survey research you are already explicitly thinking about assessment and evaluation as you construct your data collection instrument.”

The questionnaire's questions are closely bounded with the research variables, as they are constructed to test the hypothesis and answer the research questions, thus helping understand the relationship between variables (Leavy, 2017).

It is important to emphasise that traditionally designed questionnaires are usually applied to descriptive and explanatory research, working "best with standardised questions" (Saunders et al., 2009, p. 362) as the nature of the questions opted by the majority of researches are close-ended (or forced-choice) (Leavy, 2017). For exploratory research, there is a need for open-ended questions to allow qualitative data to be collected. In questionnaires, these type of questions is pertinent when the research requires "to find out what is upper most in the respondent's mind" (Saunders et al., 2009, p. 375), which was equally important to our research. A downside to using open-ended questions in questionnaires is that since this instrument is administrated in large numbers, the results are highly time-consuming to code (Saunders et al., 2009). Thus, the authors advice to keep them to a minimum.

Leavy (2017) points out that a Community Based Participatory Research, is built over the understanding and commitment to respect multiple types of knowledge. An attitude that requires the researcher to, first, understand their position in the research (including educational privilege). Secondly, it is paramount to the researcher to be opened to learn from the community and value the contribution they have do add to the research.

Participatory research should consider transferability as a goal (Leavy, 2017), where we can use the opportunity to transfer finding from one context to another, from the researcher to the community and vice-versa. Additionally, it is an opportunity to understand the skills and methods that are best suited to solve a problem (Leavy, 2017). The researcher must "develop organisational, relational, and facilitation skills to work effectively with community partners" (Leavy, 2017, p. 192).

In this sense, for our research, we designed a participatory workshop to promote engagement and collaboration with Design students. In the activity, we allowed the participants to have the freedom to discuss their decisions and opinions, making sure to provide an organised structure that allowed a more comfortable collection and coding of the data. For that, we built tools for the participants to interact with and express their opinions through them.

Results allowed to compare and construct a framework that took into consideration the community perception and validate some of our assumptions. In Chapter 5 we thoroughly describe the structure and dynamic of the instrument.

Though the collection of primary data is crucial during the research, many research questions can be answered entirely with the combination of secondary data (Saunders et al., 2009). Secondary data can include raw and published information that may be useful to the research and can be found in books, public and private reports, social communication portals, company's website, to name a few. Once harder to access, secondary data is now widely available (Saunders et al., 2009) in digital form on the internet.

Secondary data is usually useful for a case study or survey strategies, but they also might be at hand in other strategies. Saunders et al. (2009) define three sub-groups to secondary data: documentary, survey-based, and multiple sources data. The latter, which we used for our study, allow us to analyse information not collected by us, both qualitatively and quantitatively. "These data can be analysed both quantitatively and qualitatively. In addition, they can be used to help to triangulate findings based on other data, such as written documents and primary data collected through observation, interviews or questionnaires." (Saunders et al., 2009, p. 258). In our case, data comparison was fundamental to our research as it permitted us to move back and forth from the participatory workshops, questionnaires, and the secondary data to build and refine our model.

Amongst the advantages listed by Saunders et al. (2009) for using secondary data is the possibility of getting more information with fewer resources, which is extremely important for independent research such as ours. With less resource and relying on secondary sources, the researcher can analyse a more considerable amount of data. Another benefit is the likelihood of having higher quality data that allows for the researcher's comparative and contextual approach. "This means that you can place your own findings within a more general context or, alternatively, triangulate your findings" (Saunders et al., 2009, p. 269), resulting, at times, in unexpected new information. Lastly, the authors emphasise that secondary data provide access to data that are more likely to be permanent and available to be checked by others. It is also important to highlight that, being the data collected usually from a high-quality repository, the researcher must be careful with source choice since there is no control of data quality from the research end.

During the literature review presented in Chapter 1, it became clear that Design Education needs to be restructured to respond to the challenges brought by the growing crisis faced by society. Such challenges defy designers to tackle complex problems by nature, affecting the social, economic and environmental spheres. The resolution of complex problems requires designers to be trained in a new set of competencies. The two gaps found in the literature review directed our research to identify four main research questions and directed the research design presented in Chapter 2.

This chapter introduces the instruments designed and used to collect the data alongside the analysis of the findings, which were relevant to address the research opportunities we have identified. Primarily, we aimed to understand, in the case of Design, the core competencies that must be addressed by Design Education to instruct future designers to become potential agents of change, promoting Innovation, sustainable development, and Social Impact. By identifying these competencies, we shall provide Design Education institutions with a clear path to restructuring its *curricula* and actively addressing the need for change.

Once we were able to identify and define the core Design competencies, we focused our research on designing a basic framework build on the top of the competencies. The framework, which development is described in Chapter 5, uses assessed data from the instruments presented to identify how active learning methodologies can promote a process that reinforces the learning of future designers' competencies.

In Chapter 2, we defined our choice for a mixed-methodology model for our research. Earlier in this chapter, we outlined the techniques and procedures to collect the necessary data. Next, we describe the structure of each of the instruments. Chapter 4 accounts for analysis of the data compiled, outlining the key findings. Due to our study's abductive approach, we were able to seek connection amongst different data acquired and triangulate findings for a comparative and contextual approach.

To identify the competencies, we relied on three different and non-sequential moments that later were compared and analysed to compose the final list of competencies presented as one of the results for this study. First, we proceeded with secondary data analyses of published documents that elucidated the need for new professional competencies. Secondly, we applied questionnaires to Design students to gather quantitative and qualitative data via open and close-ended questions. Third, participatory workshops were held in Design schools and

attended by Design students, providing both qualitative and quantitative data do our study. Lastly, all the data were treated and analysed.

3.2.1. Secondary data sources

During the initial literature review presented in Chapter 1, we examined the set of skills necessary for future professional, in a general sense. Those skills became necessary as a new era of uncertainty is envisioned for society and workers. In that sense it became necessary to achieve a deeper understanding of how the paradigm shift would also call for new skills from the Design field, consequentially driving Design Education to adopt the necessary changes in its pedagogical structures and learning methods.

At this initial moment, we relied on secondary data sources for two specific reasons. First, it was paramount to compare how the general core competencies also affect Design as a profession. This comparative analysis provided a primary overview on the specific subject of Design competencies, which was the basis for later comparison with the results of other instruments from our study. Secondly, the secondary data consolidated list served as a benchmark to build part of our survey research and participatory activity.

Throughout this phase, we analyse a total of seven documents (see Table 3) dedicated explicitly to identify the set skills and competencies for future professionals. Amongst the documents explored, some data sources dealt with the future of jobs in general, while other documents were explicitly related to the Design and education for Sustainability. In these sources, we identified a body of work that supports the belief that education in general and, consequently, Design Education should be restructured to incorporate in the *curricula* new skills and competencies to address the growing challenges faced by society in order to provide well-equipped professionals to shape a sustainable world for the future. As we have stated in item 1.10.1 of this Thesis, the literature often uses the terms skills and competency interchangeably (Sanghi, 2007). We defend the use of competency in this Thesis and encourage the reader to interpret skills as such.

Table 3: List of secondary data sources analysed

Item	Title	Author
1	The Future of Jobs Report 2018.	(Leopold, Ratcheva, & Zahidi, 2018)
2	The Future of Education and Skills: Education 2030	(OCDE, 2018)
3	Project-based Learning (PjBL): Inculcating Soft Skills in 21st Century Workplace	(Musa, Mufti, Latiff, & Amin, 2012)
4	Education for Sustainable Development Goals: learning objectives	(UNESCO, 2017)
5	Restarting Britain: Design education and growth	(Pryce & Whitaker, 2011)
6	Rethinking Education: Towards a global common good?	(UNESCO, 2015)
7	Paradigm shift in Design Education: An overview on issues and possibilities for change	(Rocha, Ferreira, & de Azevedo, 2018b)

The list of documents analysed exhibits an international debate that it is consistent in supporting the idea that the competencies required to be developed closely relate to the need to act towards a scenario of uncertainty (Leopold et al., 2018; OECD, 2018; UNESCO, 2015) about the future of the world. A position extremely relevant for Design, especially as we believe it plays a leading role in supporting the current paradigm of production and consumption, in part consequential of the current educational paradigm (see item 1.6).

3.2.2. Survey Research

We designed two questionnaires (Q1 and Q2) to collect information from Design students during our study. First, our primary purposes were to understand their perception of how Design Education is tackling Sustainability issues in their *curriculum*. Moreover, we pursued their beliefs on the most critical competencies to be developed during their Design course towards Sustainability. The second goal was relevant for comparing the results from the secondary data analysis and the participatory workshop.

During our survey enquiry, we collected a total of 242 answers from Design students: Q1 collected 118 answers and Q2, 124 responses.

Questionnaire Q1

The initial questionnaire targeted to provide a baseline of the students' views of the relationship between Design, Design Education and Sustainability. The questionnaire was

composed of ten main questions, some with follow-up enquiries, and five demographic questions. The following table (Table 4) clarifies the structure of the instrument.

Table 4: Structure of the instrument Q1

ID	Question	Nature	Type	Follow-up
Q1Q1	1. During your course, were you in some design project that addressed social aspects?	Close ended	Yes/No	No
Q1Q2	2. Do you believe that the designs developed by you have a positive impact on society?	Close ended	Yes/No	No
Q1Q3	3. Some of the developed projects resulted from the real needs of society?	Close ended	Yes/No	No
Q1Q4	4. About the Design teaching and the culture of Design promoted at your institution, do you consider that it is appropriate to today's world crisis?	Close ended	Yes/No	No
Q1Q5	5. Do you believe that the designer, by his professional activity, has influence in changing our society?	Close ended	Yes/No	No
Q1Q6	6. The Design training acquired at your design course promotes the critical thinking focused on Sustainability and Social Responsibility?	Close ended	Yes/No	No
Q1Q7	7. The specific theme of Sustainability is addressed by teachers in the subjects of the different courses/units?	Close ended	Yes/No	Yes.
Q1Q7A	7a: How often?	Close ended	Linear Scale	Yes
Q1Q7B	7b: In what context, discipline, or situation? Give examples please.	Open ended	Paragraph	No
Q1Q8	8. When you are developing a design project for any course, do you consider the economic, environmental, and social impacts of the solution you are designing?	Close ended	Yes/No	Yes
Q1Q8A	8a: How often?	Close ended	Linear Scale	Yes
Q1Q8B	8b: In what context, discipline, or situation? Give examples please.	Open ended	Paragraph	Yes
Q1Q8C	8c: If not, why?	Open ended	Paragraph	No
Q1Q9	9. From the skills/contents listed below, mark 8 that you think are the most important (without order of importance) to develop during any course, towards sustainable (and social) design projects:	Close ended	Check box	No
Q1Q10	10. Are there anything more that you would like to say about Sustainability and/or Social Design?	Open ended	Paragraph	No

As defined in earlier, we approached students according to convenience. In that case, we benefited from our relationship with three partner universities, as the institutions made students available to participate in the survey moment of our research. First, we were able to access students from IADE – Universidade Europeia, in Portugal, taking advantage of the relationship between the PhD course in which we are enrolled and the institution's graduate programs. The second school approached was the Instituto Federal Fluminense, in Brazil and where the author is a professor with the Graphic Design course. The third was in Cyprus, at

the Cyprus University of Technology, via a partnership between IADE's research centre – UNIDCOM – and the local institution.

The questionnaires were applied in Portuguese (European and Brazilian) and English. In Portugal, the questionnaires were conducted directly on the platform *Google Forms*, whilst in Cyprus and Brazil, the students answered on paper. The answers were then manually added in a *Google Form* file and exported to a spreadsheet for data treatment and visualisation.

Questionnaire Q2

A complementary questionnaire was conducted after the participatory workshop (see 3.2.3) aiming to:

- Collect additional quantitative information on the skills and competencies crucial to be developed during Design courses to address solutions for Sustainability, complementing the information acquired during the Participatory Workshop (see 4.5).
- Collect qualitative information regarding the students' perception of Design Education and its impact on Social Innovation and Sustainability;

The questionnaire was composed of nine main questions, both open and close-ended, and two demographic enquiries. Three language versions of the instrument (European and Brazilian Portuguese and English) were designed to accommodate Portuguese, Brazilian and International students, all approached by convenience. We used the online tools *Google Forms* to collect the data and *Google Sheets* to treat the information and generate data visualisation. Table 5 elucidates the structure designed for this instrument.

Table 5: Structure of the instrument Q2

ID	Question	Nature	Type	Follow-up
Q2Q1	1. During your course, have you participated in social projects?	Close ended	Yes/No	Yes
Q2Q1A	1a. Why?	Open ended	Paragraph	No
Q2Q2	2. During your studies, did you had contact with members of the community, outside the university, which participated or contributed to the development of your design solutions?	Close ended	Yes/No	Yes
Q2Q2A	2a. Why?	Open ended	Paragraph	No
According to each of the following phrase indicate how do you stand:				
Q2Q3	3. "Design Education contributes to social, cultural, and environmental development."	Close ended	Linear Scale	Yes
Q2Q3A	3a. Why?	Open ended	Paragraph	No
Q2Q4	4. "The collaboration between schools and companies or other civil organization can foster innovation in products and services."	Close ended	Linear Scale	Yes
Q2Q4A	4a. Why?	Open ended	Paragraph	No
Q2Q5	5. "Design Education plays an important role in finding innovative solutions and strategic paths to overcome the social challenges faced today, such as environmental degeneration, climate change, ageing, extremism, migration, and so on."	Close ended	Linear Scale	Yes
Q2Q5A	5a. Why?	Open ended	Paragraph	No
Q2Q6	6. "The projects that I developed during my course are innovative, have social characteristics and contribute to sustainability."	Close ended	Linear Scale	Yes
Q2Q6A	6a. Why?	Open ended	Paragraph	No
Q2Q7	7. "Technology is an important tool for the Design field and must be used to support Social Innovation."	Close ended	Linear Scale	Yes
Q2Q7A	7a. Why?	Open ended	Paragraph	No
Q2Q8	8. Amongst the list of skills that follow, please identify eight (8) that you believe to be crucial to be developed during a design course to address design solutions for sustainability:	Close ended	Check Box	No
Q2Q9	9. From the perspective of how Design can contribute to Social Innovation and Sustainability, we would like to hear more about your thoughts on the matter. Please, use the following field to leave your opinion.	Open ended	Paragraph	No

Between April 2019 and July 2020, the author of this Thesis was Lead Teacher at a UX/UI Design Bootcamp, providing a valuable opportunity of accessing students from the course, which adopts a project-based learning methodology. To take advantage of the circumstances, we designed a variation of the instrument Q2 with two additional questions addressing the school's approach and its impact on preparing future designers to solve complex Design

projects. Both questions were close-ended with an open-ended follow-up, as demonstrated in Table 6.

Table 6: Additional questions for the second variation of instrument Q2

ID	Question	Nature	Type	Follow-up
Q2Q10	10. Do you consider that the project-based method has helped you understand how to approach Design problems?	Close ended	Yes/No	Yes
Q2Q10A	10a. Why?	Open ended	Paragraph	No
Q2Q11	11. After your Bootcamp, do you feel prepared to solve complex design projects that tackle social challenges?	Close ended	Yes/No	Yes
Q2Q11A	11a. Why?	Open ended	Paragraph	No

3.2.3. Participatory Workshop

The participatory workshop was planned based on the approach described by Leavy (2017) as Community Based Participatory Research, aiming to learn from Design students and to facilitate findings to be transferred from the community to the research and vice-versa. The activity was designed to help understand how the introduction of a problem-based active methodology could trigger a change in students' mindset and encourage critical thinking towards the responsibility of the designer in society.

A comprehensive description of the workshop was first published as part of this research (Rocha & Ferreira, 2019), on the scientific research journal 'Convergences' dedicated to publishing blind peer-review papers in Design, music and visual arts. This publication was an important milestone to validate part of our research methodology. A shorter version of the paper was also published in the proceedings of the Doctoral Design Conference (Rocha et al., 2019) at IADE - Universidade Europeia.

The participatory workshop was a key moment of this study that allowed us to confront relevant components of our assumptions and demonstrate how the research variables influence one another. The activity was designed to manipulate the Independent Variable – Design Education – through the Design Method and Active Learning Methodology.

In total, we ran three workshops with forty-one students from three separate countries, Spain (thirteen students), Cyprus (thirteen students) and Brazil (fifteen students). The students were divided into a total of eleven groups across all three editions of the workshop.

Theoretical framework for the workshop

We understand that one crucial driver for a mindset shift for students is the nature and complexity of their projects during their educational path. Thus the type of Design brief presented should reflect the role of the designer not as an isolated part deprived of context, but rather a part of a whole interconnected ecosystem dealing with real problems (Davis, 2018b; Manzini, 2011; Rocha et al., 2018a). The workshop structure was envisioned under two main pillars to introduce the students to today's Sustainability problems. The first pillar guided the problems' nature and was based on the Sustainable Development Goals (United Nations, 2015). The second pillar reinforced the need to demonstrate the complexity behind wicked problems, bringing the workshop to approach the problem in three increasing levels of complexity, product, service and system.

Sustainable Development Goals (SDGs)

Design Education must enable students to understand and act towards their role as agents of change in society and planet wellbeing (Margolin, 2014). The workshop was planned to discuss how Design Education can respond to society's challenges by incorporating this issue directly into the problems to be solved by students, thus forging Social Innovation and promoting Sustainability. (Bernarda & Ferreira, 2016; Ferreira, 2020a; Findeli, 2001; Rocha et al., 2018b)

We adopted the UN's Sustainable Development Goals (Figure 22) presented in the Agenda 2030 (United Nations, 2015) as a framework to introduce Design students to the need for action from the Design sector. As an outcome, we expected to raise awareness about their responsibilities and provide a focal point for discussion and decision making during the activity (Rocha & Ferreira, 2019).



Figure 22: Sustainable Development Goals.

Product-service systems (PPS)

Mcaloone & Andreasen (2002, p. 51) argues that Design must shift from focusing on the artefact to understand how it is inserted in a broader and more complex system "in which the traditional manufacturer-vendor-user relationship is rearranged" to provide benefits not only to Business but also to the environment and society. Idea shared by Vezzoli et al. (2014, p. 30) as they define PPS as the result of "of an innovative strategy that shifts the centre of the business design and sale of products only (physical) to systems offering products and services that are jointly capable of satisfying a given application."

During the workshop, we used the PPS as a guideline to introduce complexity levels to the students as they worked their solutions from a single product up to a system that could respond to the SDG challenge and deliver sustainable and systemic benefits. We acknowledge that a four-hour workshop is a limited time and does not guarantee profound impact on the students' attitude, but we intended to analyse the potential of this type of educational approach in the future designer's mindset. That potential mindset could be verified in the quality discussion as the students presented their results.

Workshop Editions

We had the opportunity to facilitate the activity in three different moments and context, admitting a broader perspective and more in-depth discussions than what we would have if dealing with a limited and homogeneous group of students.

The workshop titled "Design Education for *Social Impact and Sustainability: Envisioning the Next Generation of Designers*" was piloted during the DIME 2019, Design Week of Mérida, Spain.

The second edition was presented on November 13th, 2019, at the Cyprus University of Technology. The third edition took place on January 22nd, 2020 in Brazil at Instituto Federal Fluminense as a part of the welcome week RECONECTE, after holiday's break.



Figure 23: Students during the Workshop in Brazil

Participants

The workshop was built with a participatory mindset to discuss with Design students, learn from their insights, and understand the methodology's outcomes in their way of approaching problems. The decision to involve the Design students in the research is deeply rooted in our belief that the redesign of Design Education itself is a complex challenge to solve and, as such, should have an indispensable component of collaboration as we aim to ensure that we are designing with de user, not only for the user. It also safeguards that we consider their interpretation (Davis, 2018b; Spinuzzi, 2005) in the solution.

The following table (Table 7) summarises the data about all three editions of the workshop.

Table 7: Summarised information about the participatory workshop

Location	Date	University	Participants	Groups
Spain	14/03/2019	Universidad de Extremadura	13	4
Cyprus	13/11/2019	Cyprus University of Technology	13	3
Brazil	22/01/2020	Instituto Federal Fluminense	15	4

The toolkit

To systematise the activity flow, we designed a set of tools for the students to interact. The toolkit was composed of a canvas and a set of cards to be sorted as a way for the students to manifest their choice within the presented options, as they believed to be the best ways to tackle the proposed challenges (Rocha & Ferreira, 2019). The toolkit also had a cheat sheet, sticky notes, and permanent markers for writing in addition to the canvas and cards.

Following we describe each of these individual components.

The set of cards

We designed a set of cards, colour coded by individual categories: *Theme*, *Skill*, *Method or Tool*, *Human Resources*, *Time*, and *Investment* (Figure 24). In particular, for the *Skill*, *Method or Tool*, and *Human Resources* cards, it was made available extra blank cards allowing students to add any desired input or option not covered by the given choices. For each category, the students could choose a maximum of cards depending on the instructions written on the canvas, but there was no minimum, meaning that the students could choose not to use any of the available cards if desired (Rocha & Ferreira, 2019).



Figure 24: Set of Cards. Photo credit: author

Besides the *Theme* cards that define the context of the problem to be solved, we aimed to understand the students' perceptions on three critical universes for our research; The necessary Design skills and competencies (*Skill* cards); The use of tools and methods to achieve the desired results (*Tools and Method* cards); And the strategic collaboration (*Human Resources* cards) with other areas and professionals. The two additional universes *Time*, and *Investment* helped us grasp the students' perception of project management but were not deeply explored in this study's results.

Table 8 presents an overview of the card set options available to the students, followed by a detailed description of each category.

Table 8: Options of cards available for the students during the participatory workshop.

Theme	Skill	Method or Tools	Human Resources	Time	Investment
No Poverty	Adaptability	Analogous Inspiration	Advertising	Short-term	Low
Zero Hunger	Communication Skills	Audience Definition	Anthropologist / Sociologist	Medium-term	Medium
Good Health and Well-being	Creativity	Brainstorming	Architect	Long-term	High
Quality Education	Critical Thinking	Business Model	Biologist		
Gender Equality	Drawing	Co-creation Session	Civil Engineer		
Clean Water and Sanitation	Empathy	Concept creation	Craftsman		
Affordable and Clean Energy	English	Focus Group	Designer		
Decent Work and Economic Growth	Environmental Awareness	Immersion and User Observation	Economist		
Industry, Innovation and Infrastructure	Facilitation Skill	Interview	Electronic Engineer		
Reduced Inequality	Flexibility	Journey Map	Environmentalism		
Sustainable Cities and Communities	Human-Centred	Prototyping	Historian		
Responsible Consumption and Production	Management and Leadership skills	Secondary Research	Journalist		
Climate Action	Mathematics	Stakeholders map	Marketing		
Life on Land	Negotiation Skills	Storytelling	Mechanical Engineer		
Peace and Justice Strong Institutions	Optimism	SWOT Analysis	Philosopher		
Partnerships for The Goals	Participatory approach	Tests and User Testing	Politician		
	Social-political Awareness		Software Engineer		
	Strategic Thinking		Video Maker		

Theme cards (yellow)

Each of the *Theme* cards (Figure 25) held one of the seventeen the Sustainable Development Goals defined by the United Nations. The cards had the goal displayed on one side and a QR Code in the back to facilitate direct access to the United Nations website of the respective goal for a deeper understanding of the targets defined to the given SDG.



Figure 25: Example of the Theme Card with the theme “No Poverty”

Skill cards (orange)

Each card contained an individual item from a list of soft and hard skills, based on a preliminary literature review on the designers' skills and competencies today. Alongside we added competencies and skills cited by selected authors (Brown, 2009; Pryce & Whitaker, 2011; Vezzoli & Manzini, 2008) and necessary for a designer to tackle wicked problems addressing Social Innovation and Sustainability.

Method or tool cards (red)

This set of cards grouped tools and methods collected from a preliminary selection of Design Toolkits (Amsterdam University of Applied Sciences, n.d.; IDEO.org, 2015). There was no in-depth explanation of each of the tools or methods, so if necessary or desired, the participants had the opportunity to go online to understand a particular topic better. Links and QR codes to specific toolkits were made available to the students, via a cheat sheet, to allow direct access to the toolkits.

Human Resources cards (purple)

To introduce the concept of collaboration and co-design, to the participants, the *Human Resources* cards listed professionals that could constitute potential strategic partnerships to the development of the proposed solutions and help them tackle the goal chosen by the group.

Time cards (blue)

The cards displayed the options for the amount of time necessary to complete the project (product, service, or system) in question.

Investment cards (green)

The investment cards suggested the level of capital investment needed to develop the project.

The canvas

The *Canvas* (Figure 26) was the direct support to organise the workshop's structure whilst facilitated and systematised the decision-making process. The tool was designed in size A1, and each group had one printed canvas at disposal. During the activity, the groups used the cards to express their decision by placing them in the designated spaces. The *Canvas* had each space adequately identified, with a placeholder for the *Theme* card to be displayed and a table organised as following:

- Rolls: Titles, Product, Service, System
- Columns: Solution Universe, Skills, Methods and Tools, Human Resources, Time Frame, Investment Level, and Potential Solution.

THEME CARD		POTENTIAL SOLUTION	SKILL	METHODS AND TOOLS	HUMAN RESOURCES	TIME FRAME	INVESTMENT LEVEL
	PRODUCT						
	SERVICE						
	SYSTEM						

Figure 26: Canvas designed that the students used to organise their decisions during the workshop.

Cheatsheet

Due to the workshop's practical and intensive nature and time constraints, the facilitators did not explain any content in-depth. Attempting to mitigate this and encourage students to practice a brief exploratory research, it was made available a *Cheatsheet* with links to the videos shown during the *Overview* part of the activity as well as to two Design toolkits for a more comprehensive understanding of the Design tools and methods, if needed (Rocha & Ferreira, 2019).

Workshop Structure

The workshop's whole duration was planned to take four hours, divided into three main parts, *Overview*, *Participatory activity* and *Presentation*. The planned agenda of the activity accommodated the following timeframe for each activity:

- Overview: 30 min
- Participatory activity: 2h30 min
- Presentation: 1h

Each of these moments will be explained in detail in the subsequent sections.

Overview

The workshop's introductory moment was designed to level the basic knowledge necessary to the students on the theme. A short lecture on the pillars presented earlier on the theoretical framework was planned. The SDGs' introduction attempted to put the students into the intended mindset to work during the participatory activity.

Also, followed a brief presentation on Product-service System's concept was structured using the Sustainable Development Goal 14, *Life Below Water*, to exemplify how a holistic view is needed from the designers' perspectives as they envision products and services in connection synergy with a complex system. The SDG used in the example was then removed from the students' options as we understood that it could influence the students to follow a too similar solution (Rocha & Ferreira, 2019).

Since the workshop target specifically Design students, we understood that there was no need to introduce any Design theory or Design methodology, as we assumed they were already

familiar with such topics. However, the whole activity was structured to follow a basic Design method without prior or in-depth knowledge, thus permitting students from the first to the last year to participate.

Participatory activity

The participatory activity was organised to be completed in groups to stimulate collaboration, teamwork, and discussion. It was reinforced that the groups should be composed of no less than three and no more than five elements, depending on the participants' total numbers. This second and most demanding section of the workshop was structured in a sequence of tasks with limited time for each, helping the students to focus on one activity at the time:

Choosing the theme: from 0h00 to 0h15 min

Students were shown the *Theme* cards. The cards were laid in a neutral space. The groups were asked to browse through them and chose one to work with. They were encouraged to go online and research as much information as possible about the chosen SDG for the remaining time. The participants were free to find content anywhere but were stimulated to start from the UN website, moving from there.

Brainstorming: from 0h15 min to 0h25 min

The groups were expected to start working on the Product universe of the canvas. For ten minutes, the groups focused on brainstorming ideas of products that could help respond to the selected theme, using sticky notes. The participants were stimulated to follow the basic brainstorming rules (IDEO.org, 2015) and encouraged to seek wild ideas, defer judgment, build on others' idea, stay focused on the topic, be visual, seek quantity, and lastly, focus on one conversation at a time.



Figure 27: Participants brainstorming during the participatory activity in Brazil. Source: Author.

Voting: from 0h25 to 0h30 min

For this activity, each student was given three votes to cast on the ideas they thought better solved the problem in question. They were explained that they were free to place all votes on one idea or to spread them in distinct ones, meaning that a promising idea could get more than one vote from the same person. The result of this activity was a heat map of the ideas the group believed to be most interesting to move forward.

The brainstorming and voting exercises meant to illustrate in practice the how creativity and the Design process relies on cycles of Convergent and Divergent thinking (Rocha & Ferreira, 2019)(Figure 11), two sides of the cognitive approach to problem-solving (Kim & Pierce, 2013). While convergent thinking seeks to explore multiple answers to the problems at hand, divergent thinking narrows the possibilities to a few or single solutions to be developed tested and iterated. In Design, these cycles repeat in deferent moments of a project (Ball, 2019), not necessarily in a linear progression. A comprehensive definition of the Design process is presented in Chapter 1 of this Thesis.

Card sorting: from 0h30 to 1h00 min

For the following thirty-minutes, the students received a set with the remaining cards and were asked to place them in the Product universe of the canvas as they saw fit. For this moment they had a maximum of cards to use. For the *Skill, Methods and Tools*, and *Human Resources* spaces, the participant could choose up to six cards. For the *Time Frame* and *Investment Level*, one card each. “The participants were also reminded and encouraged to use the blank cards to add any information they believed could fit but was not available on the cards.” (Rocha & Ferreira, 2019)



Figure 28: Participants filling the canvas with the cards during the participatory activity in Brazil. Photo credit: Author.

Service and System Universes: from 1h00 to 2h30 min

The same sequence of *brainstorming*, *voting* and *card sorting* was planned to be repeated by the students at each of the two other universes of the activity, Service and System. Students were made aware that those universes were complementary and supported the previous ones, meaning that the service should be built on top of the product and the system on top of both product and service, envisioning a systemic solution.



Figure 29: Participants discussing their decisions during the participatory activity in Spain. Photo credit: Author.

Presentation

For the workshop's final hour, each group was asked to present their decisions and solutions for ten minutes. For a more in-depth discussion and further analysis, the groups were asked to go over every card and explain why they made such decisions. In order to guarantee the discussion and dialogues' integrity and allow future consultation, all the presentations were recorded in audio and video. The canvas generated by each group were also digitalised in PDF for the forthcoming analysis of the results.



Figure 30: Participants presenting their outcomes from the workshop in Spain. Photo credit: Author.

3.3. Chapter Summary

This chapter has detailed the techniques, procedures and instruments utilised to collect data during our study. We have established a convenience sampling strategy due to the easy access we had to Design students from different Design institutions. For this study, we have used different sources to collect data. This section presented and discussed the questionnaires' structure, participatory workshops with Design students, and secondary data sources.

Chapter 4

Data analysis and evaluation

4.1. Introduction

This chapter is dedicated to analysing the data collected by the designated instruments presented in Chapter 3. Each source is thoroughly analysed individually and then consolidated into a summary for comparison. In the end, it presents the most significant findings pre-conclusions drawn from all instruments designed for the study.

4.2. Secondary Data Analysis

For the selected secondary data, we analysed a total of seven documents dedicated to identifying the competencies needed for future professionals. We analysed the documents in four stages (Figure 31), moving from a broader view and narrowing the results as we moved forward.

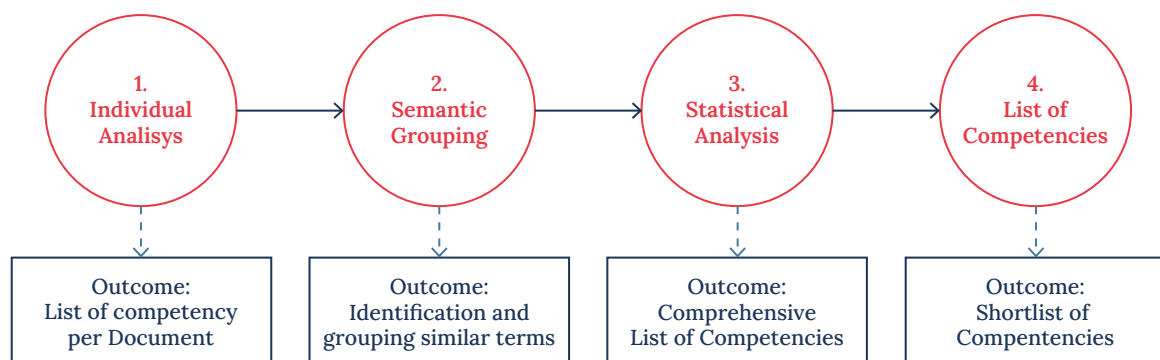


Figure 31: Secondary data analysis pipeline

4.2.1. Phase 1: Individual document analysis

We started our data analysis by isolating from the documents the list of the competencies identified and defended by each piece as necessary to be developed by future professionals. This stage generated a unique long-list of competencies organised by reference, independent of a direct relationship with the Design field. Following, we present a summary of each source alongside a list of competencies.

The World Economic Forum (WEF) report *The Future of Jobs* (Leopold et al., 2018) provides an update on the information presented in 2016 by the institution in a homonymous document as the Fourth Industrial Revolution influences factors such as socioeconomics and demographics, business face the need to change and adapt to new realities. The jobs landscape is being disrupted as new categories emerge, calling for new set competencies that will change how and where people work (Leopold et al., 2018).

Although the document presents a thorough overview of the jobs perspectives in many industries worldwide, it is in our particular interest the comprehensive set of competencies identified by the document (Table 9).

Table 9: Summary of Competencies identified in the Future of Jobs: Report 2018. Source: (Leopold et al., 2018).

Item	Competency
1	Analytical Thinking and innovation
2	Active learning and learning strategies
3	Creativity, originality and initiative
4	Technology design and programming
5	Critical thinking and analysis
6	Complex problem-solving
7	Leadership and social influence
8	Emotional intelligence
9	Reasoning, problem-solving and ideation
10	Systems analysis and evaluation

The position paper published by the OECD (2018) *The Future of Education and Skills: Education 2030* recognises unseen challenges – social, economic and environmentally wise. The source also recognises that these challenges also pose opportunities for Innovation and human advancement. To be ready to deal with an uncertain world, future adults will need to develop new competencies that must start to be addressed by education now. “Education can equip learners with agency and a sense of purpose, and the competencies they need, to shape their own lives and contribute to the lives of others” (OECD, 2018, p. 2). The document presents the first results for two main questions. "*What knowledge, skills, attitudes and values will today's students need to thrive and shape their world?*" and "*How can instructional systems develop these knowledge, skills, attitudes and values effectively?*" (OECD, 2018, p. 2), which are near related with our research. Following, we list the competencies identified in the document.

Table 10: Summary of Competencies identified in the document The Future of Education and Skills: Education 2030. Source: (OECD, 2018)

Item	Competency
1	Collaboration
2	Creative Thinking
3	Critical Thinking
4	Empathy
5	Learning to Learn
6	Self-regulation
7	System Thinking
8	Accountability
9	Ethics
10	Problem Solving

The paper Project-based Learning (PjBL): Inculcating Soft Skills in 21st Century Workplace (Musa et al., 2012) identifies a set of soft skills necessary in the twenty-first century as competitiveness in the marketplace increases at local and global levels and examines how the Project-Based Learning approach can equip students with the related skills. The study concluded that “it is evident that project-based learning facilitates the growth of learners in acquiring the aforementioned skills” (Musa et al., 2012, p. 565), a significant outcome of the document that helps also address the matter of how active learning methodologies help build competencies. The list of competencies mentioned in the paper, as presented in Table 11.

*Table 11: Summary of Competencies identified in the document The Future of Education and Skills: Education 2030.
Source: (Musa et al., 2012)*

Item	Competency
1	Communication Skills
2	Problem Solving
3	Computer Literacy
4	Information Literacy
5	Ability and willingness to Learn
6	Teamwork
7	Critical Thinking
8	Collaboration

Built on the sequence of the Sustainable Development Goals presented by the United Nations in 2015, Education for Sustainable Development Goals: learning objectives (UNESCO, 2017) posits education as a pivotal instrument to promote change and help achieve the goals accorded globally. This book is of great importance to our research as it presents education for sustainable development with a core goal of developing the competencies required to "act in complex situations in a sustainable manner, which may require them to strike out in new directions; and to participate in socio-political processes, moving their societies towards sustainable development" (UNESCO, 2017, p. 7).

The book identifies a group of eight fundamental competencies directly related to education for Sustainability (Table 12), two critical elements of our study.

Table 12: Summary of Competencies identified in the document *Education for Sustainable Development Goals: learning objectives*. Source: (UNESCO, 2017)

Item	Competency
1	Systems thinking competency
2	Anticipatory competency
3	Normative competency
4	Strategic competency
5	Collaboration competency
6	Critical thinking competency
7	Self-awareness competency
8	Integrated problem-solving competency

The report by the Design Committee from the UK entitled *Restarting Britain: Design Education and growth* (Pryce & Whitaker, 2011) reflects on the merit of Design in helping economic growth in the twenty-first century and on Design Education's status quo. After the analysis, the document recommends that “to be appropriate in the 21st century context, we need to shift education to an interdisciplinary approach. In other words, from a system that operates in discrete specialist subjects, towards an integrative system that promotes adaption as skills needs [sic] change" (Pryce & Whitaker, 2011, p. 62). The report identifies the Design skillset as both intellectual and practical, highlighting that the intellectual skills are often shared with other educational areas, which was positively verified by other sources.

Table 13: Summary of Competencies identified in the document *Restarting Britain: Design Education and growth*.
Source: (Pryce & Whitaker, 2011)

Item	Competency
1	Lateral thinking
2	Conceptual thinking
3	Analytical and critical thinking
4	Social, historical, cultural and political awareness
5	Creativity
6	Observation skills
7	Visual communication skills
8	Visual appreciation skills
9	Understanding and manipulation of materials and processes

Inspired by two landmark documents from UNESCO, the *Faure Report* and the *Delors Report*, from 1972 and 1996 respectively, *Rethinking Education: Towards a global common good?* (UNESCO, 2015) intends to enhance the documents' vision as the world faces great complexity and contradiction (UNESCO, 2015). Positioning the sustainable development as a central concern, it reaffirms the humanistic approach to education as a contribution to achieving a development model where "economic growth must be guided by environmental stewardship and by concern for peace, inclusion and social justice" (UNESCO, 2015, p. 10). Although the report does not systematically present the competencies to be developed, we could extract from the text the following list (Table 14).

Table 14: Summary of Competencies identified in the document *Rethinking Education: Towards a global common good?*. Source: (UNESCO, 2015)

Item	Competency
1	Complex Problem-Solving
2	Critical Thinking
3	Ethics
4	Independent Judgement
5	Information and media literacy
6	Learn to Learn

Lastly, *Paradigm shift in Design Education: An overview on issues and possibilities for change* (Rocha et al., 2018a), is an Academic paper presented by the authors of this Thesis which presents an overview of Design Education defending Design Education as a gateway to drive change the source identifies "new skills for a new designer", an additional set of competencies that must be addressed by Design Education complementing those already covered in Design schools.

Table 15: Summary of Competencies identified in the document *Paradigm shift in Design Education: An overview on issues and possibilities for change*. Source: (Rocha et al., 2018a)

Item	Competency
1	Co-creation
2	Empathy
3	Environmental Awareness
4	Social-Political Awareness
5	Human-Centred
6	Critical Thinking
7	Strategic Thinking

4.2.2. Phase 2: Semantic Grouping

Once we analysed and cross-examined the documents, it was possible to identify patterns that showed similarities across the sources. The literature accessed mentioned an average of eight competencies per piece. While we identified a total of twenty distinct competencies, there was a higher occurrence of some competencies, e.g. *Critical Thinking*, *Complex Problem-solving*, *Creativity*, *Empathy* and *System Thinking*. A semantic grouping exercise sought to facilitate the identification of similarities and adopt a standard nomenclature. Competencies that were only

cited once in all the references were not grouped and left in the *Uncategorised* box. Figure 32 shows the result of this phase of the analysis.



Figure 32: Semantic grouping of the competencies identified during the literature review.

4.2.3. Phase 3: Analysis

Complementary to the previous stage, a quantitative analysis allowed ranking the competencies by the percentage of recurrences in the examined documents. The calculation was made using the online spreadsheet tool *Google Sheets*, applying a function to calculate the percentage of the total references that cited each competence. It is essential to mention that if a reference cited two or more competencies clustered in the same group, the source was only counted once, thus avoiding false percentages. With the result, we generated a visual output of the patterns in the form of a bar chart, therefore evidencing what the literature understands as crucial competencies (Figure 33).

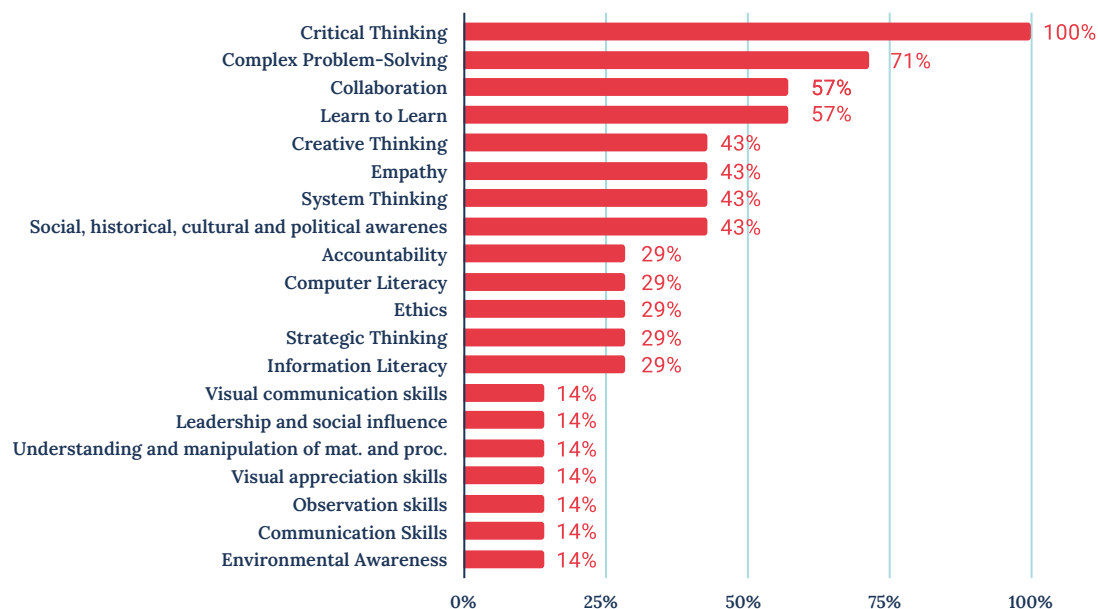


Figure 33: Data visualisation of the competencies found in the literature review.

4.2.4. Phase 4: Final list of core competencies

To facilitate our understanding and later comparison with other data sources, such as the questionnaires and workshops, we selected a list of top competencies that fit three main criteria. The first being directly related to the number of citations of the competency by different authors during the literature review, as shown in Phase 3 of this analysis. Since not all the literature was focused on Design or Design Education, a second criterion was applied to prioritise the competencies directly related to the Design field.

Finally, it was necessary to identify within the competencies their relationship to the development of the outcome intended by this study with is to better train designers to tackle Sustainability issues and promote Social Impact and Innovation—the third condition allowed to prioritise Environmental Awareness over Computer Literacy and Information Literacy, for instance. The shortlist of twelve competencies, after refinement and analysis, is listed alphabetically in Table 16.

Table 16: List of competencies originated from the analysis of the data from the literature review.

Item	Competency
1	Accountability
2	Collaboration
3	Complex Problem-solving
4	Creative Thinking
5	Critical Thinking
6	Empathy
7	Environmental Awareness
8	Ethics
9	Learn to Learn
10	Social, historical, cultural and political awareness
11	Strategic Thinking
12	System Thinking

4.3. Questionnaire Q1 Data Analysis

Summary

- Number of responses: 118
- Location of the responders: Cyprus (27,1%), Brazil (35,6%) and Portugal (37,3%);
- Top ten skills and competencies selected by the students as a response to question Q1Q9:

Table 17: Top ten skills responses from questionnaire Q1.

Item	Competency
1	Creativity and Innovation
2	Teamwork
3	Critical Thinking
4	Complex Problem Solving
5	Marketing
6	Drawing
7	Project Methodology Literacy
8	Environmental Awareness
9	Social-political Awareness
10	Research Methods

4.3.1. Comprehensive data analysis

The instrument Q1 provided mainly quantitative data. However, the low number of open-ended questions and follow-ups blurred the results of questions so that we could not have a deeper understanding of their opinions beyond the numbers. Nonetheless, we identified some vital information, allowing us to start drawing some initial conclusion. The findings were also crucial as they guided the Design of the second questionnaire (Q2).

Q1Q5: "Do you believe that the designer, by his professional activity, has an influence in changing our society?"

As we analysed the data from question Q1Q5, it became clear that the students understand the designer's impact as a potential agent of change. The majority of the responders (93,2%) believe that the designer influences changes in society by exercising their professional activity.

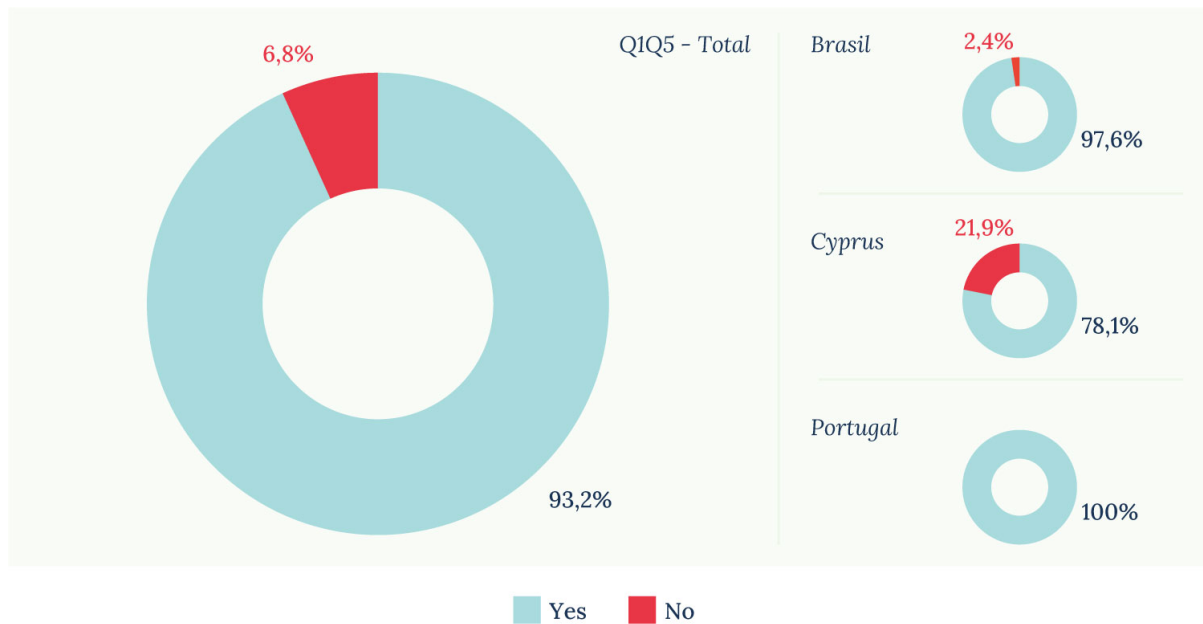


Figure 34: Results for question Q1Q5: "Do you believe that the designer, by his professional activity, has an influence in changing our society?"

Q1Q1: "During your course, were you in some Design project that addressed social aspects?"

Almost half of the participants (48,7%) responded that they did not enrol in projects that address social aspects. Filtering the data by country, we noticed a significative difference in the results. Within the responders from Brazil, only 7,1% of students have responded to part in projects of such nature. In the opposite direction, in Portugal, this number increases to 70,5%. The highest numbers come from Cyprus, where 83,9% of the responders declared to have been part of projects that address social aspects.

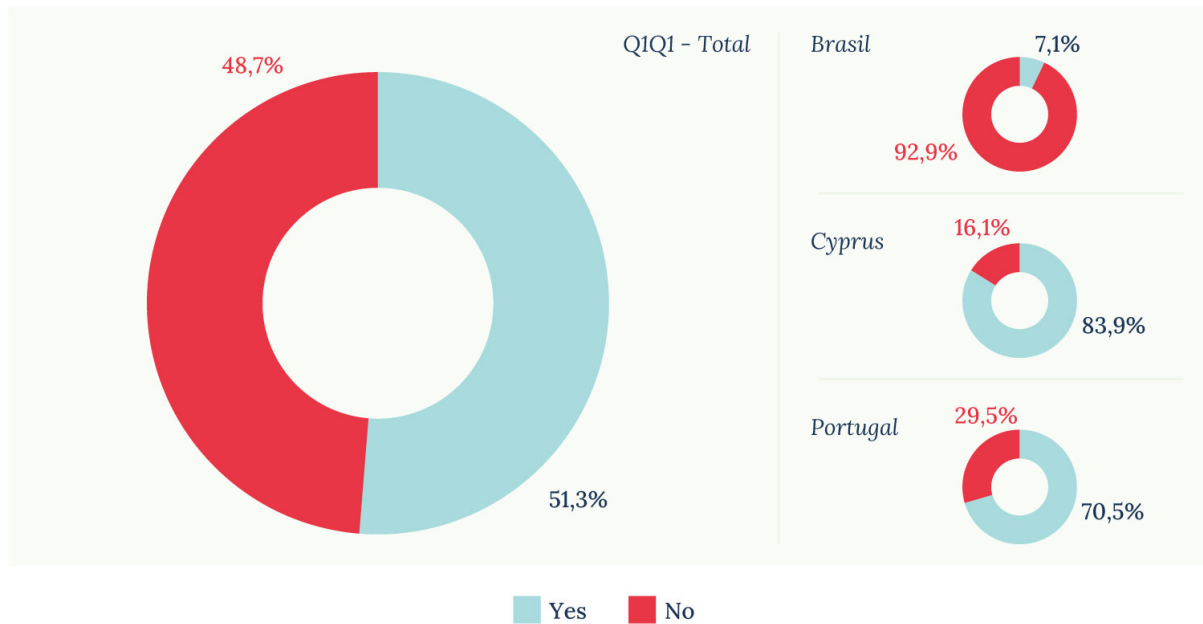


Figure 35: Results for question Q1Q1: “During your course, were you in some Design project that addressed social aspects?”

While it is possible to observe a direct relationship between Portugal and Cyprus's numbers from the current question and item S1Q5, this is not the case for Brazil's responses. In this case in particular, the non-participation in projects of this nature did not seem to directly affect their perception of the impact of Design on society. One factor that may influence this perspective might be the different social conditions of the European countries against the South American, as Brazilian students struggle daily with social issues that might make them more sensitive to such issues and need for change. Nevertheless, an open-ended question seemed necessary to draw further conclusions and validate our assumption.

Q1Q2: “Do you believe that the designs developed by you have a positive impact on society?”

Students who were evolved in solidarity Design projects during the course tended to believe that their projects positively impacted society, as shown in the answers for question Q1Q2. This finding was important as we defend that the nature of the project dealt with within Design Education is crucial to developing the awareness necessary for designers to understand their role in society.

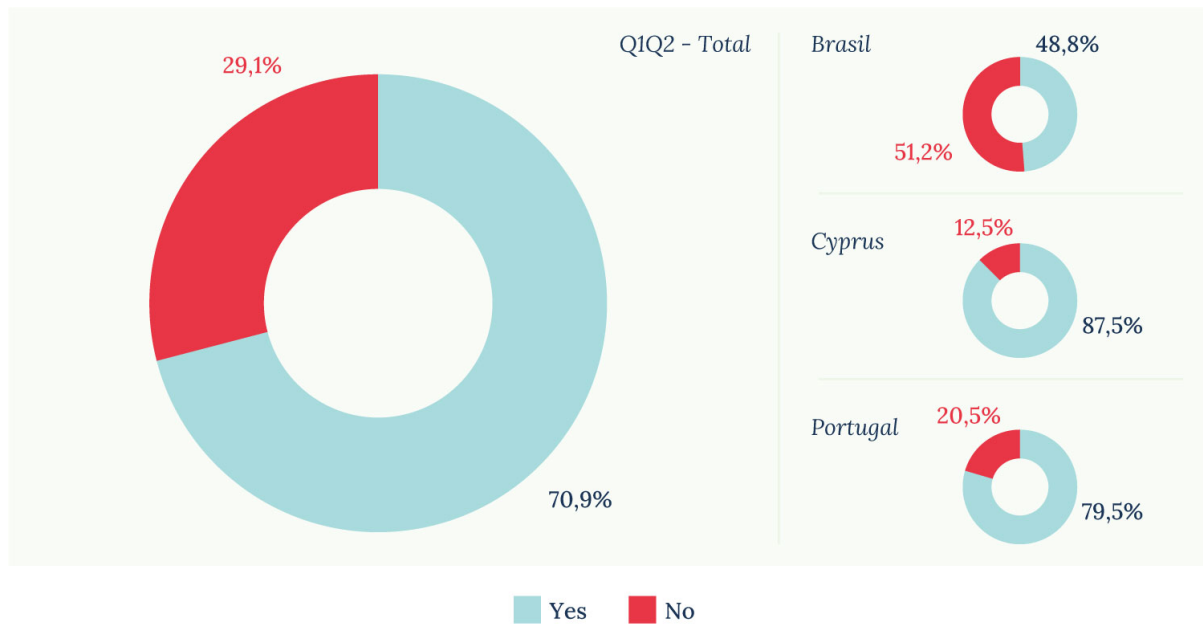


Figure 36: Results for question Q1Q2: “Do you believe that the designs developed by you have a positive impact on society?”

Q1Q3: “Some of the developed projects resulted from the real needs of society?”

The results from question Q1Q3 corroborate with our conclusion from question Q1Q2, where the numbers reflected a similar pattern. When questioned if the projects they have participated in originated from society's real needs, the majority believes that they did. Again, if segmented by country, there is a significant difference in the results, with the European countries averaging above 80% of agreement, while amongst the Brazilian students, only 24,2% answering ‘Yes’ to the question.

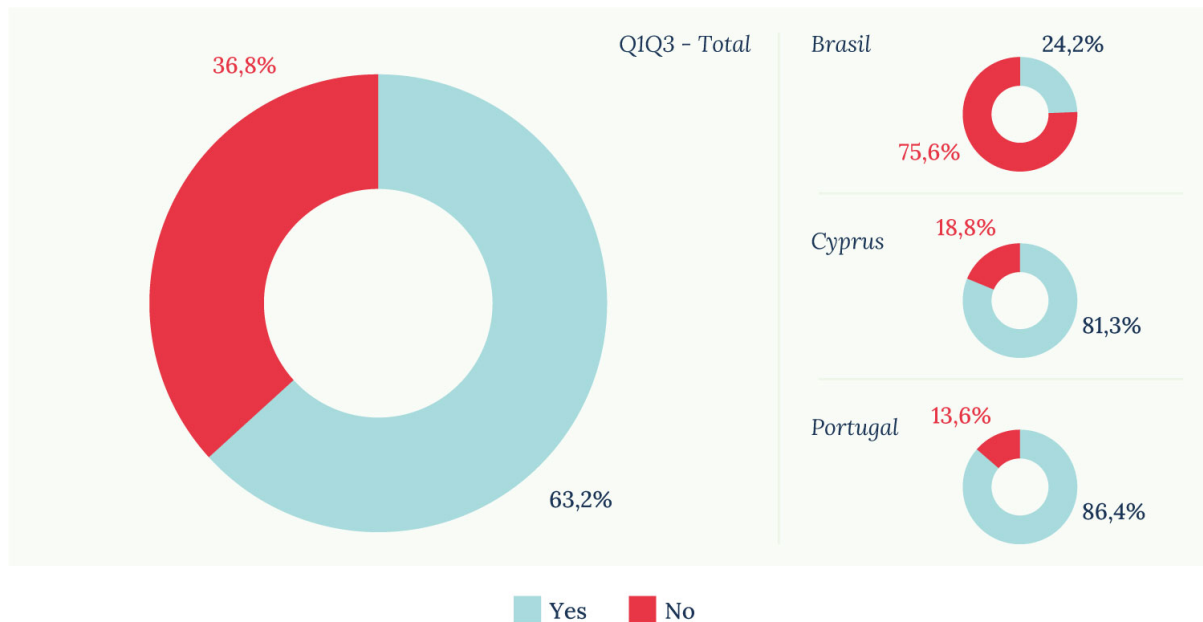


Figure 37: Results for question Q1Q3: “Some of the developed projects resulted from the real needs of society?”

Q1Q6: “The Design training acquired at your Design course promotes the critical thinking focused on Sustainability and Social Responsibility?”

Contrasting with the results from Q1Q1, the data from question Q1Q6 showed that most of the students (75,4%) believed that the training acquired in their institutions promotes critical thinking focused on Sustainability and Social Responsibility. This incompatibility was specially pushed by Brazilian students' answers, strengthening our belief that the Sustainability and social values of Design are not embedded in the projects but are presented elsewhere during their path.

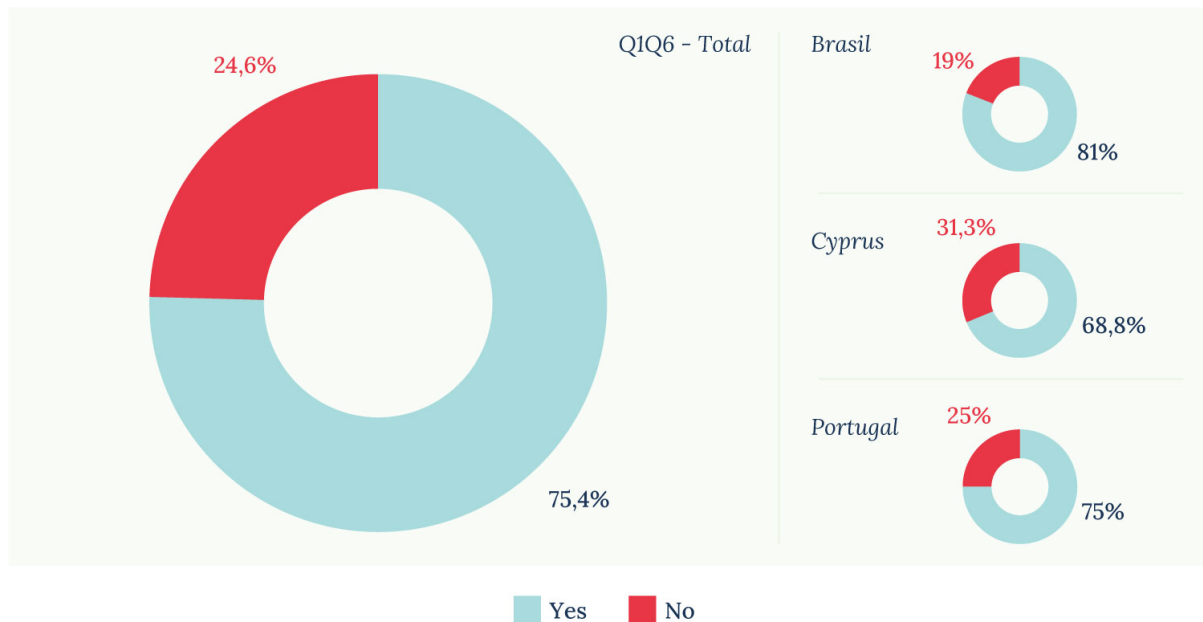


Figure 38: Results for question Q1Q6: “The Design training acquired at your Design course promotes the critical thinking focused on Sustainability and Social Responsibility?”

The discrepancy was not correctly understood due to the lack of a follow-up question or even an open-ended enquiry. One possible explanation for these results might be found on question Q1Q7, which is analysed next.

Q1Q7: “The specific theme of Sustainability is addressed by teachers in the subjects of the different courses/units?”

An important finding worth mentioning of the instrument Q1 was the role of the individual endeavours from teachers in the student's perception of Sustainability and its relationship with Design. In the answers for item Q1Q7, most responders said that their teachers addressed the theme of Sustainability.

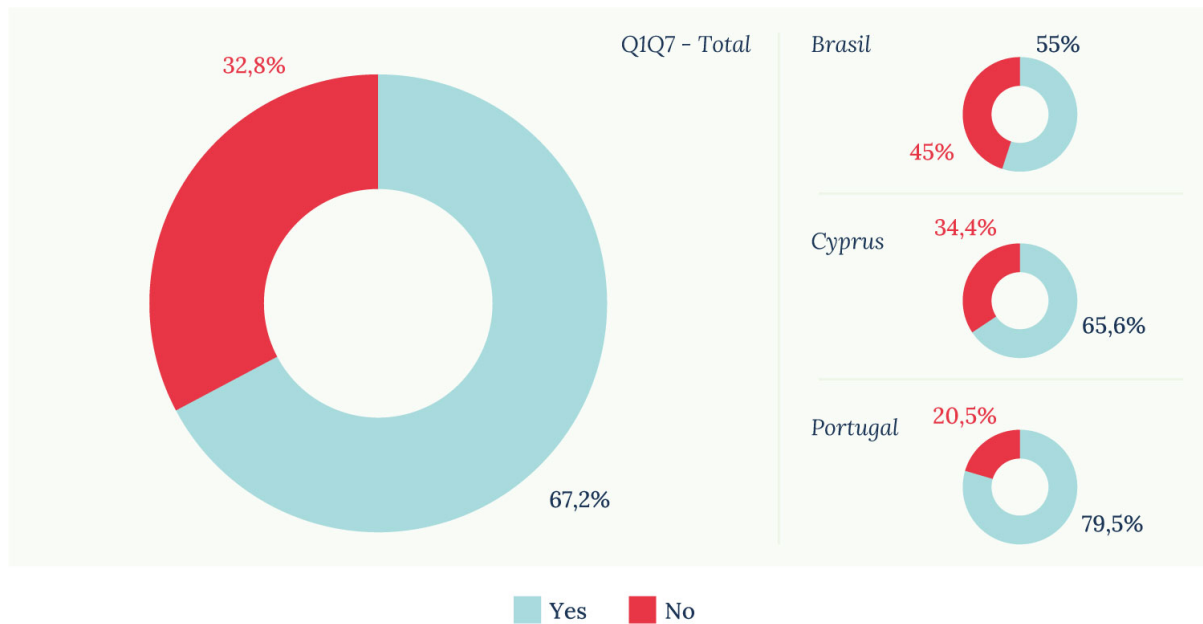


Figure 39: Results for question Q1Q7: “The specific theme of Sustainability is addressed by teachers in the subjects of the different courses/units?”

Nevertheless, in a more in-depth analysis, we first identified that 49,2% said that this mention only happened "sometimes", while 29,6% responded 'never' or 'almost never' (Q1Q7A).

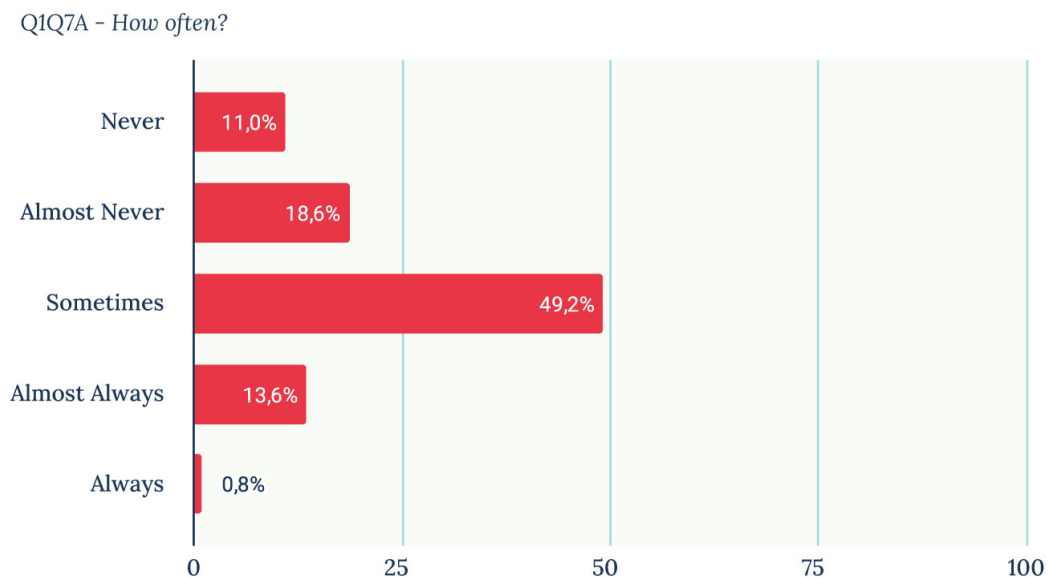


Figure 40: Results for question Q1Q7A

That information was essential to understand that the themes were still not core to the courses, instead was particular to few disciplines or professors, which corroborates with what we have found and described in our literature review on Chapter 1.

Q1Q4: “About the Design teaching and the culture of Design promoted at your institution, do you consider that it is appropriate to today’s world crisis?”

Question Q1Q4 asked the students’ perceptions about the culture of Design and teaching promoted by their institutions and if they perceived them as appropriate for today’s world crisis. The results here were balanced, with most of the students perceiving a positive attitude from their institutions. Once more, in Brazil's case, the answers conflicted with the answers from questions Q1Q1 and Q1Q3.

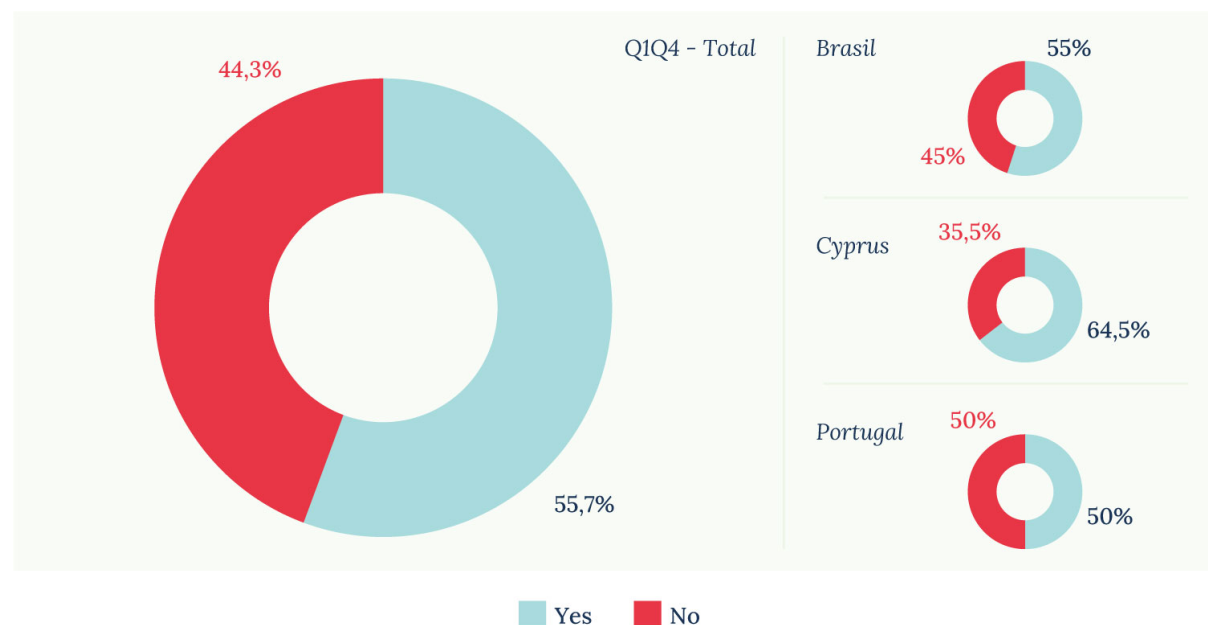


Figure 41: Results for question Q1Q4: “About the Design teaching and the culture of Design promoted at your institution, do you consider that it is appropriate to today’s world crisis?”

These findings played an essential part in our research in three main aspects. The first was the possibility to collect quantitative data from the students to help us identify the critical competencies for designers to have to tackle Sustainability and Social Innovation. Secondly, we started to conclude the status of Design Education towards there issues. Third, we acknowledged the need for a second questionnaire (Q2), where we could also collect

qualitative data from students to help us have a more comprehensive understanding of their opinions.

4.4. Questionnaire Q2 Data Analysis

Summary

- Number of responses: 124 (total)
- Number of responses from the Bootcamp: 34
- Location of the responders: Portugal (78,2%), Brazil (19,4%) and Spain (2,4%);
- Top ten skills and competencies selected by the students as a response to question Q2Q8:

Table 18: Top ten skills responses from questionnaire Q2.

Item	Competency
1	Human-Centered
2	Empathy
3	Strategic Thinking
4	Creativity
5	Adaptability
6	Communication Skills
7	Environmental Awareness
8	Critical Thinking
9	Social-political Awareness
10	Flexibility

4.4.1. Comprehensive data analysis

Q2Q1: "During your course, have you participated in social projects?"

The instrument Q2 helped consolidate some of the findings of Q1, the first one being related to the student's participation in social projects (Q2Q1). The answers showed students' opinions to be divided, consistent with the numbers found in Q1.

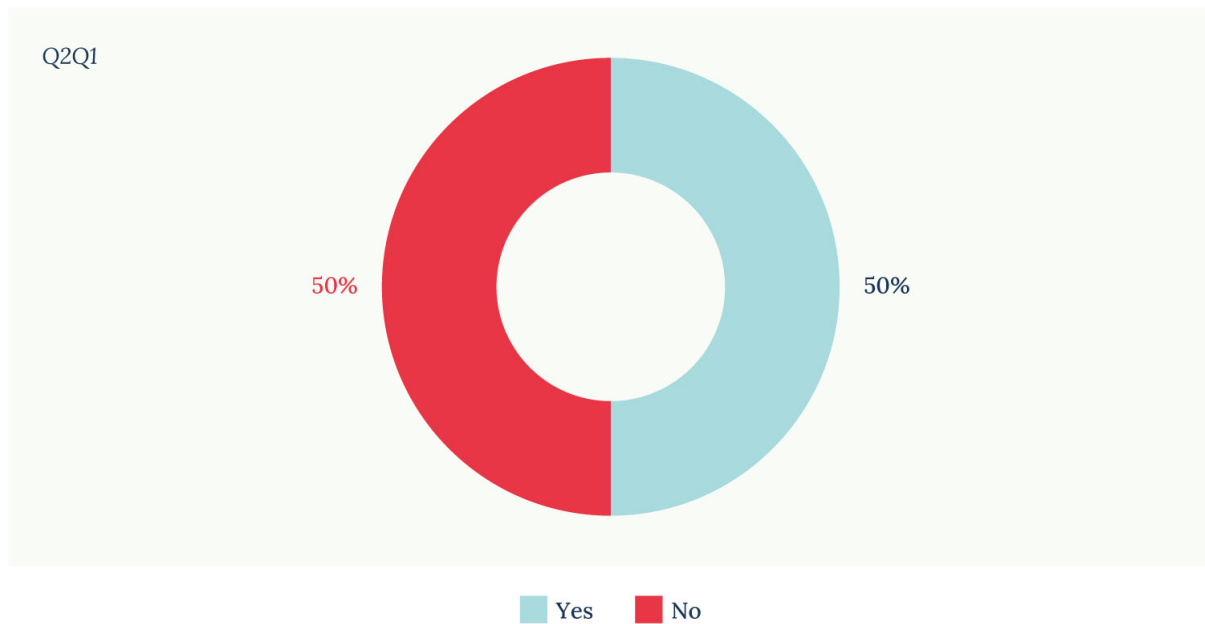


Figure 42: Results for question Q2Q1: “During your course, have you participated in social projects?”

The follow-up item Q2Q1A demonstrated that most of the students who participated in social projects cited the project L3 as their primary contact with this type of venture. The L3 project was part of a consortium from three universities in Portugal and founded by Calouste Gulbenkian Foundation (Rocha et al., 2018a). The project had a duration of 18 months and involved students from five disciplines. Though the initiative has a high value to build Social Impact awareness, it was a project with a short life span, not ensuring that other students from the same courses who did not participate in the project ought to have the same perception or opportunity to participate in projects of this nature. Some students also affirmed to have chosen social issues as final projects themes, which is not part of the education requirement, but a personal preference. Amongst the students that claimed to have not participated in social projects, the most common reasons were lack of time and lack of opportunity from the Design brief presented to the class.

On Q2Q3 to Q2Q7, students were asked to express their agreement or disagreement with statements in a 5-point Likert scale ranging from *Strongly Agree* to *Strongly Disagree*. If cited directly during the analysis, the students will be identified by an alphanumeric sequence ranging from Q2P1 to Q2P124.

Q2Q3: "Design Education contributes to social, cultural, and environmental development."

Q2Q3 stated that "Design Education contributes to social, cultural, and environmental development", and 86,9% of the responders either *Strongly Agree* or *Agree* with this statement.

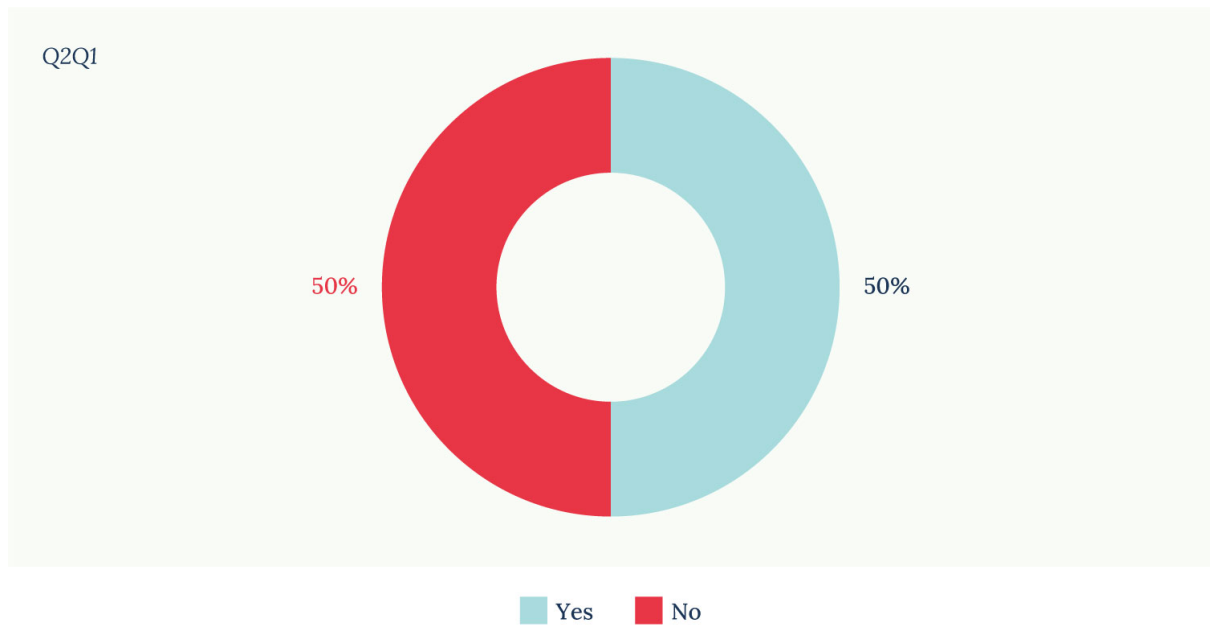


Figure 43: Results for item Q2Q3: "Design Education contributes to social, cultural, and environmental development."

When asked to elaborate on the reasons for Q2Q3A, students showed a clear understanding of education's impact on the professional path. The answers show ideas that if the education is appropriately done, promoting projects that show the importance of Design for society, the professional outcome shall live by the same values and '*become a transformative agent*', as stated by one of the students (Q2P11). This impression is also shared by another responder that says, '*We need to be taught to create good, lasting and responsible products: products that seek to help and empower individuals rather than exploit them (and their attention)*' (Q2P26). A third participant raised the attention to the need for a holistic perception from the designer, reinforcing the need for systemic thinking, '*There's no point of act or thing [sic] separately from that [sic] issues. design [sic] acts always with certain types of social and cultural boundaries and landscapes*' (Q2P30).

Q2Q4: " The collaboration between schools and companies or other civil organisation can foster Innovation in products and services."

The statement "The collaboration between schools and companies or other civil organisation can foster Innovation in products and services" (Q2Q4) also showed a strong agreement, as a total of 81,2% of the students *Strongly Agreed* or *Agreed* with it.

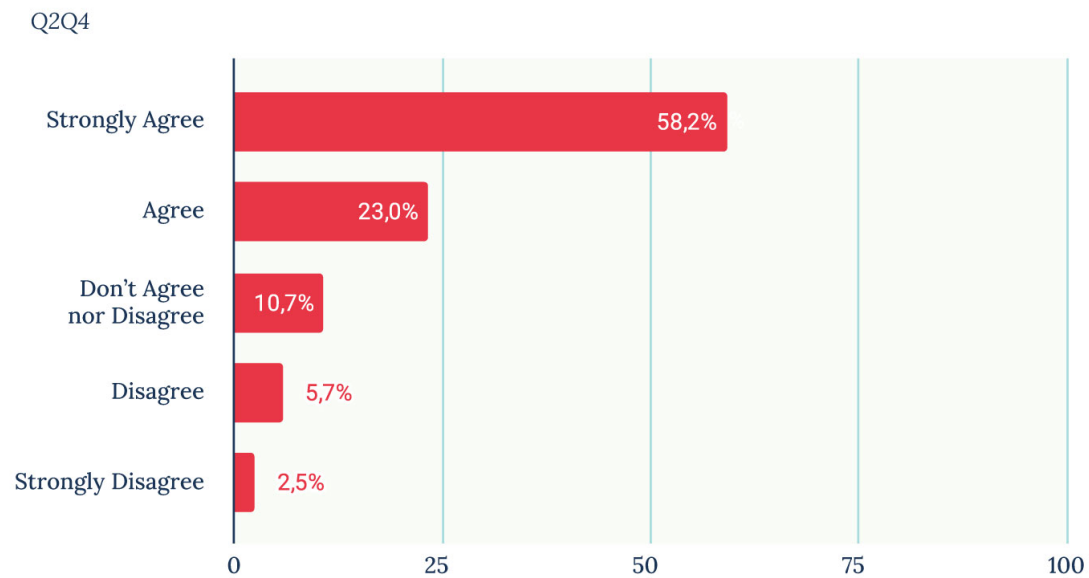


Figure 44: Results for item Q2Q4: " The collaboration between schools and companies or other civil organisation can foster Innovation in products and services."

Comments (Q2Q4A) from the students show an understanding that this type of partnership can foster Innovation as Design students have more space to experiment and come up with creative solutions with and for outside organisations. The participants also highlighted that this type of collaboration could better prepare the students for the real-world as they face real problems and constraints.

Q2Q5: "Design Education plays an important role in finding innovative solutions and strategic paths to overcome the social challenges faced today, such as environmental degeneration, climate change, ageing, extremism, migration, and so on."

The data from item Q2Q5 portrays that 79,5% of the responders *Strongly Agree* or *Agree* that "Design Education plays an important role in finding innovative solutions and strategic paths to overcome the social challenges faced today, such as environmental degeneration, climate change, ageing, extremism, migration, and so on" (Q2Q5).

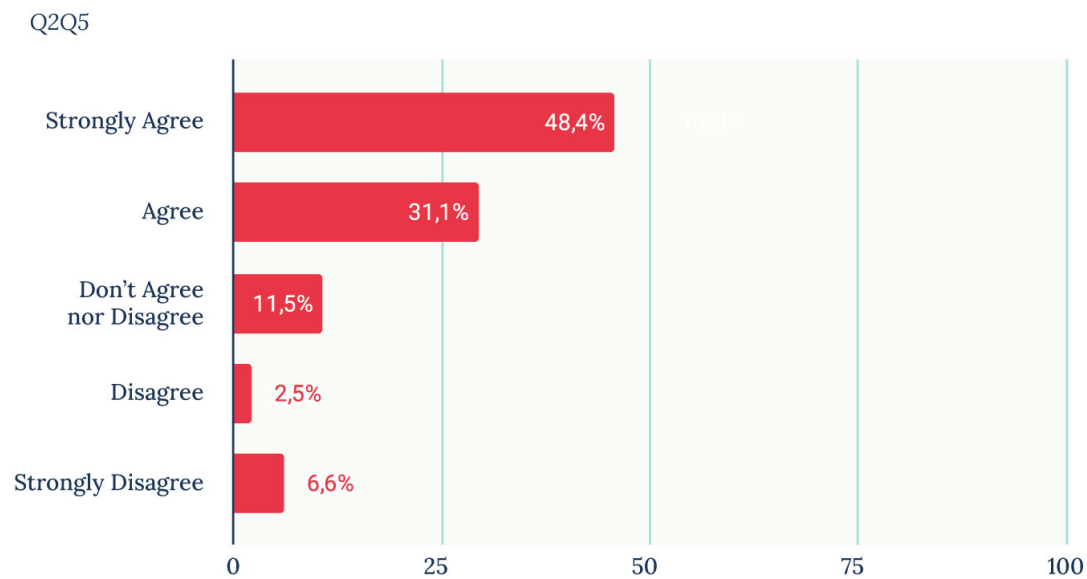


Figure 45: Results for item Q2Q5: "Design Education plays an important role in finding innovative solutions and strategic paths to overcome the social challenges faced today, such as environmental degeneration, climate change, ageing, extremism, migration, and so on."

These results indicate that most of the students believe in the impact of education when tackling the growing number of wicked problems. One student stated that Design is not about beautiful things but how we interact with the world. Other participants affirmed that Design Education should plant the seed to this social approach making these issues a priority encouraging a critical discussion in the academic environment. However, few students declared that if the statement was right, it is still not embedded in Design Education as this kind of problem is still not framed by academia, reinforcing the answers from Q2Q1. One participant stated that designers cannot tackle wicked problems such as hunger, migration or ageing and that Design should serve the client.

Q2Q6: " The projects that I developed during my course are innovative, have social characteristics and contribute to Sustainability."

Although it was evident through the answers that most students understand and value an approach of Design Education towards Sustainability and Social Innovation, when confronted with the statement, "The projects that I developed during my course are innovative, have social characteristics and contribute to Sustainability." (Q2Q6), 41% of the responders remained neutral, opting for "Don't Agree nor Disagree". In comparison, only 18% Strongly Agree, and 24,6% Agree.

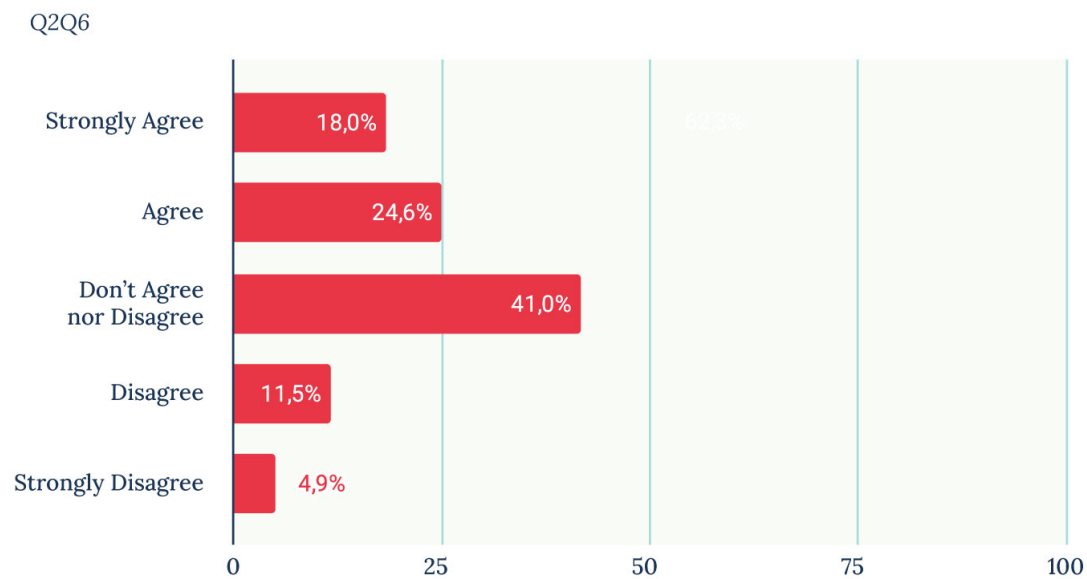


Figure 46: Results for item Q2Q6: "The projects that I developed during my course are innovative, have social characteristics and contribute to Sustainability."

In the follow-up question (Q2Q6A), students cited distinct reasons when prompted to elaborate and explain their decisions. The ones who 'Strongly Agree' or 'Agree', mentioned final or graduation projects – where they had the opportunity to define the problem they wanted to focus independently from a Design brief proposed by the teacher; Initiatives from the professors who provoke them to think about the role of Design in society critically; And personal beliefs that drove them to see the challenges as opportunities to do good Design. In more than on opportunity, students declare that there is not much opportunity to Design appropriately, as projects must follow the market rules and client's perspective.

Q2Q9: From the perspective of how Design can contribute to Social Innovation and Sustainability, we would like to hear more about your thoughts on the matter. Please, use the following field to leave your opinion

For the participants that were neutral and neither agree nor disagree, one argued (Q2P9) that projects could be more "interesting" and "give the future designer a better inspirational base", denoting projects as "over-dated". More than one student said that the projects did not impact Sustainability, but most were focused on improving social connection, while others stated that there had been debates about the themes, but they were not considered in the projects.

Finally, the participants that either 'Disagree' or 'Strongly Disagree' (16,4%) mention not having worked on projects for Social Impact at all. One student identified that only one professor

incentivised them to think of those issues (Q2P34). Another student stated that most of the Design briefs are fictional and unable to provide any impact or interaction with society (Q2P37). Once again, how the program is designed to address market issues was established as what students believe to be an incompatible relationship to projects addressing social characteristics and contribute to Sustainability.

On item Q2Q9, we asked the participants to share their perspective on how they believe Design can contribute to Social Innovation and Sustainability. This question was not mandatory but still received 40 voluntary answers that helped capture students' opinions about the role of designer and Design towards change.

Most of the students recognise that Design can leverage Social Innovation and Sustainability, especially if relying on human-centred processes, positioning designers as problem-solvers. As one student puts, *'Design – and, especially, processes like the design thinking process and human-centered Design – can strongly contribute to finding solutions that will address socio-economic and environmental needs. Ideally, input for finding solutions for these types of issues should come through a multi-disciplinary approach, which these design processes encourage'* (Q2P6). A participant mentioned (Q2P10) that Design could be a great discipline to face new problems, as we struggle to solve them an *'old approach'*. Students also recognise that the issue is not discussed enough as *'I wish it was something we discussed more. It falls under like the ethics of Design. If you're not thinking of the social/political/environmental impacts that the Design can contribute to than [sic] it would be useless to put the time and resources into it'* (Q2P13). Some of the statements recognise the need for designers to anticipate consequences of their designs, as products, primarily digital, have come to affected people on many levels, including psychological. They argue that this power of influencing behaviour from Design must be favouring Social Innovation and Sustainability.

Following (Table 19), we display selected statements from the item Q2Q9: *From the perspective of how Design can contribute to Social Innovation and Sustainability, we would like to hear more about your thoughts on the matter. Please, use the following field to leave your opinion.*

Table 19: Selected statements from the item Q2Q9.

Id	Answer
Q2P3	“There is a lot to do to create a better impact on society and the environment. I strongly believe that technology and design could be a leverage, and enable innovation happen in order to improve existing processes, working methodologies and create a better impact on people and the environment in a human centred, efficient and collaborative way.”
Q2P7	“Designers create everything. Designers need to argue for design that creates a better and more impactful world....not just for designs that appeal to stakeholder needs.”
Q2P11	“Design can contribute to Social Innovation and Sustainability because it can help to find solutions to any kind of problem. Human centered design can help to develop process and solutions that can improve the quality of life of people.”
Q2P13	“This is honestly something I have been thinking about a lot since the class finished. I wish it was something we discussed more. It falls under like the ethics of design. If you're not thinking of the social/political/environmental impacts that the design can contribute to than it would be useless to put the time and resources into it. To me the design thinking process brings mindfulness to design. Understanding the impacts and understanding the people that it will effect. To be mindful of what you're contributing into the digital world. Because A LOT already exists. There is a lot of digital clutter and I, personally, don't want to design something that just piles on top of the rest of the nonsense. Right now is the time to make a sharp right turn into really integrating the digital world with social innovations and sustainable design. Refine the process for our future designers through education.”
Q2P16	“Sustainability is thinking about all the cycle of a product or service in general. Our society is aware of the economic and social problems, and the finitude of natural resources. This conscience leads us to the need for new solutions. This mindset is very important, in my opinion, to understand the role of the Designer and the commitment of contributing to social innovation.”
Q2P25	“Specially during this times we are living design is more that just creativity and having good ideas. Design has an opportunity to solve problems that really need to be solved. Design innovation is a better and more practical way of designing a better society”.
Q2P31	“It's important that design is driven not only by commercial needs, but by social impact, focusing on actually creating a better world for the people and the planet.”
Q2P52	“I missed this type of content during the course. [...] It is hard to understand the needs of the future. I believe that it would be very good if we had more content on technology and sustainability, which I think is essential” (translated by the author)
Q2P54	“I believe it is crucial to think about it, as designers and producers, we are, in a way, responsible to create what exists in the world and influence behaviors, thus we need to be conscious” (translated by the author)
Q2P81	“The sociological aspect of design is evident, design must be made for people, by understanding the societies and communities in which it is part. However, Social Design is clearly different as we focus on a specific people that are in a week situation. Social Design is not for the people, it is the people. It is, indeed, important to address social design at a Design course. Personally, this is the type of design I want to support” (translated by the author)

Finally, we analysed the additional questions answered by former students from a UX/UI Design Bootcamp – an intensive nine-week and full-day program where students worked on a project-based learning approach. It is essential to highlight that our sample for these particular questions significantly smaller (34 responses). Nonetheless, it helped us understand how these students evaluate the effectiveness of PjBL, as we were able to collect also qualitative data.

Q2Q10

When questioned if they considered that the school's PjBL approach helped them understand how to approach Design problems (Q2Q10), 100% of the participants responded 'Yes', which was a strong statement in favour of learning with projects. To develop a deeper understanding of why they believed it to be true, we analysed the follow-up questions, where they were asked to elaborate on their reasons for their responses (Q2Q10A).

For most students, the '*hands-on*' and '*learn-by-doing*' methodology applied throughout the course allowed them to approach problem-solving clearly. They valued the variety of projects they were involved in as it allowed them to see the flexibility of the method and practice the tools in distinctive situations. One student stated that they have become more autonomous as the method "*makes us think for ourselves and during this process we learn how to do the things, solve the problems that will appear during the project*" (Q2P8). Another responder compared the experience with the one he or she had during college where "*we mostly learned theory. Once I graduated, I didn't really know what to do next*", affirming that after the Bootcamp "*I fel [sic] confident*". The opportunity to apply the theory into practice and learn during practice was also frequently mentioned in their answers as a highly positive outcome of PjBL, as it can be verified in the three following quotes. "*The theory was well taught and confirmed with a good amount of practice. Being able to put into practice everything we have learned was crucial to my development.*" (Q2P28); "*You have the opportunity to put in practice what you just learned in theory.*" (Q2P31); "*...This allowed us to apply everything we were learning. And by making it not excercises [sic] but real-life issues we were trying to solve, we had to take it seriously and really understand the tools we were using and how they could help us solve our problem*" (Q2P33).

Q2Q11: "After your Bootcamp, do you feel prepared to solve complex Design projects that tackle social challenges?"

On item Q2Q11, the participants were asked if, after the Bootcamp, they felt prepared to solve complex Design problems that tackle social challenges, with 71,4% responding 'Yes' and 28,6% 'No'.

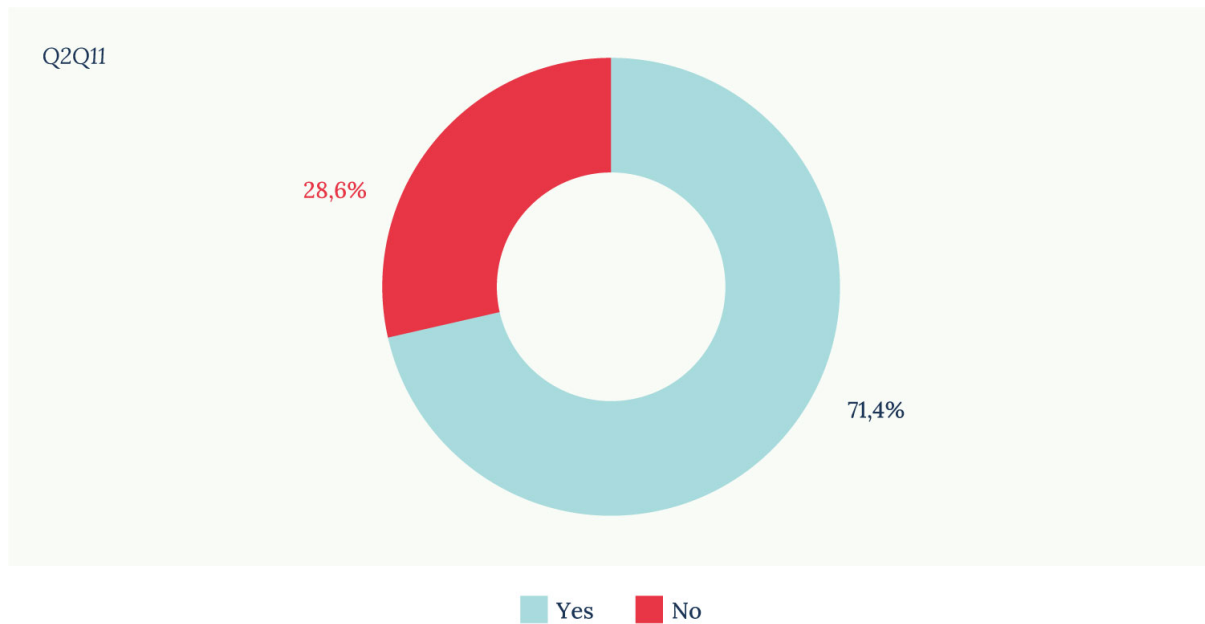


Figure 47: Results for item Q2Q11: "After your Bootcamp, do you feel prepared to solve complex Design projects that tackle social challenges?"

The students had the opportunity to justify their answers in the follow-up question (Q2Q11A), which provided rich insights and qualitative data to our study. Many students manifested an optimistic view of the possibility of tackle social challenges. However, many participants manifested that would need to learn more, have more experience or work with a team to feel prepared. *"Some of the projects that I worked on had a visible effect on contemporary social issues. However, I remain open to learn more about applying these methodologies into real life complex design projects"* (Q2P12), *"I will say yes if I can count with a team"* (Q2P1) and *"We have worked with real-life problems and it's evident that all kinds of problems are approachable with Design Thinking"* (Q2P21) were some of the answers collected from the questionnaires that illustrate the students' general opinions.

With the comprehensive analysis of this instrument, we were able to confirm that most students share the view of the authors visited during the literature review of this study, agreeing that Design and Design Education must contribute to the solve the complex challenges faced by society as incited by UN on the Agenda 2030. Nevertheless, there is yet work to be done by Design Education as we have concluded that the participants in our study believe that themes like Sustainability and Social Innovation and Impact are still not addressed in a structured form by the type of projects proposed to students. Some participants

have highlighted the power of education to train the designer to a certain mindset. If students are continually facing cosmetic and market challenges within their basic Design training, they will tend to face Design like a professional in the same fashion. Whilst, if Design Education takes the lead to introduce a problem-based approach, it can challenge students with real complex problems to be discussed and solved in the classroom. This approach opens the possibility to work alongside the community impacted by the problems, purposefully taking one or more steps forward in the direction of better preparing future designers to become agents of change for a better society.

4.5. Participatory Workshop Data Analysis

Summary

- Number of participants: 41
- Number of workshops run: 3
- Location: Spain, Cyprus and Brazil
- Top ten skills and competencies selected by the participants:

Table 20: Top ten skills responses from the participatory workshop.

Item	Competency
1	Communication Skills
2	Human-Centered
3	Strategic Thinking
4	Empathy
5	Creativity
6	Critical Thinking
7	Social-political Awareness
8	Adaptability
9	Environmental Awareness
10	Management and Leadership Skills

4.5.1. Comprehensive data analysis

For the participatory workshop, we had both quantitative and qualitative outcomes. The Canvas filled with the students' choices arranged by the categories contained the quantitative data to be treated and confronted with the information acquired from the secondary data collection and the questionnaires.

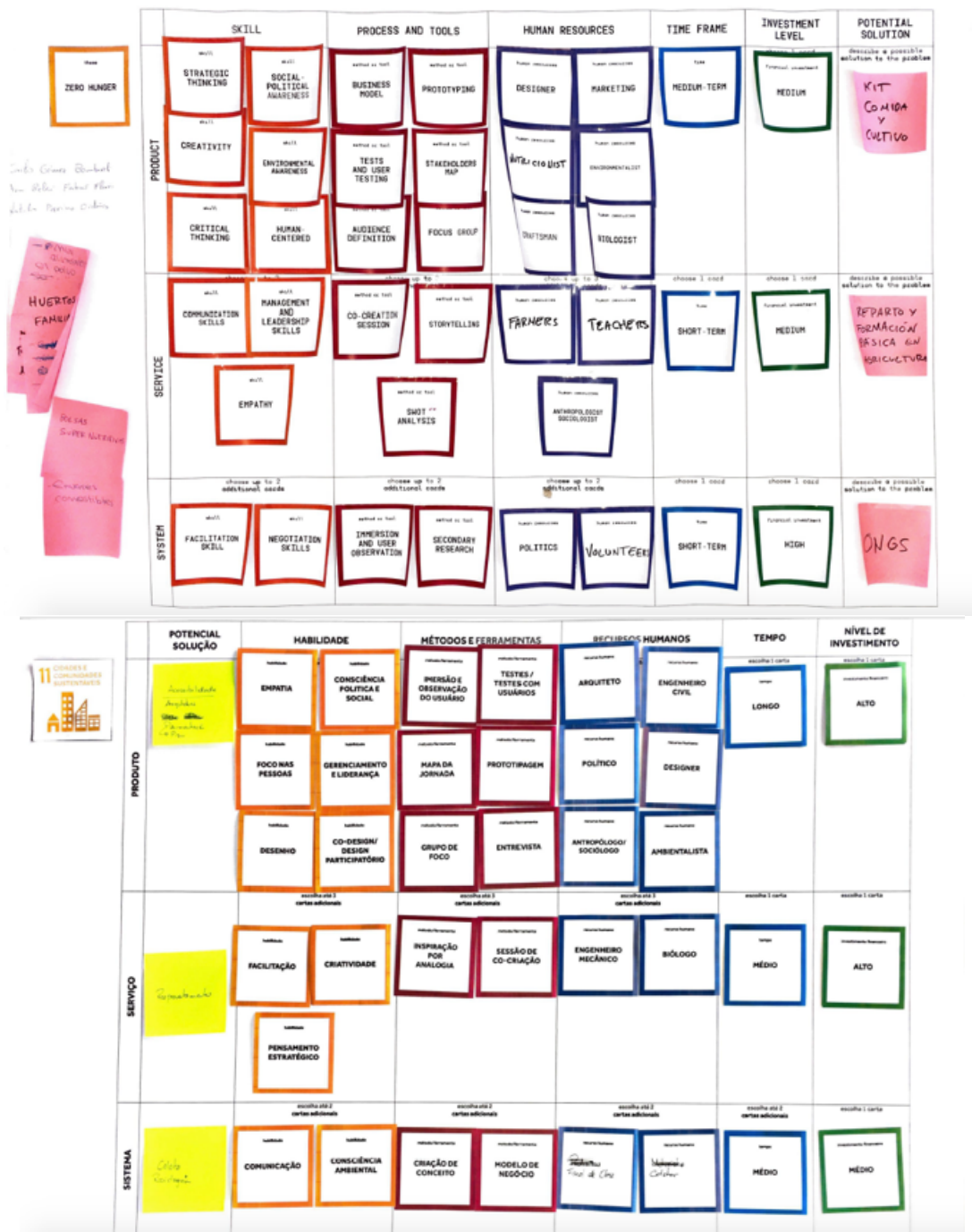


Figure 48: two canvases from two different activities. Photo credit: Author.

To analyse the data collected, we created a form using the digital tool *Google Forms*. The use of this tool was to help visually compile the information. We seek to understand the students' perspective towards the categories: *Skill*, *Tools and Methods* and *Human Resources*. Particular attention was given to Skills due to the nature of our research questions. However, we present here the data from all three categories.

It was not crucial to this research to assess the nature of Design outputs, namely the products, services and systems designed by participants, as these outputs were only used as an academic exercise to understand the path and means to achieve the results, according to Design student's point of views. We were not trying to conduct a creative exercise that expected highly innovative solutions; instead, we used the creative method to gather feedback.

The choices of SDGs were, in general, heterogeneous as seven different SDGs were selected by the eleven groups that participated in the activity (Figure 49). Students from the same cohort could not choose the same SDG since only one card was available *for each theme*. Although heterogeneous, two SDGs were selected at all three editions of the workshop, *Gender Equality* and *Responsible Consumption and Production*.

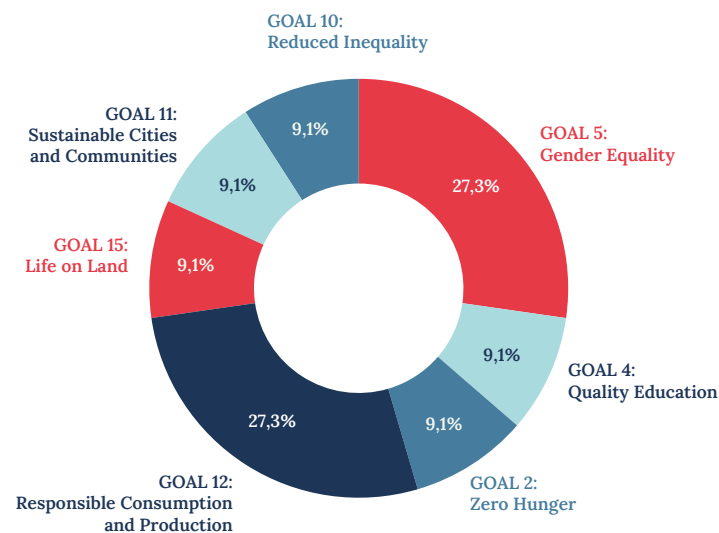


Figure 49: The Themes chosen by the groups of students during the three editions of the workshop.

Continuing our examination, we analysed the students' choices for the *Skill*, as it allowed us to compare with findings from other sources, namely the secondary data and the questionnaires.

We also evaluated the results from the choices of *Tools and Methods* and *Human Resources*. With that information, it was possible to conclude how the participants see the designer's role in the solution to Sustainability problems. It was also possible to analyse their appreciation of the needed competencies to Design for Social Innovation and Sustainability. Moreover, we could understand the tools and methods they believed to be useful to achieve expected results and the types of collaborations necessary to tackle the growing complexity of the challenges designers must deal with. The answers were compiled into a spreadsheet and used to generate visual data, which allowed for the treatment of the students' information. Figure 50 visually summarises the *Tools and Methods' answers*, Figure 51 for *Human Resources*, and Figure 52 for *Skills*.

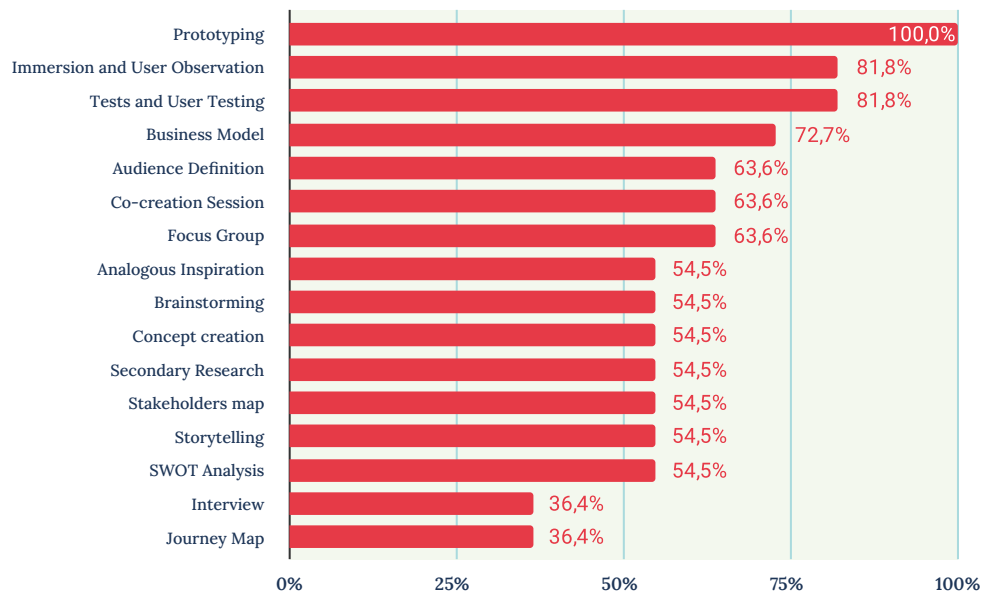


Figure 50: *Tools and Methods selected by the students during the workshop.*

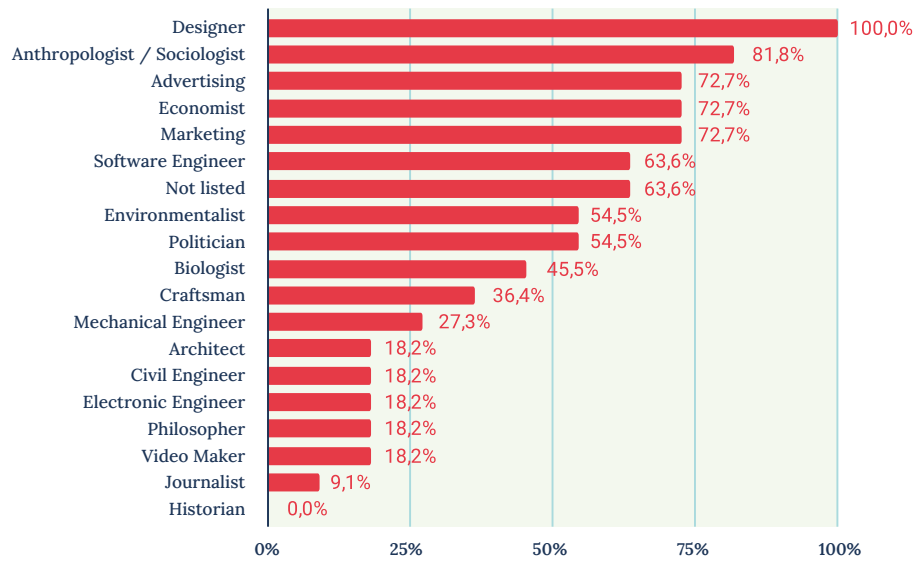


Figure 51: Human Resources selected by the students during the workshop.

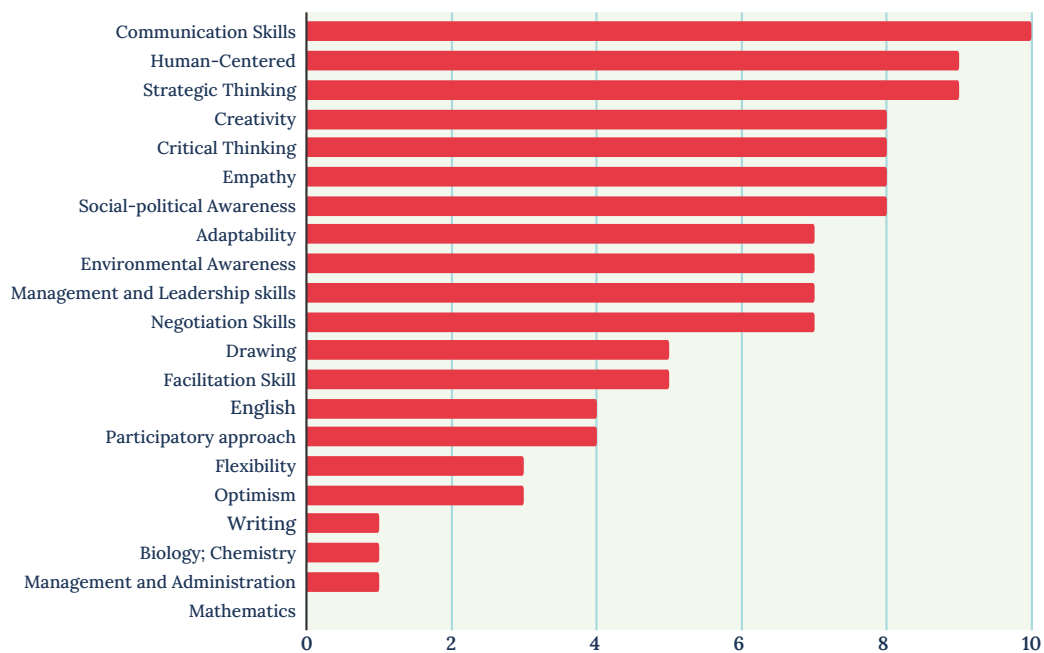


Figure 52: Skills selected by the students during the workshop.

As stated earlier, our primary focus of outcome from this activity was directed at the results obtained in the *Skill* category. In general, the students' choices resonate with the information collected by the questionnaires and secondary data. Nevertheless, we identified some unique results that must be considered. It is important to stress that, unlike the data collected from

other instruments, during the participatory workshop the students made choices influenced by context, as they selected the cards explicitly based on the problems they were tackling at the moment. Such information is fundamental to our research, as we evaluate the impact of a problem-based approach to problem-solving. Since the nature of the problem often dictates the tools to be used and the competencies to be tailored, the projects proposed throughout the students' academic path should embrace diversity, allowing them to understand the flexibility needed to solve different kinds of challenges. During our enquiry, the Bootcamp students showed to value the plurality of projects. Their statements supported this conclusion. "*Every project was different in what information you have already and what you need. It taught us to think critically about how we can find solutions*" (Q2P5), "*I have a process and different tools which I can choose from depending on the problem*" (Q2P14).

With that being said, we highlight and discuss three key points that deviated from the results we have seen from the other sources.

- 90,9% of the groups choose *Communication Skills* as a core skill for the designer. A reflection on how students perceive value not only in the creation of the artefact, service or system. They also understand that there is an essential component related to how designers must adequately communicate their ideas (Shedroff, 2009).
- 63,6% of the groups selected *Management and Leadership Skills* and *Negotiation Skills*. Those choices evidence their understanding that Design is a vital component embedded in Business, and for it to achieve success and recognition, designers must play a political part in companies and organisations to show the value of Design to their stakeholders (Shedroff, 2009).
- Only 36,4% of the groups believe that a *Participatory Approach* was an adequate competency to solve Design problems. Whilst the literature vigorously defends that a participatory approach to Design is beneficial to Social Design (Manzini & Coad, 2015a; McMahon & Bhamra, 2016; Normoyle, 2019; Sanders, 2002, 2013; Sanders & Stappers, 2008; Shedroff, 2009), students may still not understand its value. One of the reasons for that might be how the nature of projects in the academic environment still fail to include the community and stakeholders in the Design process.

4.6. Key findings

We highlight key findings and pre-conclusions drawn from all instruments designed for our research:

The mixed-methods applied in the study allowed for data from different sources to be analysed and compared, in which it was possible to identify patterns across sources. There has been a high occurrence of competencies such as *Critical Thinking*, *Complex Problem-solving*, *Creativity*, *Empathy* and *System Thinking*.

It was possible to evaluate how different Design institutes are integrating and tackling Sustainability issues in their *curricula*, showing improvement from some institutions whilst others are still addressing Design in a format that has been highly criticised. Almost half of the participants in our research have participated in projects that tackle social issues, but in general, students still see that institutions' culture of Design not to be fully committed to addressing today's world crisis. These issues are only discussed in a few disciplines or by individual endeavours of some professors.

Independent from being exposed to complex problems during their educational path, most of the students believed that Design and Design Education can foster change in society and that Design Education contributes to social, cultural and environmental development. This is of great importance, showing a predisposition from the students to welcome a more ethical and responsible education.

The students' perception of their influence in society was directly affected by the nature of the projects they develop during the course. Students involved in projects that address Social Impact were more likely to see their positive influence on society.

Students see a high value in the PjBL approach to learn and consolidate the Design methodology and develop competencies. They felt more prepared to solve complex problems by developing projects as they felt more autonomous and confident about their capabilities.

Design Education must embrace a broad diversity of projects and problems to be solved to allow students to acquire a diverse set of competencies, according to the project's requirements, learning to adapt to different contexts and situations.

4.7. Chapter Summary

This chapter analysed the qualitative and quantitative data collected from different instruments designed for our study. In the secondary data analysis, we examined seven documents dedicated to identifying the competencies needed for future professionals in the context of a paradigm-shifting world. Two questionnaires collected opinions from Design students in four different countries, namely Brazil, Portugal, Spain and Cyprus. They were designed and applied in a sequence of one another in order to collect complementary information. Next, we presented the results of three participatory workshops facilitated with Design student in Spain, Cyprus, and Brazil. Each instrument provided a final list of competencies that will be refined and applied to developing a Design competencies framework in the next chapter. At the end of the chapter, we highlight our most important findings, which allowed us to draw pre-conclusions regarding our research questions and hypothesis. These findings were essential to the next steps addressed in the following chapter.

Chapter 5

A New Design Competencies Framework

5.1. Introduction

In Chapter 4, we analysed the data from different sources and were able to identify a list of Design competencies from each of these sources. For the present chapter, we define a New Design Competencies Framework to serve as a tool for Design Educators to rely on to start addressing the change in Design Education. In other words, we here present our solution to the gap identified in Chapter 1.

The framework's construction made it necessary to delineate its structure to facilitate its understanding and use of the model. It was also equally crucial to present a consolidated list of core Design competencies to address Sustainability, Social Impact, and facilitate strategic Innovation. Both of these issues are addressed in this chapter. First, we propose the structure of the competency framework. Secondly, we consolidate the competencies in a comparative and iterative process. Finally, we populated the model with the areas, competencies and enablers.

5.2. Defining the structure of the framework

As previously stated, defining the Design competencies is the first step to support Design Education into making a change into a pedagogic model that is more in tune with society's complex problems and, consequently, by the Design sector. However, the simple

identification of the competencies is not enough to facilitate the desired transition in Design Education.

It was essential to define a structured model to make the competencies accessible and straightforward to incorporate as outcome Design projects within academia. The systematisation of a framework permits easy visualisation and perception of how the competencies relate, first to one another and secondly to the Design process. The primary references for our study include The Entrepreneurship Competence Framework – EntreComp (Bacigalupo et al., 2016), The European Digital Competence Framework – DigiComp (Vuorikari et al., 2016) and the ReACt Model (Ferreira, 2020b; Ferreira, Savva, et al., 2020).

We analysed the overall structure of the three frameworks, concluding that while different in its particularities, they followed a similar structure of Dimensions, where:

- Dimension 1 – Clusters of competencies organised by different areas and identified under a unifying theme. E.g., '*ideas & opportunities*' and '*Communication and collaboration*'. No pattern was found to neither the number of areas or Competencies under each area for this dimension.
- Dimension 2 – Competencies titles. E.g., '*Mobilising resources*' and '*Programming*'.
- Dimension 3 – Level of Proficiency: All three models approach each Competency by proficiency level, varying from three to four stages. E.g., '*Foundation*' and '*Expert*'.

Figure 53 illustrates our findings, summarising the basic typical structure of the analysed frameworks.

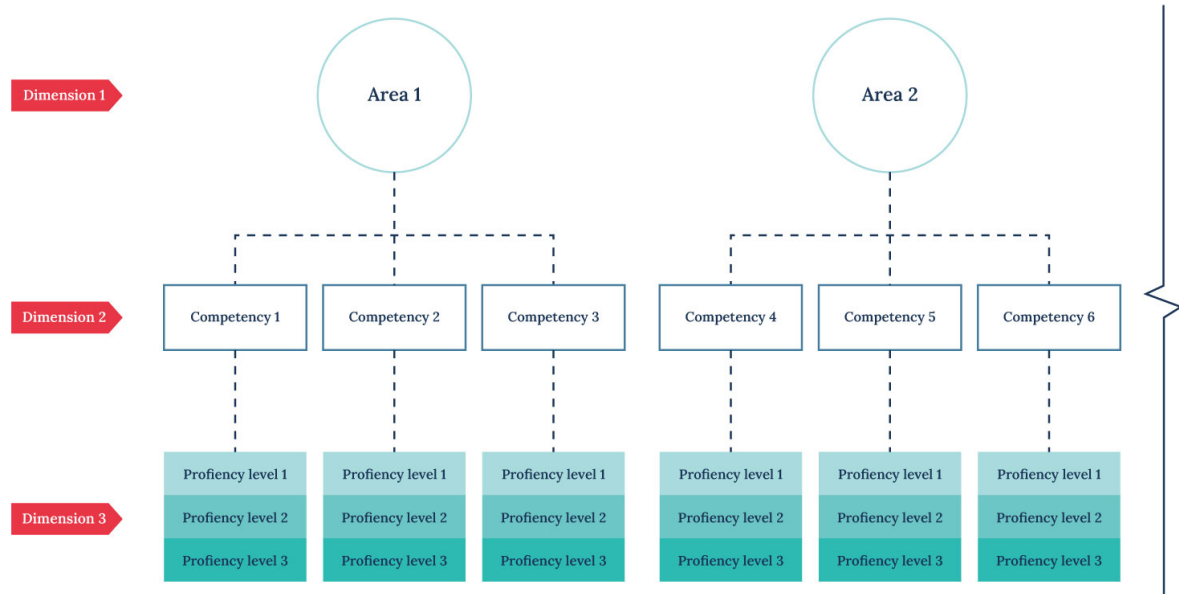


Figure 53: Common structure identified in the analysed frameworks.

We followed a similar configuration based on this analysis but limiting this initial version of the Design Competencies Framework. We adopted the *Competencies* and *Areas* dimensions from the reviewed structure, hence living out the *proficiency* levels. However, we identified a distinct yet necessary third Dimension that we call *Enablers* of the Competency. For the context of this study, we will define *Enablers* as the structured tools and methods that support the access to information to develop skills and mindsets from which Competencies can be nurtured.

It is not our intention to create a new set of tools for the sole purpose of the adoption of the framework. On the contrary, our research has shown that there is already vast content published in the growing number of Design Toolkits available to the public, many under *Creative Commons Licenses*⁵. We intended to create the connection between the existing information and the Competence it enables to help Design Education benefit from it. On item 5.5, we discuss the *Enablers* and their role in the Competency Framework we propose.

At this point, we defined the basis of our model, as displayed in Figure 54.

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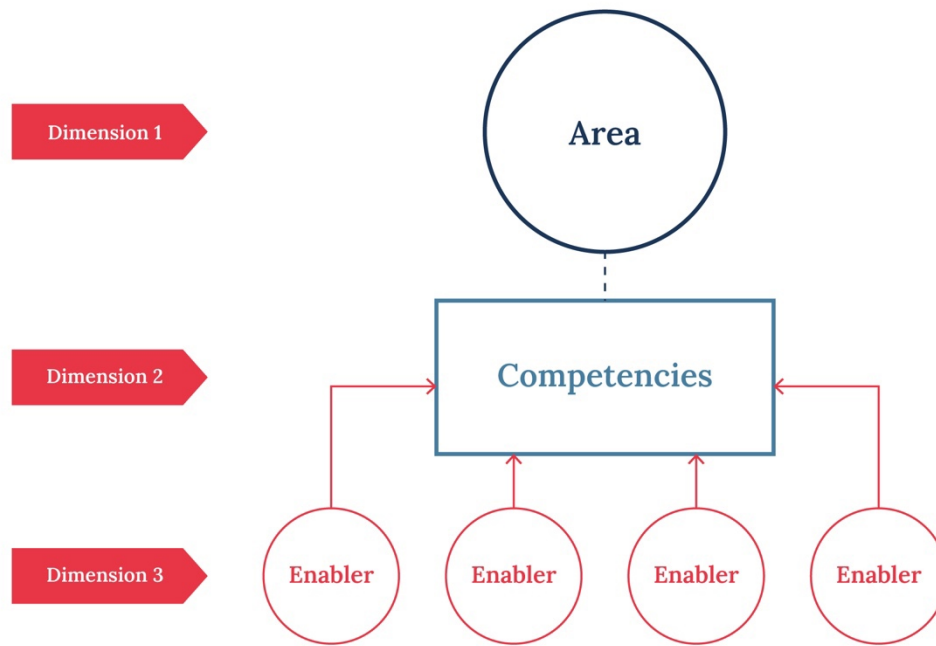


Figure 54: Proposed structure for the Design Competencies Framework. Source: Autor.

5.3. Core Design Competencies

While in the previous chapter, we introduced how we collected and analysed the data from different sources to help answer our research questions, we still ended up with different outcomes from each of the sources. As Figure 55 illustrates, there was a need to consolidate our findings in a final framework and draw our conclusions regarding the set of competencies expected from designers in a paradigm-shifting world. We argue that the set of competencies will allow designers to become professionals aware of the importance of their civic action and active role towards Innovation, social wellbeing, and Sustainability.

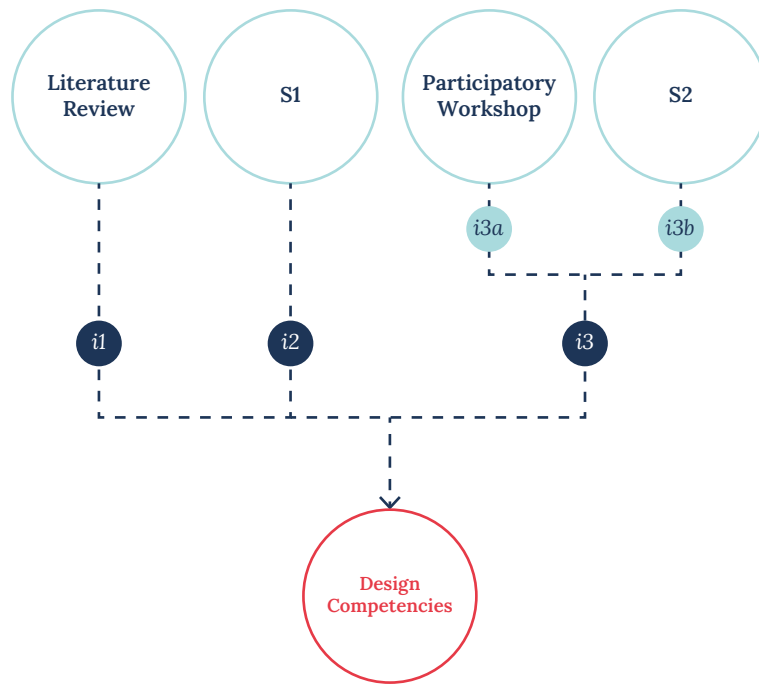


Figure 55: Consolidation of results scheme from the data collection instruments. Source: Author.

The four sources of data provided three different inputs for the Design competencies:

- i1: List of twelve Design competencies from the complementary literature review;
- i2: List of ten Design competencies from the initial questionnaire (Q1);
- i3a: List of ten Design competencies from Participatory Workshop;
- i3b: List of ten Design competencies from the second questionnaire (Q2);
- i3: Consolidation of items i3a and i3b into one item, as both sources had the same options for students to choose but were collected in different instruments.

Table 21 summarises the final list of competencies obtained from the three inputs (i1, i2 and i3) arranged alphabetically.

Table 21: Final list of competencies obtained from inputs i1, i2 and i3. Source: Author.

Item	i1	i2	i3
1	Accountability	Complex Problem Solving	Adaptability
2	Collaboration	Creativity and Innovation	Communication Skills
3	Complex Problem-solving	Critical Thinking	Creativity
4	Creative Thinking	Drawing	Critical Thinking
5	Critical Thinking	Environmental Awareness	Empathy
6	Empathy	Marketing	Environmental Awareness
7	Environmental Awareness	Project Methodology Literacy	Human-Centred
8	Ethics	Research Methods	Management and Leadership Skills
9	Learn to Learn	Social-political Awareness	Social-political Awareness
10	Social, historical, cultural and political awareness	Teamwork	Strategic Thinking
11	Strategic Thinking		
12	System Thinking		

From that point on, we started to work on refining and simplifying the list of competencies. We assured that the final list was consistent with our research's premisses and findings by proceeding in that direction. Competencies provided a clear path for a future generation of designers who must be equipped to deal with the world's growing complexity, aware of the importance of their civic action and active role towards Innovation, social wellbeing, and Sustainability. Competencies that are the basis to a framework to support the Design Higher Education in revamping their *curricula* and offer a program aligned with a new paradigm already established but yet to be addressed by most Design institutions.

Figure 56 shows how the list of competencies iterated to achieve the final framework proposed by this study. A total of four iterations were individually influenced by questioning moments. For a practical purpose, we have called these moments '*Modifiers*', which have influenced the existing version to a level that has presented the need for a new variation. These cycles were repeated until we found no more *Modifiers* in our processes. During this process, we opted to make small incremental iterations to ensure that we were modifying one aspect at a time.

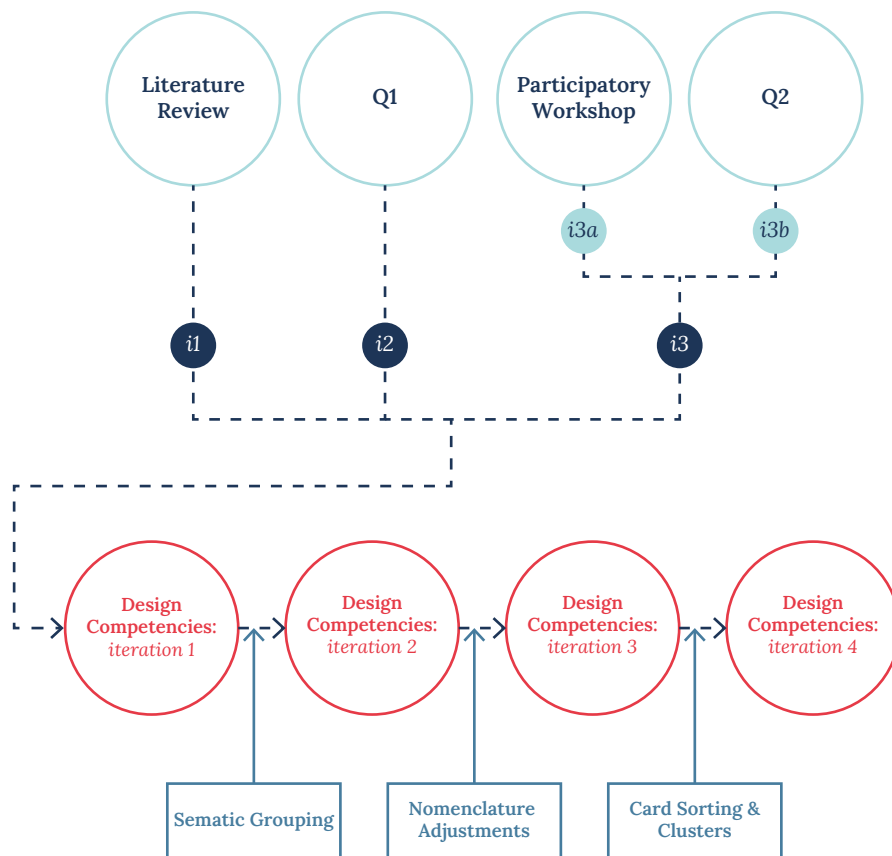


Figure 56: List of competencies' iterations during the process of developing the Design Competencies Framework. Source: Author.

5.3.1. Iteration 1: Consolidation of sources

The first iteration was the direct result of combining items i1, i2 and i3, as shown in Table 21. To define the consolidated list, we proceeded in three steps. We identified common elements present in at least two of our sources (see Table 22).

Table 22: Common competencies present in at least two sources (i1, i2 and i3). Source: Author.

Item	i1	i2	i3
1	Accountability	Complex Problem Solving	Adaptability
2	Collaboration	Creativity and Innovation	Communication Skills
3	Complex Problem-solving	Critical Thinking	Creativity
4	Creative Thinking	Drawing	Critical Thinking
5	Critical Thinking	Environmental Awareness	Empathy
6	Empathy	Marketing	Environmental Awareness
7	Environmental Awareness	Project Methodology Literacy	Human-Centred
8	Ethics	Research Methods	Management and Leadership
9	Learn to Learn	Social-political Awareness	Social-political Awareness
10	Social, historical, cultural and political awareness	Teamwork	Strategic Thinking
11	Strategic Thinking		
12	System Thinking		

Secondly, we identified from the remaining competencies those that responded to the expected outcome, referenced continuously by the literature, for a designer that acts towards Sustainability and social change.

Table 23: Identification of competencies related to the designer as an agent of change, accordingly to the literature.

Item	i1	i2	i3
1	Accountability	Complex Problem Solving	Adaptability
2	Collaboration	Creativity and Innovation	Communication Skills
3	Complex Problem-solving	Critical Thinking	Creativity
4	Creative Thinking	Drawing	Critical Thinking
5	Critical Thinking	Environmental Awareness	Empathy
6	Empathy	Marketing	Environmental Awareness
7	Environmental Awareness	Project Methodology Literacy	Human-Centred
8	Ethics	Research Methods	Management and Leadership
9	Learn to Learn	Social-political Awareness	Social-political Awareness
10	Social, historical, cultural and political awareness	Teamwork	Strategic Thinking
11	Strategic Thinking		
12	System Thinking		

We argue that this was the moment to critically revisit the raw data collected to reintroduce competencies that did not figure on the final list of some sources for two main reasons. First of all, the list of competencies was established by us as a benchmark for easy comparison but should not be inflexible to harm the results. Furthermore, as we were still in the first moments of the decision-making process, it was ideal to have a more comprehensive list of pertinent possibilities to decide from rather than develop the final framework from fewer options, risking the results' quality.

With that being said, we identified two extra competencies to be added to the fifteen already selected. As expressed on items 1.5.1 and 1.5.3 of this Thesis, *Participatory Approach* is a core competency for the designer to developed as covered by the literature. *Flexibility* was the second Competence added to the groups based on the fact that wicked problems, besides complex, are ill-defined and dynamic by nature (Chevallier, 2016; Funke, 2012), which requires from the designer the capacity to be flexible being able to navigate in different scenarios as the problem unravels new possibilities in its course.

Table 24 summarises the list of seventeen competencies listed alphabetically.

Table 24: Design Competencies: Iteration 1.

Item	Competency
1	Accountability
2	Adaptability
3	Collaboration / Teamwork
4	Communication Skills
5	Complex Problem Solving
6	Creativity
7	Critical Thinking
8	Empathy
9	Environmental Awareness
10	Ethics
11	Flexibility
12	Human-Centred
13	Learn to Learn
14	Participatory Approach
15	Social, historical, cultural and political awareness
16	Strategic Thinking
17	System Thinking

5.3.2. Iteration 2: Semantic Grouping

At this point, we were able to identify competencies that could be semantically grouped. We proceeded to cluster competencies in an attempt to simplify the framework and remove possible duplicated concepts. It is important to stress that we were not yet worried to define a unified title for each group.

The first group was formed by the union of *Human-Centred* and *Empathy* as both concepts are intertwined in Design as the Human-Centred Approach to problem rely heavily on Empathy to build successful products, services and systems for people. The second cluster grouped *Collaboration*, *Teamwork* and *Participatory Approach*, as they related to the capacity to work together with different stakeholders designing for and with them in an approach that conjugates the parts interested in the Design processes' outcomes. Lastly, the third group was constituted by concatenating *Adaptability* and *Flexibility* as both concepts, although different,

rise from a capacity to deal and evolve from the uncertainty that is evident in complex challenges. Table 25 highlights the groups in red.

Table 25: Design Competencies: Iteration 2.

Item	Competency
1	Accountability
2	Adaptability / Flexibility
3	Collaboration / Teamwork / Participatory Approach
4	Communication Skills
5	Complex Problem Solving
6	Creativity
7	Critical Thinking
8	Empathy / Human-Centred
9	Environmental Awareness
10	Ethics
11	Learn to Learn
12	Social, historical, cultural and political awareness
13	Strategic Thinking
14	System Thinking

5.3.3. Iteration 3: Nomenclature Adjustment

Subsequently to identifying the fourteen Design Competencies, it was still necessary to proceed with adjustments, namely the terms used for each Competency, to achieve a more straightforward approach. While some of the terms were clear enough and required no changes, others were simplified or modified to provide a straightforward concept. Whilst it may seem simple, this process involved diving deep into the definitions of each of the Competencies. For that, we again went back to the specific literature to provide the basis for our decisions. For now, we present the outcome attained with the process; however, on item 5.5, we provide a more comprehensive definition of each Competency.

Table 26 illustrates the adjustments, comparing side by side iterations 3 and 4, highlighting the changes in red.

Table 26: Comparison between Design Competencies Iteration 2 and 3.

Item	Design Competencies Iteration 2	Design Competencies Iteration 3
	Competency	
1	Accountability	Envision Design Outcome
2	Adaptability / Flexibility	Adaptability and Flexibility
3	Collaboration / Teamwork / Participatory Approach	Participatory Approach
4	Communication Skills	Communication Skills
5	Complex Problem Solving	Complex Problem Solving
6	Creativity	Creativity
7	Critical Thinking	Critical Thinking
8	Empathy / Human-Centred	Empathy
9	Environmental Awareness	Environmental Awareness
10	Ethics	Ethics
11	Learn to Learn	Learn to Learn
12	Social, historical, cultural and political awareness	Context Awareness
13	Strategic Thinking	Strategic Thinking
14	System Thinking	System Thinking

5.3.4. Iteration 4: Building the clusters

We adopted a three-step process to ensure that we structured the competencies into Areas or Clusters that reflected a more substantial relationship between them and were accessible and easy to understand. First, we defined the clusters internally in an individual and introspective exercise, resulting in the first draft of the model, as seen in Table 27. Next, we invited experts to take part in a participatory activity. Moreover, we consolidated our findings into a final model.

Based on the present model, we identified four main clusters where a broader motif could group the competencies: *Evolve*, *Innovate*, *Sustain* and *Engage*. During this iteration, the goal was not to force any unnatural grouping for the sole objective of having evenly distributed Competencies by clusters. As a result, some of the areas ended up with more Competencies, while others with less.

Table 27: Competency clusters initially proposed by the author.

Areas	Competencies
Evolve	Learn to Learn
	Adaptability and Flexibility
	Critical Thinking
Innovate	Complex Problem Solving
	Participatory Approach
	Creativity
	Empathy
Sustain	Context Awareness
	Environmental Awareness
	System Thinking
	Envision Design Outcomes
	Ethics
Engage	Communication Skills
	Strategic Thinking

As we reached a critical moment for our research findings, it was necessary to confront our discoveries with experts' perspectives to obtain feedback and build a more reliable and consolidated model. We designed an online Card Sorting activity using the digital tool *Optimal Workshop* and invited specialists from the Design field, focusing on education, Social Innovation or Sustainability, to participate and contribute. Participants were sent an invitation e-mail with a link to the activity (see Appendix 5:) to collaborate in our research.

The partakers were briefly introduced to the research, and current phase at the welcome page then asked to start the activity by clicking on the "Continue" button (see Appendix 6:).

There were fourteen cards on the left side of the following screen, each with one of our study's identified Competency (see Appendix 7:). The Competencies were arranged randomly. Participants were then asked to read through the competencies list and arrange them in clusters that made sense to them by dragging each card to the canvas on the screen's right side. As this activity was an *Open Card Sorting*, participants could create and name their groups as they saw fit. We suggested no names or quantity of clusters. Once satisfied with their arrangement, the participants should then click on the "Finished" button on the screen's top

right side. The responders could view the instructions and leave a comment by clicking on the respective buttons at any time.

A total of eighteen specialists took part in the activity generating valuable information to compare and adapt the framework for a universal understanding. Following, we summarise the results of the card sorting.

The number of categories created by the participants varied from two to seven. However, the majority (56%) of the participants grouped the Competencies into three different categories. The groups created demonstrated that the experts believed that a framework with only three categories could work as a final solution. Only 22% chose four categories, like our first proposal.

In order to compare the most popular sorting strategies, we proceeded with a participant-centric analysis (PCA). The analysis provided by *Optimal Workshop* identifies responses up to three possibilities that find strong agreement amongst the participants' choices. The tool identified that eight out of the eighteen specialists agreed with the following categories structure (Table 28):

Table 28: Most common responses from the card sorting activity. Adapted from the results available at the Optimal Workshop results.

Areas	Competencies
1	Learn to learn
	Adaptability and Flexibility
	Participatory Approach
	Communication Skills
	Empathy
2	Envision Design Outcomes
	Complex Problem Solving
	Creativity
	Strategic Thinking
	System Thinking
3	Critical Thinking
	Environmental Awareness
	Ethics
	Context Awareness

Comparing the output of the activity with our own results, we could identify similarities when grouping the following items:

Table 29: Grouping similarities' comparison from our initial research proposal and the card sorting results.

Author's Grouping	Card Sorting Results
Grouping Similarity 01	
Learn to Learn	Learn to learn
Adaptability and Flexibility	Adaptability and Flexibility
Critical Thinking	Participatory Approach
	Communication Skills
	Empathy
Grouping Similarity 02	
Complex Problem Solving	Envision Design Outcomes
Participatory Approach	Complex Problem Solving
Creativity	Creativity
Empathy	Strategic Thinking
	System Thinking
Grouping Similarity 03	
Complex Problem Solving	Learn to learn
Participatory Approach	Adaptability and Flexibility
Creativity	Participatory Approach
Empathy	Communication Skills
	Empathy
Grouping Similarity 04	
Context Awareness	Envision Design Outcomes
Environmental Awareness	Complex Problem Solving
System Thinking	Creativity
Envision Design Outcomes	Strategic Thinking
Ethics	System Thinking
Grouping Similarity 05	
Context Awareness	Critical Thinking
Environmental Awareness	Environmental Awareness
System Thinking	Ethics
Envision Design Outcomes	Context Awareness
Ethics	

Three of the competencies did not have a direct relationship between the two structures. They were *Critical Thinking*, *Communication Skills* and *Strategic Thinking*.

The answers' plurality reveals that grouping the Competencies is open for individual interpretation and reinforces the idea that there are strong relationships amongst most of the Competencies (see item 5.5). However, we were able to consolidate our position with the card sorting results to build the competencies' final grouping.

We followed the card sorting activity results and adopted a three-group structure instead of the four we have previously built. The three areas were named accordingly to the type of outcome intended by the group of competencies it is composed: *Build Resilience*, *Understand Consequences* and *Propose Solutions*.



Figure 57: Final clusters naming for the Design Competencies Framework. Source Author.

Build Resilience is constituted by the *Grouping Similarities 01* and *03* and the competency *Critical Thinking*. The cluster kept most of the structure found in the first group of the card sorting activity. *Build Resilience* groups competencies that aim to equip future designers to build resilience while learning from a collaborative approach and developing Critical Thinking that enables a lifelong learning capability.

Understand Consequences congregates a set of competencies that invites the designer to deal with complexity and how the outcomes of their actions can affect the world's Sustainability. By providing context to the Design Process, designers develop a holistic and systematic

approach. The *Understand Consequences* cluster was composed by the *grouping Similarities 04 and 05*.

The third group, *Propose Solutions*, accounts for building creative and innovative thinking to drive solutions that address Sustainability issues. It also enables future designers to strategically communicate the value of such proposals to businesses and society. The cluster was composed of *Grouping Similarity 02* and the Competencies *Communication Skills* and *Strategic Thinking*.

One final adjustment regarding the nomenclature of two competencies was made at this stage. *Participatory Approach* was replaced with *Collaboration* since a participatory approach can be developed inside a *Collaboration* competency which safeguards a broader scope. With the adoption of *Collaboration*, it is possible to include other collaborative endeavours under the same domain, such as co-design and co-creation. Secondly, *Communication Skill* was simplified to only *Communication*. The word skill conflicted with the definition of Competency adopted by this Thesis and presented in Chapter 01. Table 30 showcases the final Competencies' areas after all the iterations.

Table 30: Competencies' areas for the New Design Competencies Framework. Source Author.

Build Resilience	Understand Consequences	Propose Solutions
Collaboration	Context Awareness	Complex Problem Solving
Empathy	Environmental Awareness	Creativity
Learn to Learn	Ethics	Strategic Thinking
Adaptability and Flexibility	System Thinking	Communication
Critical Thinking	Envision Design Outcomes	

The fourth and more complex iteration completed the cycle that defined our framework's two main dimensions: *Area* and *Competencies*.

5.4. Identifying the competency *Enablers*

Arguably, the present research's most significant outcome was identifying core Design competencies that future designers should develop to become agents of change towards a more sustainable world. However, the sole identification of such competencies is not enough to guarantee that the next generation of designers will develop the mindset we defend in this

Thesis. Design Education plays a crucial part in developing the competencies by integrating them into their *curricula*. As posted in Chapter 1, we argue in favour of Problem Based Learning. This approach allows students to develop competencies in the context of solving complex and real problems. Students must be stimulated to learn to use tools and methods that address problems while developing the set of competencies defined by the professors during academic projects. For this study and the systematisation of our framework, these tools and methods are identified as *Enablers*.

The popularisation of the Design Thinking model allowed for a logical organisation of the Design process and provided alignment structured the stages a Design project goes through. As a later result of the popularisation of Design Thinking, the Design sector witnessed the publication of a growing number of Design toolkits. Freach (2019) argues that “while the Industrial Age produced and thrived on instructional Design manuals, the Information Age builds toolkits for a diverse set of users.”

Design toolkits introduced a structured process to address problem-solving in a designerly way. “Design tools and toolkits provide the syntax and semantics for such a new language that serves as a catalyst between the design disciplines and industry” (Freach, 2019). Being usually organised in phases and sequential tools, they provide a "how to" guide to solve problems, making the process of designing clear, understandable and easy to follow. Such characteristics are valuable assets for the Design Education to take advantage of and incorporate into the Design learning process. Design schools have the opportunity to equip students with new tools to use in their Design process and develop competencies while doing so.

"Contemporary design toolkits attempt to equip organisations and teams with a means for dealing with the ambiguous and complicated nature of their problems. They can add confidence to the process of answering basic questions, such as: What problem am I trying to solve? How should I solve it? What do I need to do to solve the problem? What might the outcome look like? Can my approach and solution solve similar problems in the future?" (Freach, 2019)

Freach (2019) also highlights the practical benefits of the Design Toolkits that:

- Enable teams to frame or reframe problems from a collaborative perspective facilitating dialogue and engagement within the team and external stakeholders (Freach, 2019).
- Offer a framework to visualise problems and solutions while equip the Design team to learn from people's experiences as a source for insights and ideas (Freach, 2019).

The benefits pointed by the author reinforce the development of many of the competencies identified in our research, such as *Collaboration*, *Complex Problem-Solving*, *Critical Thinking*, *Context Awareness*, *Communication*, *Creativity*, *Empathy* and *Strategic Thinking*, to name a few.

The toolkits often fall short of identifying and communicating the type of competence designers develop when using those instruments while exhibiting a rich amount of information and Design tools. It is our intention to close such gap with the proposal of the Design Competencies Framework. To identify the *Enablers* of the competencies within Design toolkits, we conducted a thorough analysis of twelve documents available publicly. Being opened to use and consultation was paramount for our choosing, as we seek to provide easy access to information for the Design community. At this point, we aimed for a wide variety of Design fields but targeted mainly at toolkits related to complex problems, such as social and environmental issues. The list of toolkits analysed is displayed in Table 31.

Table 31: List of Design Toolkits analysed during the study.

Item	Toolkit	Category
1	Civic Service Design	Service Design
2	The Field Guide to Human-Centered Design	Design For Social Impact
3	Circular Design Guide	Design for Sustainability
4	Design Method Toolkit	Digital Product Design
5	Design Sprint	Design / Agile
6	Design Thinking for Educators Toolkit	Education Design
7	D-Think Toolkit	Education Design
8	Collective Action Toolkit	Design for Social Impact
9	Designing for Public Services	Service Design
10	Service Design Tools	Service Design
11	Planet Centric Design toolkit	Design for Sustainability
12	Design Council Method Bank	Design

We identified each toolkit (phase) structure during the analysis, listed each phase's activities, and identified tools used in each activity. Those tools were then correlated with the Design competencies they have the potential to help foster. After analysing the listed Design toolkits, we were able to identify a total of 185 tools or *Enablers*. All the information of the toolkit analysis was feed into a database using the online tool *Tabidoo*. The database allows for

posterior use at a website that will consolidate the findings of this research granting access to the tools that drive the development of Design competencies by Design institutions and instructors. Figure 58 shows a summary of compiled information in the database.

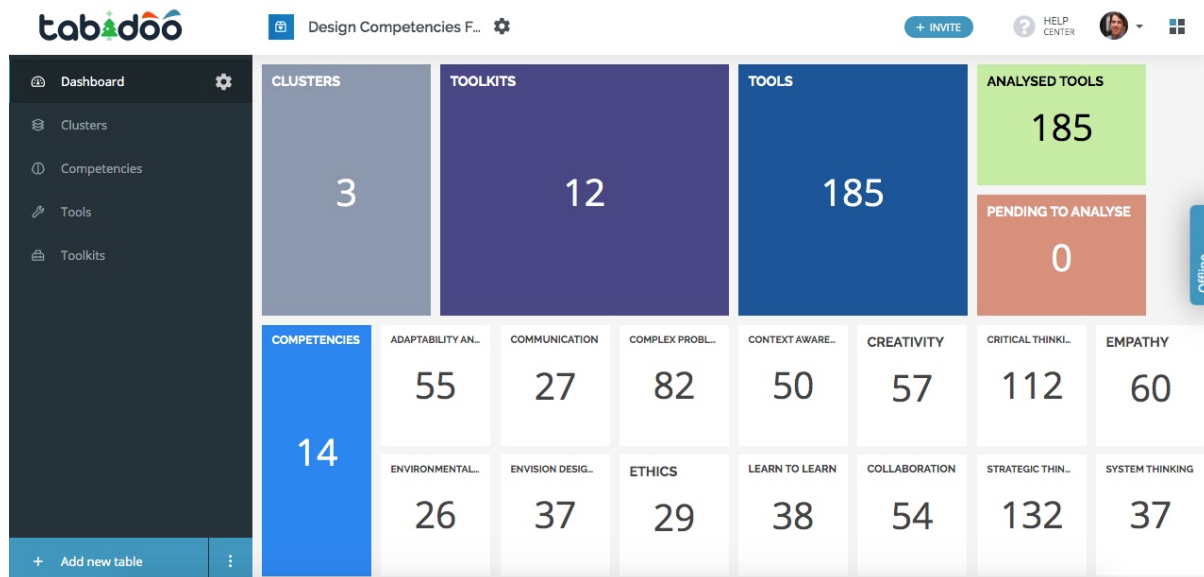


Figure 58: Summary of compiled information in the Tabidoo database.

It is essential to state that the indiscriminate use of Design tools and toolkits do not guarantee the quality of outcome or the development of the Design competencies we defend in our research. Design itself is a complex discipline that takes time and instruction to be mastered (Freach, 2019). For the results to be effective, Design instructors must guide the students through the process, designing alongside and making sure to expose them to various problems in different contexts. Students must use the tools and, most importantly, critically understand why they are using them. The role of the teacher is crucial in this process. Guiding students through a path will shape how these future designers will tackle problems in their professional lives.

Identifying the competency *Enablers* concluded the third dimension of our framework, as presented in item 5.2 of this chapter. In the following section, we introduce the Design Competencies Framework as a tool to drive the change in Design Education towards Sustainability, Social Change and Strategic Innovation.

5.5. The Design Competencies Framework

Purpose

The Design Competencies Framework is a model built to facilitate the development of Design competencies that have become crucial to future designers to become agents of change. Such competencies must equip professionals to tackle the growing numbers of complex problems faced today by society.

The Design Competencies Framework's primary purpose is to support Design Education to understand what competencies are to be developed during the Design courses to prepare students for a paradigm-shifting world. Also, it presents a vast number of tools to be introduced and used in academic Design projects that can enable the development of such competencies. By presenting a clear relationship between tools and competencies, Design instructors can structure projects using consolidated Design tools and understand the expected outcome regarding students' expected mindset.

The Design Competencies Framework is to be seen as a flexible and adaptable source of inspirations that can and should be adapted to fit the reality of different context. However, directed initially to support Design Education a secondary use of the framework by non-formal learning environments and professional context. Experienced designers that lack such competencies are welcome to use the framework as a starting point to their learning process and growth.

Dimensions

The Design Competencies Framework's basic structure comprises three dimensions: Area, Competency and Enablers.

Dimension 1 – Areas: Competencies grouped by affinity. Three Areas of competencies constitute the framework.

Dimension 2 – Competency: The smallest part of the framework. Fourteen competencies have been identified by the study and are presented in this conceptual model.

Dimension 3 – Enabler: Design tools, methods and techniques that, when used correctly, can drive the development of one or more Competencies. The Enablers were identified by the

analysis of publicly available Design Toolkits. For the initial version of the Design Competencies Framework, there are 185 listed Enablers. Although, as new publications are edited, additional Enablers may come to be part of the model.

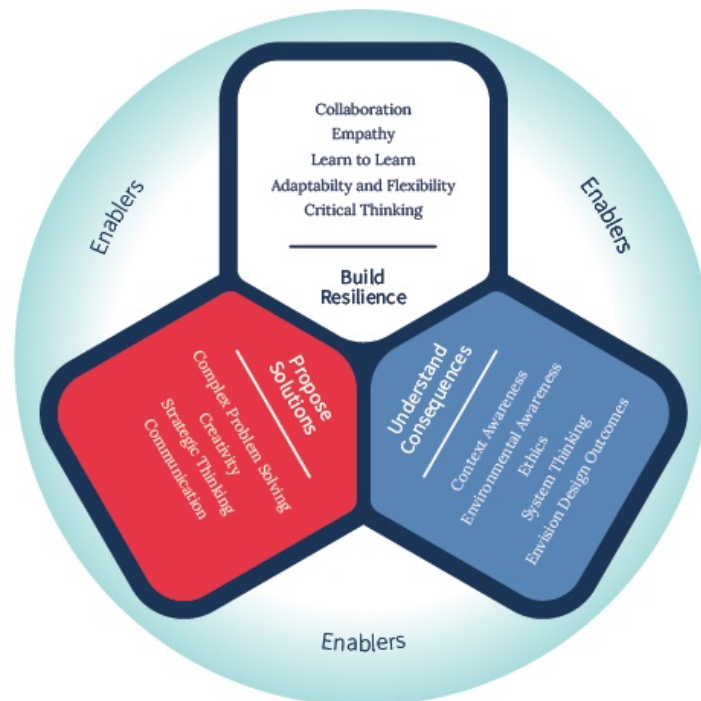


Figure 59: The Design Competencies Framework overview. Source: Author.

Principles

The Design Competencies Framework was built upon three principles that guide its structure and use: *Equality*, *Autonomy* and *Openness*.

All the competencies identified in the framework are treated equally. There is no level of importance or core competency. The same concept is applied to the Areas of competencies. Whilst it is vital that – with a given time – all competencies are addressed and developed, there is no defined starting point. The user has the autonomy to explore and identify, according to the project, which competencies should focus on and, consequently, Enablers to be used.

Different projects demand distinct approaches as context asks for particular paths. Furthermore, different instructors and experiences facilitate the use of specific tools and methods. Design Competencies Framework is open for users to discover and tailor the best

use of it. It does not define or suggests any path to follow or logical sequence. This principle also allows the users to introduce new tools and methods, adapting the framework to their particular needs.

Areas

Three areas constitute the Design Competencies Framework, *Build Resilience*, *Understand Consequences* and *Propose Solutions*.

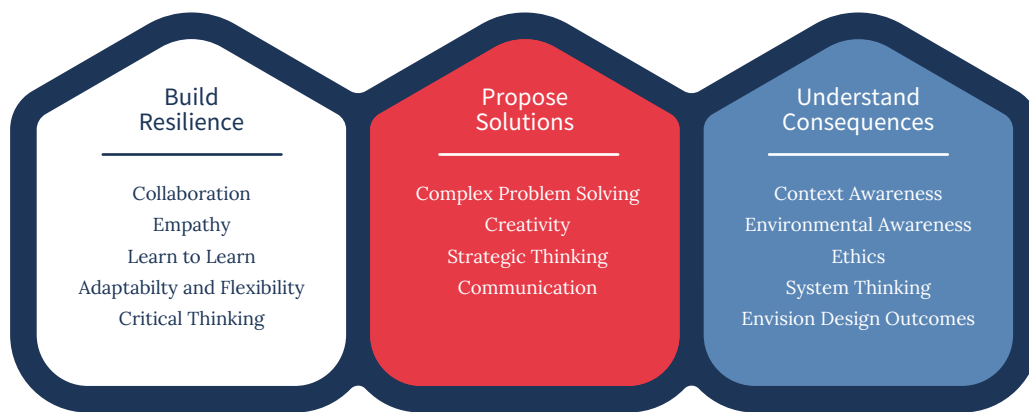


Figure 60: The Design Competencies Framework's areas. Source: Author.

Build Resilience groups competencies that aim to equip future designers to be flexible and adapt quickly while learning from a collaborative approach and developing critical thinking that enables a lifelong learning capability.

Understand Consequences congregates a set of competencies that invites the designer to understand complexity and how the outcomes of their actions can affect the world's Sustainability. By providing context to the Design process, designers can develop a holistic and systemic approach.

Propose Solutions accounts for building creative and innovative thinking to drive solutions that address Sustainability issues. It also enables future designers to strategically communicate the value of such proposals to businesses and society.

Competencies

Summary

The Design Competencies Framework identifies a total of fourteen unique competencies, as shown in Table 32. On item 5.5 of this Thesis, we describe each Competency individually to allow a more comprehensive understanding.

Table 32: The fourteen competencies' areas and key concepts.

Area	Competence	Key Concept
Build Resilience	Collaboration	Collaboration is the ability to collaborate as a team, with stakeholders, experts, and users to enrich the creative process. Collaboration provides empowerment to communities and helps build Resilience, whilst it avoids decisions based on the Designer's biases.
	Empathy	"Empathy is the capacity to step into other people's shoes, to understand their lives, and start to solve problems from their perspectives." (IDEO.org, 2015, p. 22)
	Learn to Learn	Learn to Learn is the ability to build autonomy through actively and continuously crafting new knowledge alone, with others, during and after their formal educational path.
	Adaptability and Flexibility	Adaptability and Flexibility are the Designer's ability to adjust their approach and actions as new variables are presented in the project's context.
	Critical Thinking	Critical Thinking is the Designer's ability to analyse and reflect clearly about information and ideas that support their decision-making. Equally important, designers must be able to evaluate their practice and their impact on society critically.
Propose Solutions	Complex Problem Solving	Complex Problem-Solving is the Designer's ability to understand and address problems in a non-linear approach, identify hidden connections and propose solutions that impact society and the world at many levels.
	Creativity	Creativity is the original and Iterative thinking that leads to innovative solutions which provides value to the social, economic and environmental contexts.
	Strategic Thinking	Strategic Thinking is the ability to analyse contextual information and make decisions bases on the desired outcome while balancing the economic, social and environmental perspectives and impacts.
	Communication	Communication is the Designers' capability to interact with peers and other stakeholders during the design process, present and pitch design ideas, share findings, and evidence the values of a sustainable approach to Design to the overall community.
Understand Consequences	Context Awareness	Context Awareness is the Designer's ability to investigate how context (political, cultural, social, economic and historical) may affect the solution to a problem and Design accordingly to provide the best response possible.
	Environmental Awareness	Environmental Awareness is the ability to understand the relationship of their work in the environment and create a more sustainable practice.
	Ethics	Ethics is the moral obligation to respect every human, living system and to serve society as a whole, preventing harm to be done as a consequence of their actions.
	System Thinking	System Thinking is the ability to analyse and identify, from a holistic perspective, the parts and forces that constitute a system and its dynamics.
	Envision Design Outcomes	Envision Design Outcome is a designer's capacity to critically understand the impact and consequences of their actions by combining speculative future scenarios and past experiences.

Relationship

It is essential to state that although the framework posed the competencies individually, they are not separated at all levels. The competencies presented in the framework are identified for designers to pursue a practice that tackles society's complex problems. It is expected that they present some similarities and that the boundaries between competencies to be blurred at times. Competencies may help foster and influence other Competencies as they present strong relationships with each other, some stronger than others. Figure 61 illustrates the relationship map amongst all competencies. The colours indicate the Areas, dark blue for *Build Resilience*, red for *Propose Solutions* and light blue for *Understand Consequences*. The arrows show the influence direction.

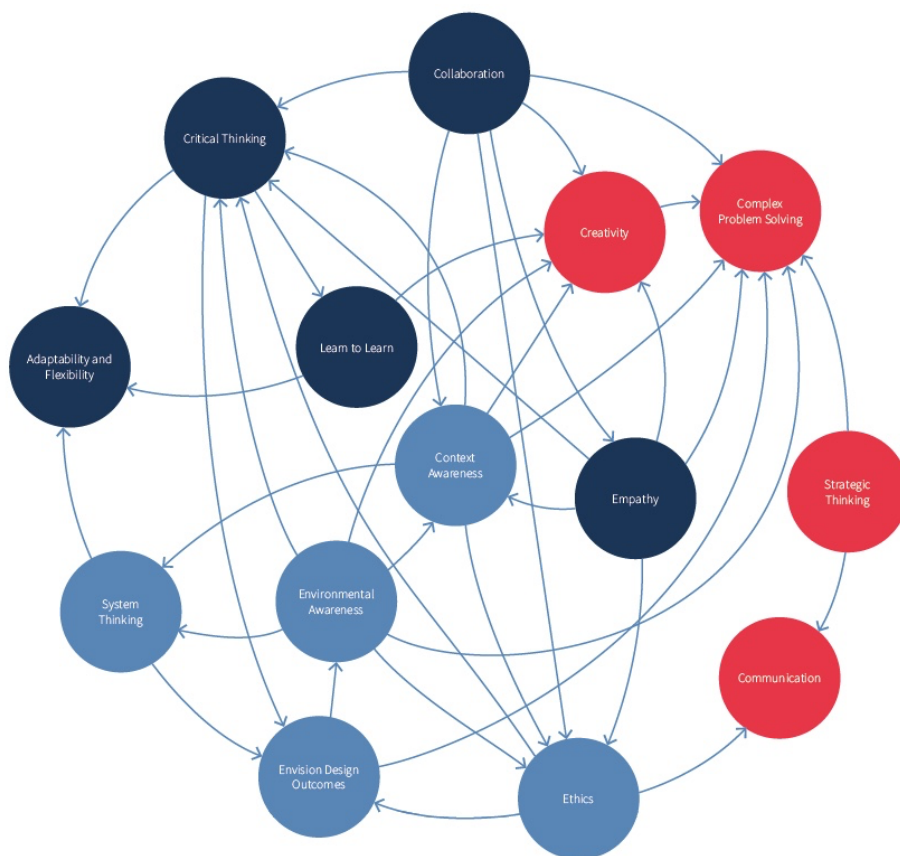


Figure 61: Map of relationship amongst competencies. Source: Author.

In order to understand the given relationships, we can isolate a competence and analyse how it influences, and it is influenced by other competencies. Taking the competence *System*

Thinking as an example (Figure 62), it is possible to see that by developing this Competence, one can also start becoming more *Flexible* and *Adaptable*. *System Thinking* also allows for a better understanding of *Design Outcomes*, allowing designers to connect their actions with the consequences of their practice. On the other hand, *Context* and *Environmental Awareness* are key components of a systemic thinker.

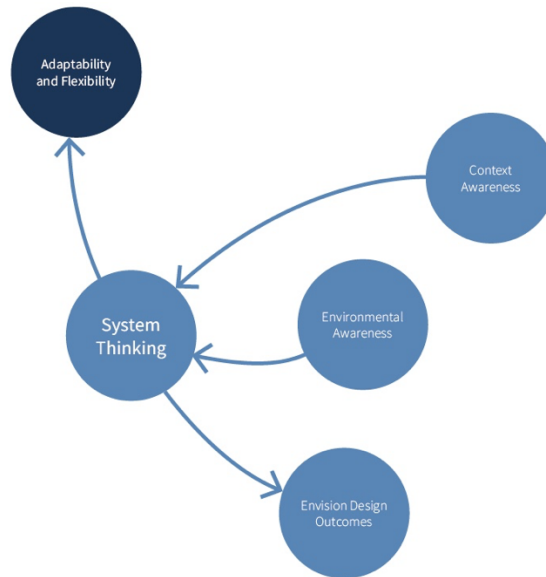


Figure 62: Detail of the relationship between System Thinking and other competencies. Source: Author.

Competencies Description

It is important to reinforce that the framework's competencies were identified as the core one for designers to become agents of change towards Sustainability and positive social change. In that sense, we present a brief definition of the fourteen competencies aligned to the need for Design Education to train students to develop the right mindset to foster the expected transition.

The background in which these fourteen competencies unravel is a world in crisis of grand proportions and nature. Poverty, hunger, health, sanitation, health, safety, and inequality are some of society's challenges today (United Nations, n.d.). Such issues affect designers in two ways, first designer as members of society, but more importantly, as professionals capable of creating novelty and produce value and therefore generate impact and change. The United Nations, with the presentation of the seventeen Sustainable Development Goals (SDGs), provokes the world to take action and be part of the change.

The SDGs are a perfect focal point for Design Education to lean and help develop the competencies at hand. Design schools must change their emphasis from commercial and aesthetics solutions and dedicate themselves to innovate in fields that might help bring to the world better designers. These competencies add to the ones already consolidated by the Design field, creating a more adequate and competent professional.



Adaptability and Flexibility are the designer's ability to adjust their approach and actions as new variables are presented in the project's context.

- Cluster: Build Resilience
- Enablers: 55
- Main authors: (Furniss, 2015) (OECD, 2018)

The need to adapt and be flexible in Design has grown as designers started to broaden their activity beyond the traditional Design fields such as graphic and Industrial Design. Being more exposed to problems that defy the limits of their skills beyond technical ones, designers are asked to become agents of change. The findings of Design research provide a rich amount of information that often invalidate initial assumptions. Flexible designers can overcome such issues by looking at these findings as new opportunities rather than blockers.

The problems faced by the designers are not only more complex, but they are also more fluid. With a more in-depth and, at times, continuous research, new information often rises during a project. The systems designers deal with are no longer straightforward, local or small. The world connectivity and globalisation create complexity to a level that apparently unrelated issues across the globe may affect local communities in unthinkable ways.

By developing the ability to adapt and be flexible, designers can change directions if faced with new crucial information. The Competency also equips future professionals to be open-minded and ready to take new approaches when old ones no longer fit the purpose.

Amongst the *Enablers* that help build this Competence are *Analogous Inspiration* and the *Dark Side*. *Analogous inspiration* is a tool that gives a new perspective to the research by changing its focus to a new context (IDEO.org, 2015). The method can be used in Service Design when the team visit other services that do not compete with the project they are developing to gather insights that could also work in their favour. In a distinct setting, the *Dark Side* tool explores the unwanted and negative consequences of the Design solution (Amsterdam University of Applied Sciences, n.d.). This tool forces the designer to look at the Design challenge from a new perspective.

Both tools help foster Adaptability and Flexibility by creating an unexpected input in the process and forcing the designer to discuss and consider new perspectives in their final solution.



Collaboration is the ability to collaborate as a team with stakeholders, experts, and users to enrich the creative process. Collaboration provides empowerment to communities and helps build Resilience, whilst it avoids decisions based on the designer's biases.

- Cluster: Build Resilience
- Enablers: 54
- Main authors: (Fuad-Luke, 2007) (Manzini, 2007) (Manzini & Coad, 2015a) (Fuad-Luke, 2009) (Spinuzzi, 2005) (Sanders & Stappers, 2008) (McMahon & Bhamra, 2016) (Sanders, 2002) (Sanders, 2013)

Designing alone or only with the Design team is not enough anymore to tackle social and environmental problems. Designers must create a common practice of inviting and participating stakeholders into different parts of the process as a crucial method of being exposed to new perspectives.

Collaboration should be seen as a broader helm where many variations fall underneath it. Co-creation, co-design, Participatory Design, cooperation and Transformation Design are some of the forms of Collaboration that designers must be comfortable with. Although all categorise some form of Collaboration, they may differ in detail.

During a collaborative process, designers must be ready to assume two distinct roles. The first role is of a creative partner, where the designer works alongside other stakeholders to discuss and create solutions together. A second role that designers might assume is the role of the facilitator. In that particular case, designers withdraw from participating in the discussion or idea generation to facilitate the process through a structured process such as a workshop.

Collaboration may assume different levels. Designers may work in teams with other designers or on multidisciplinary endeavours where professional from other spheres are brought to the project as part of the creative squad. One example of this is the growing presence of anthropologists and social scientist in the Design field. Other Collaboration levels may include working with field specialists, subject matter experts, clients and users, which evidentially may vary according to the nature of the project.

Besides helping designers achieve better results from the process, *Collaboration* is a fundamental approach to share knowledge and empower communities. When participating in parts of the process, users, clients, and citizens become better equipped to tackle problems without relying on professional help. By doing so, they help society become increasingly more resilient.

An expected by-product of Collaboration is that the end product of the Design process might face less resistance as users and clients are co-authors. Once participating in the process, they understand the importance of the solution without further convincing. The value of Design itself is also perceived as stakeholders are exposed to a deeper part of the process, not only the results.

Co-creation sessions and workshops are efficient tools to help foster Collaboration in the Design process. During collaborative activities, designers work directly with the people they are designing for (IDEO.org, 2015). Bringing the community to the creative process provides rich insights whilst empowering them as they are invited to design alongside the project team.

Another example of Collaboration *Enabler* is *Cultural Probes*. Seen as a more unobtrusive technique of collecting user's information (Amsterdam University of Applied Sciences, n.d.),

Cultural Probes provide participants with ways to document themselves during a period of time. The results are given to the Design team to dig into and find valuable insights and Design opportunities.



Communication is the designers' capability to interact with peers and other stakeholders during the Design process, present and pitch Design ideas, share findings, and evidence the values of a sustainable approach to Design to the overall community.

- Cluster: Propose Solutions
- Enablers: 27
- Main authors: (Russ, 2019) (Brown, 2009)

In Design, *Communication* has become a fundamental competency as the field is evolving from an in-house and reflective practice into a more collaborative approach. The introduction of people from different backgrounds and experiences in the process makes Communication critical for the process to run without significant friction (McMahon & Bhamra, 2016). Designers must communicate with different languages and understand behaviours to gather the information needed for the process.

During the creative process, designers must be capable of discussing ideas amongst peers and stakeholders. When acting as facilitator, designers must clearly inform participants about the goals of activities and lead them through the different required stages.

Designers are frequently in a position of giving presentations and pitching ideas to key stakeholders, building compelling and meaningful arguments (Brown, 2009) for it to be heard and adopted. In a scenario where the market discourse must give space to societal and environmental issues, the ability to properly communicate values is crucial to our systems' Sustainability.

Regarding their role of active agents change, designers must be able to communicate the values of a more just and sustainable future to clients, policymakers and society in general. For designers to lead the path to change, it is crucial to be prepared to act as leaders rather than followers (Russ, 2019). By embracing such a position, designers must apply principles that pursue social change and Sustainability and make sure to elucidate the benefits of doing so through their communication agenda.

Finally, designers must aim to share – in an open-source format – their findings, successes, and fails to the Design community and society. Only by adopting this sharing Approach, designers can stop serving the interest of a few and start to serve the interest of the public and the world.

Sustainability Storytelling and *Open-Source Scaling* are some of the *Enablers* identified to help build the *Communication Competency*. Both tools are featured at the Planet Centric Design Toolkit (Vincit, 2019). The *Sustainability Storytelling* tool guides designers through a canvas to build a transparent Sustainability message across their audience. On the other hand, the *Open-Source Scaling* provides a blueprint to help designers open their findings to the community, therefore potentiating the impact as others can build on the top of their solutions and discoveries.



Complex Problem-Solving is the designer's ability to understand and address problems in a non-linear approach, identify hidden connections and propose solutions that impact society and the world at many levels.

- Cluster: Propose Solutions
- Enablers: 82
- Main authors: (Chevallier, 2016) (Jonassen, 2011) (Frensch & Funke, 2014) (Funke, 2012) (Funke, 2019) (Fuad-Luke, 2009) (Moreira, 2019) (AIGA, 2017) (Moreira, 2015) (OECD, 2018) (Buchanan, 1992) (United Nations, 2015) (Jones, 2017) (Davis, 2018a) (Norman, 2011) (OECD, 2014) (Lawson, 2005)

The growing complexity of the problems has become evident in many areas, and Design is no exception. Often also defined as wicked-problems, they are ill formulated, where the information is not easily accessible (Fuad-Luke, 2009). Design itself is a problem-solving activity that now deals with complexity daily. Meaning that the process of solving a problem of such nature, unlike a traditional Design approach, is a non-linear one, swinging back and forth into an iterative process as the project follows along.

In order to tackle complex challenges, designers must understand the consequences of their actions and take responsibility for the solutions they propose. For that, designers must learn how to understand and navigate complexity to visualise the often-hidden connections between parts of a system.

Solving complex problems require designers to dive deep into research to find opportunities and insights that might lead to positive outcomes that are somehow aligned with societal and environmental needs. Designers can no longer rely only on a solitary process done entirely inside their work environment. Instead, they need to turn to the outside world to find the inspiration to guide their creative process.

Bigger Impact is a tool that helps designers start to understand complexity levels in a given project. The tool encourages discussing how the world's changes relate to the problems they are trying to solve, evolving from a personal micro to a broader and macro-level (Vincit, 2019).



Context Awareness is the designer's ability to investigate how context (political, cultural, social, economic and historical) may affect the solution to a problem and design accordingly to provide the best response possible.

- Cluster: Understand Consequences
- Enablers: 50

- Main authors: (Brown, 2009) (Shedroff, 2009) (Vezzoli et al., 2014) (van Engelenburg et al., 2019) (DESIS Network, 2013) (Julier, 2013) (Fuad-Luke, 2009) (NASAD, 2020)

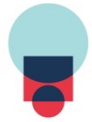
Design does not happen in a vacuum. Therefore, it should not be practice without considering many variables involved. Designers rely on the context in which the problem is surrounded. This holistic understanding is crucial to the success of the solution proposed. Context encapsulates many spheres that may impact the designer's work, such as political, historical, social, economic and cultural ones.

Designers cannot design too far from the problem. However, they must be able to distance themselves from their biases and prejudices. Involving local communities in the Design process is a meaningful way to understand the context and address it adequately. "It is not just the eye enabling one to look at a context, but also the context enabling the eye to see things in a different way." (Baerten, 2013, p. 44)

Designers must understand how the local community interacts with the problem they are trying to solve. They should ask questions that will allow themselves to understand how a given culture deals with a particular context and how history or even the present moment may affect the project's potential success.

In recent years, designers have become more engaged with social and political agendas, at times acting as activists. This attitude is expected from all designers aware of the context their creation will live on and the potential transformation it has in the world. Without the awareness that Design itself is political, designers fail to understand that they usually serve a particular ideology (Fry, 2009).

Interviews are an often-used tool to understand the context from the viewpoint of the people affected by the problem. This method provides a connection to people's hopes, desires and aspirations as designers can hear from the user's own words to describe their point of view (IDEO.org, 2015). More context can be observed if the interviews are conducted in a person's space rather than in a laboratory. Besides interviewing users individually, designer can also conduct *Group Interviews* and *Expert Interviews* to broaden their contextual understanding.



Creativity



Creativity is the original and Iterative thinking that leads to innovative solutions which provides value to the social, economic and environmental contexts.

- Cluster: Propose Solutions
- Enablers: 57
- Main authors: (Lubart & Thornhill-Miller, 2017) (Villalba, 2008) (OECD, 2018) (Lawson, 2005)

Creativity has always been a fundamental Competency for designers. From a general perspective, creativity can give birth to innovative solutions to solve a problem (Leopold et al., 2016; Villalba, 2008). However, in recent years and given the present societal moment, designers have been challenged not only to be creative and innovative but also to do it in a way that no longer hurts the environment or society.

To be creative relies on four key characteristics: Imaginations, purpose, originality and adequacy (Villalba, 2008). Designers depend on an iterative process of Divergent and Convergent thinking to achieve creative outcomes, continually testing their ideas in the real world. Every creative professional must be comfortable going through this process continuously, seeking new and fresh ideas.

Risk-taking is another critical skill to enable *Creativity* (Lubart & Thornhill-Miller, 2017). Without taking risks and being open to experiment and explore concepts, the chances of Innovation are low. Designers must be comfortable being uncomfortable to explore unconventional paths that might lead them to come up with solutions to unprecedented problems.

Nature can provide a great deal of inspiration to the designer's creativity. *Learn from nature* (IDEO & Ellen MacArthur Foundation, n.d.) is a tool that looks at how biological systems can inspire problem-solving to achieve a more circular and holistic approach. Although biomimicry is not new to Design, it has become even more relevant in the current state of environmental crisis witnessed by the world today.

One of the most popular tools designers use in the creative process is *Brainstorming Sessions*. This classic method empowers generating a significant amount of ideas, deferring judgment, and encouraging wild ideas (IDEO.org, 2015), leaving the discussion of adequacy to a second moment. *Brainstormings* are collaborative that can be done with clients and users' participation to enrich the discussion and pertinence of the solution.



Critical Thinking is the designer's ability to analyse and reflect clearly about information and ideas that support their decision-making. Equally important, designers must be able to evaluate their practice and their impact on society critically.

- Cluster: Build Resilience
- Enablers: 112
- Main authors: (Russ, 2019) (Dunne & Raby, 2013) (Loewe, 2019)

During the creative process, designers are exposed to a significant amount of information that will guide them into a decision-making moment to solve the problem they were challenged with. While making decisions, it is essential that designers can think critically. First, to understand and translate the information to which they are exposed to. Secondly, to reflect and reason about the solution they will propose and its impact in spheres other than economic.

To become a critical thinker, one must develop an analytical mindset to determine relevant arguments and identify fallacies or misconceptions. However, *Critical Thinking* is not then be applied to the analysis of other arguments only. Designers must reflect critically about their practice, constantly confronting their decisions with society's values as a whole.

By developing the ability to think critically, designers can distance themselves from personal decisions and aim for Design outcomes that benefit the planet and the people living on it.

Moreover, *Critical Thinking* requires designers to revisit their work to understand its consequences and propose changes or improvement when possible and necessary.

Critical Thinking is crucial to address complex problems (Loewe, 2019) as it aims always to question what is given (Dunne & Raby, 2013), rather than just taking things for granted. This is important since designers, during their process, will collect information from many distinct sources, from interview to desk research. However, not all information is accurate or makes sense in the context of the project. Likewise, not all that is said during a conversation might be accurate or represent the reality of facts. Designers must develop the ability to question, analyse and reframe the information critically.

Two *Enablers* that can promote *Critical Thinking*, especially towards Sustainability, are the *People Planet Profit* and the *Business Model Flip*. The former helps designers analyse the impact of their ideas and concepts on people, the planet and the profit, providing a structure may to rate each universe according to established criteria. The latter is a variation of the traditional Business Model Canvas. Here, designers are invited to think about business models in a planet-centred approach, aiming to impact the planet positively.



“Empathy is the capacity to step into other people’s shoes, to understand their lives, and start to solve problems from their perspectives.” (IDEO.org, 2015, p. 22)

- Cluster: Build Resilience
- Enablers: 60
- Main authors: (Barnes & Preez, 2015) (Brown, 2009) (Fenn & Hobbs, 2015)

Empathy has become a big word in the Design world with the introduction of the Human-Centred Design approach. This Competency requires designers to become as close as possible to people to understand their perspectives, pains, gains and values. Learning about people's difficulties and understanding their need and desires demand designers to comprehend their

environment and how users interact with it. This approach may lead to an understanding of their behaviours and attitude (Dam & Siang, 2018).

In order to build *Empathy*, designers have to get acquainted with ethnographic approaches popularised by anthropologists. Ethnography provides a possibility to observe participants in a setting that feels natural (Littlejohn & Davis, 2019). Designers must become comfortable being outside their traditional work environment since *Empathy* requires context, which can only be found out of the office.

By putting themselves through the situations lived by the people affected by the problem, designers can immerse themselves and develop a clearer understanding of the problems and its nuances. “[i]n-context immersion means far more than attending class with the people you’re designing for. It means fully understanding and experiencing the circumstances of their lives.” (IDEO.org, 2015, p. 66).

A successful *Empathy* exercise requests one to look at the information presented with open eyes and without biases. Designers must leave, in the first moment, their opinions and beliefs out of the picture. This attitude provides an opportunity for designers to perceive other people's ideas more openly and without judgment, even if they may disagree with them.

Immersion and *Emotional Journey Map* are two tools that designers can leverage to build Empathy. *Immersion* provides a contextual understanding of a given situation. During this activity, designers should put themselves in the user's situation for a period that can vary from a couple of hours to weeks or more. While immersing in the user's environment, designers must take notes on relevant information they find along their journey that might help them find Design opportunities for later action.

The *Emotional Journey Map*, on the other hand, is a tool that helps designer consolidate and visualise their findings, as well as analyse the emotional pains and gains that a user is exposed to while experiencing a service or product (Oblo & POLL.design, 2019). This tool's emotional component allows designers to keep visual the moments where users are in distress, proving visual cue on how to improve an experience based on an empathic approach.



Environmental Awareness



Environmental Awareness is the ability to understand the relationship of their work in the environment and create a more sustainable practice.

- Cluster: Understand Consequences
- Enablers: 26
- Main authors: (Fry, 2009) (Vezzoli & Manzini, 2008) (Shedroff, 2009) (Vezzoli et al., 2014) (Russ, 2019)

Environmental Awareness is the designer's capacity to think about the relationship of their work with the impact it may cause on the environment. Environmental Awareness requires designers to have a holist and systemic approach to the life cycle of products and the impact of services in a broader scenario. Designers must be aware of the relationship between things (Russ, 2019).

To become environmentally conscious, designers must measure the success of a project-based not only on economic thrive but also on the impact (positive or negative) that it may cause in the world. That attitude highlights how designers are part of a larger system, besides de the economic one (McDonough & Braungart, 2002).

The development of any Design project impacts the planet, but a much more significant impact happens due to the process's outcomes. Looking at the environment perspective can no longer be subject to specialisation. Instead, it must be a core pillar in Design projects. A mindset that must be nurtured during school time and that should be part of creating and evaluating projects independent of its magnitude.

Designers must develop the ability to think about circularity and leave the linear way of designing behind. Circularity means understanding how the end of a cycle can feed the beginning of a new one, how they relate and how that affects the designer's decision towards materials, energy sources and fabrication methods, to name a few.

Awareness is the first step for designers to become agents of change. They must seek an approach capable of creating more intelligent and resilient systems that feed one's capacity to understand the consequences of their practice and work towards it.

The *Planet Centric Bootcamp* is a collaborative tool that can be used at the beginning of a Design project to gather "everyone to understand the causes and effects of climate change" (Vincit, 2019, p. 5). The tool aims to align the participants on the mindset of how being Design-centric is vital and necessary.

While standard to the natural systems, circularity might be still challenging for designers to work with. *Understand circular flows* is a tool featured at the Circular Design Guide (IDEO & Ellen MacArthur Foundation, n.d.) that helps designers and stakeholders understand different approaches to make a product, service or business more circular.



**Envision Design
Outcomes**



Envision Design Outcome is the designer's capacity to critically understand the impact and consequences of their actions by combining speculative future scenarios and past experiences.

- Cluster: Understand Consequences
- Enablers: 37
- Main authors: (Fry, 2009) (Shedroff, 2009) (Russ, 2019) (Dunne & Raby, 2013) (Fuad-Luke, 2009) (Normoyle, 2019) (Littlejohn & Davis, 2019) (OECD, 2018)

Designers often create novelty that may disrupt a given *status quo*, changing habits, behaviours and attitudes. Some of those changes may be small, while others can have a worldwide impact, changing dynamics and creating unprecedented distress. However, the discussion around accountability still falls short in the Design sector and even shorter in Design schools.

Research is a crucial skill to help develop the type of *Critical Thinking* necessary to make connections between actions and consequences. “[N]ot just information retrieval at the beginning of the Design process but ongoing feedback and evaluation of the consequences of

Design action, including across the lifespan of messages, products, environments, and services” (AIGA, 2017).

To *Envision Design Outcomes* is a key competence that designers must practice. While foreseeing future outcomes might not be a perfect science, designers must dedicate time to think about the possible consequences of their action. They must be able to speculate future scenarios to contribute to a better and more just future. Besides the speculative practice, designers need to step forward and accept the responsibility and accountability of their actions and ideas.

The *Ripple Effect* featured on The Collective Action Toolkit (Frog Design, n.d.) is an *Enabler* which invites the Design team to imagine the desired impact to improve people’s lives. The activity starts from an individual perspective and grows in scale, questioning how it could change or effect a nation or the world.



Ethics



Ethics is the moral obligation to respect every human and living system while serving society as a whole and preventing harm to be done due to their actions.

- Cluster: Understand Consequences
- Enablers: 29
- Main authors: (Russ, 2019) (Fenn & Hobbs, 2015) (Fry, 2009) (Berman, 2009) (Fuad-Luke, 2009) (Barnes & Preez, 2015) (Findeli, 2001)

Design established itself as a profession due to the thrive of capitalism and consumerism. Both represent a known threat to the balance of the world. Amongst the consequences are the environmental depletion and social inequality. Often seen as a crucial tool to fuel sales, designers are now confronted with the need to balance their practices with stakeholders' expectations and the planet's Sustainability.

Ethics provides a moral compass to designers to work under and guide their decisions to prevent harm. Designers must discuss how they should serve society and act not according to market needs but to societal ones.

Professional *Ethics* is the foundation of all profession. *Ethics* in Design say that what should be weighted are the processes' outcomes, "not the underlying rules or motivations for the design." (Russ, 2019, p. 50). In Sustainability, designers face challenges that go beyond traditional approaches as they become responsible for the planet's future (Russ, 2019).

The foundation of an ethical Design practice relies on critical and systemic thinking and awareness of context and impact of one's actions, always respecting every human and living being. It should always be inclusive and promote equality for all. The starting point of the social and moral judgment to designers happens at the moment they decide if the project, whether the project merits his attention (Papanek, 1971).

The *Extremes and Mainstreams* (IDEO.org, 2015) encourages designers to propose solutions that could work for all people. To achieve this result, they must aim for a broad audience that fits extremes users and the mainstream. Besides the benefit of understanding marginalised people's needs, talking to people at the extreme of a problem can provide valuable insights, Design opportunities and foster creativity (IDEO.org, 2015), while it contributes to more ethical practice.



Learn to Learn is the ability to build autonomy by actively and continuously crafting new knowledge alone, with others, during and after their formal educational path.

- Cluster: Build Resilience
- Enablers: 38
- Main authors: (Russ, 2019) (Delors et al., 1996) (UNESCO, 2020)

The complex problems that designers face today and the growing number of societal changes and crises generate high uncertainty and disruption (UNESCO, 2020). To deal with that, designers must develop the ability to learn regularly and autonomously. They must *Learn to Learn*.

As the teachers' role shifts from the traditional instructor of knowledge to a facilitator of the learning process, Design students need to be equipped with the motivations and capacities to become lifelong learners. The process of learning goes beyond individual effort. It should also be seen as a collective endeavour (UNESCO, 2020), keeping the community close and central to them.

Designers must understand that their educational path goes beyond their formal classes and need to be ready to keep a continuous learning path. Learn to learn means that “learners are active agents rather than passive recipients of prescribed knowledge.” (UNESCO, 2020, p. 12). The formal educational institutions must create the foundations for a lifelong learning basis.

Learn to Learn requires designers to think critically about how they are getting their information and how to process them. Equally, it emphasises the importance of digital literacy as the digital revolution has shifted the way the world deals with information from a physical to digital support.

By developing their ability to learn, designers can contribute to a more resilient society and achieve positive impacts on all territories of Sustainability and become active agents of change.

Both quantitative and qualitative research is a crucial skill designer must acquire to gather information during a project. *Secondary research* is a tool which can provide previous knowledge created by different sources. This *Enabler* allows designers to examine and review the information relevant to the project without conducting unnecessary inquiries. It also shows missing information that can be discovered with other research tools such as *Interviews* or *Surveys*.



Strategic Thinking is the ability to analyse contextual information and make decisions bases on the desired outcome while balancing the economic, social and environmental perspectives and impacts.

- Cluster: Propose Solutions
- Enablers: 132
- Main authors: (Shedroff, 2009) (Chevallier, 2016)

Traditionally, Design is a popular strategic tool for business. Companies have learnt how Design can bring advantages to their business models, with many big companies (e.g. Fortune 500 ones) have entirely dedicated Design sectors. Some of them even are seen and called Design Driven companies. In the past decades, the popularisation of Design Thinking undoubtedly contributed to the optimistic view of Design in the business sector.

Designers must navigate the formalities of a project and understand how to think strategically, as Design has become a significant part of businesses. They need to be aware of the company's goals and target to produce the desired outcome in their process. Designers must be accustomed to defining goals and measurements for success.

Throughout the creative process, designers are required to make decisions based on the data they are presented. Those decisions need to be strategic in order to produce the desired results. However, *Strategic Thinking* is not to be seen only as a Competency to produce more business or sales. It is also crucial for designers to tackle social and environmental issues. They must find ways to best achieve business goals without generating social distress and environmental depletion. As a novelty creator, designers must act as a judge of value to help drive business to a more sustainable approach, becoming real agents of change.

Design Principles (IDEO.org, 2015; Oblo & POLI.design, 2019) is a strategic tool that allows designers and organisations to help deliver a consistent experience across channels. *Design Principles* describe the essential elements of a solution providing integrity and consistency (IDEO.org, 2015). A second *Enabler* that fosters *Strategic Thinking* is *Drivers and Hurdles*. Through

the exercise, the goal is to identify where to focus the energies for more effective action (Design Council, 2015a), especially at projects with limited resources.



System Thinking is the ability to analyse and identify, from a holistic perspective, the parts and forces that constitute a system and its dynamics.

- Cluster: Understand Consequences
- Enablers: 37
- Main authors: (Brown, 2009) (Shedroff, 2009) (Vezzoli et al., 2014) (Reed, 2007) (Jones, 2017) (United Nations, 2015) (Dubberly, 2014) (Meadows, 2009)

Complex problem-solving requires designers to develop a holistic perspective, broadening their understanding of the problem and identifying connections and relationships amongst the parts involved, in other words, thinking systemically.

In order to address the Sustainability issues, designers must consider the systems and context in which the problem is rooted. A systemic view demands seeing problems from a larger perspective before developing the solutions. Designers must understand that “every solution lives within several ecosystems relating to environmental, sociocultural, and financial systems” (Shedroff, 2009, p. 357).

System Thinking provides an opportunity to reframe traditional models from a new perspective (Shedroff, 2009). Successfully approaching system thinking may include co-design and Collaboration, where many stakeholders contribute to the solution's pluralism (Jones, 2017; Manzini & Coad, 2015a). A diverse discussion can enrich the possibilities of sustainable solutions and enable easier adoption.

Designers must integrate *System Thinking* into the Human-Centred Design approach (Jones, 2017) to understand the human factor and its relationship with other systems (e.g. nature). Finally, they must be familiarised with the concept of bottom-up and top-down approaches as

co-existing parts of a system, not separated and excluding elements (Manzini & Coad, 2015a; WDO, 2021).

Systemic Touchpoints is an *Enabler* that confronts a concept with the impacts and effects it might have on a bigger scale in society. The tool proposes the participation of experts from different fields to analyse and discuss the role and impacts of a product or service (Vincit, 2019).

Another tool that to forge *System Thinking* is *Influencing Forces*, a divergent thinking technique that uncovers “areas for research by exploring the different forces that might influence it” (Kershaw et al., 2016, p. 28).

Enablers

Enablers are Design tools, methods, and techniques borrowed from publicly available resources, such as Design toolkits that help develop the Design Competencies presented in the framework if used correctly in a Design process. The initial version of the framework features 185 Enablers identified and catalogued from twelve Design toolkits found online.

The proper use of each tool requires experience, and Design students, during their initial path, should be guided and supervised by experienced teachers responsible for introducing them to the Design process and tools. This Collaboration between teachers and students can help build autonomy as projects scaffold in complexity, and students get a better understanding of each tool and how they help them build the desired Competencies.

Unlike the previous two Dimensions that compose the Design Competencies Framework, the *Enablers* are not fixed elements of the model. As the framework evolves, it is expected to feature new tools, methods and techniques that help build the competencies that will help designers address Sustainability challenges. For the complete list of *Enablers* identified during this research project, see Appendix 8:.

5.6. Chapter Summary

This chapter presented a walk-through of the Design Competencies Framework’s development. We started by defining its structure after the analysis of other available models of competency building. Following, we identify the fourteen core competencies based on the data presented and analysed in Chapter 4. The definition of the competencies is showcased as a process composed of four iterations: consolidation of sources, semantic grouping,

nomenclature adjustments and cluster building. The fourth and final iteration was achieved in a participatory activity with field specialists. At last, we thoroughly describe the Design Competencies Framework's purpose, principles, and dimensions.

Chapter 6

Design Competencies Framework Validation

6.1. Introduction

In the previous chapters, we presented the procedures of our research that culminated in the development of the Design Competencies Framework. The process of creation and structure of the framework was presented in Chapter 5. The complete version of the framework can be consulted in Appendix 1:.

The validation of the framework was crucial to the assessment and optimization of the results of this study. Therefore, we proceeded with the validation of the instrument in two distinct moments, two complementary research methods and end users. The first moment was based on the outcome of the participatory workshop, as the methodology used in the activity was the base for the problem-based approach proposed by the Design Competencies Framework. The second validation focused on presenting the framework and receiving feedback from specialists from the Design, Design Higher Education, and Sustainability fields.

6.2. Validation with students

During the participatory workshop (see item 3.2.3), we collected information regarding the set of competencies participants believed necessary to solve real problems, which contributed to developing the Design Competencies Framework. We also understood how exposure to

complex societal problems could affect and influence their project decisions and proposed solutions. As part of the activity, students communicated how their proposed outcomes were influenced by their chosen themes from the options available (SDGs).

In our research, we defend the use of Active Learning methodologies, namely Problem-based Learning (PBL) in combination with Design Thinking, as an approach to learning Design. In the Participatory Workshop, we introduced the SDGs as a reference point for students to uncover complex societal problems that could be addressed by Design and asked the participants to brainstorm and propose solutions for them, thus creating the relationship with the PBL approach. Table 33 lists the themes (SDGs) chosen by each group and the respective proposed solutions.

Table 33: Summary of Themes and Proposed Solution for the Participatory Workshop

Group	Country	Theme (SDG)	Proposed Solution
WS1G1	Spain	Gender Equality	Educational videogame to promote gender equality through games and gamification.
WS1G2	Spain	Zero Hunger	Cultivation kit for food growing.
WS1G3	Spain	Quality Education	Easy assembly school.
WS1G4	Spain	Responsible Consumption and Production	Sustainable Packaging.
WS2G1	Cyprus	Responsible Consumption and Production	Disposable packaging for drinks which afterwards can be planted.
WS2G2	Cyprus	Life on land	Product with the purpose of spreading awareness for the protection of the natural habitat and to reduce deforestation of the Akamas forest
WS2G3	Cyprus	Gender Equality	Personal kit that will work both for men and women.
WS3G1	Brazil	Sustainable Cities and Communities	Pavement made from construction sites' debris.
WS3G2	Brazil	Reduce Inequalities	An virtual and physical platform to promote the redistribution of food to prevent waste.
WS3G3	Brazil	Gender Equality	Safety device (panic button) for women's safety.
WS3G4	Brazil	Responsive consumption and production	App to connect local food producers (farmers) to a network of potential to sell left overs for a cheaper price, avoiding food waste.

6.2.1. Result analysis

As can be verified in Table 33, it is clear that the outcomes presented by the students were influenced by the themes they have chosen from the options available (SDGs). Although the four-hour duration of the workshop did not allow for an overall development of the ideas, it is

evident that the nature of the problem presented by the facilitators to the participants has a direct influence on the design outcomes proposed. Such a result corroborates our belief that the type of challenges students face is a crucial, pivotal point for Design Education to address real problems and make the knowledge created during their educational path beneficial to society.

The direct relationship between the nature of the problem the solution is a strong argument toward the approach proposed by the Design Competencies Framework. Still, during their presentations' students naturally provided additional and valuable feedback regarding important aspects such as dealing with complex problems and the role of Design towards a more sustainable future. Furthermore, while explaining their solutions, students analysed the consequences of their actions as designers and as creators and their responsibilities and roles in building a better society.

Based on analysis of the groups' presentations and the material delivered by them after the workshop (the Canvas filled with their options), we highlighted a selection of their proposals to elucidate the relationship with the respective themes.

Addressing Gender Equality, the group WS3G3 proposed a way to fight the violence against women in Brazil by imaging a physical device that could be pressed if a woman found herself in a dangerous situation. The button would trigger a network of other users prompted to assist her based on geolocation. Thus, the team envisioned a network of users of the product to create an environment of safety. Although the idea did not evolve beyond the initial phase due to time constraints, the understanding of system thinking was clear.

Also tackling Gender Equality, Participants of WS1G1 stated that to develop their solution – a videogame to make a difference and promote change – they must think critically. They affirmed that it is crucial to collaborate with others and understand different cultures to create efficient communication and address complex problems.

Three groups (WS1G4, WS2G1 and WS3G4) chose to work with Responsible Consumption and Production as their themes during the workshop. Two groups coincidentally ideated towards designing sustainable packaging, while their motivations were distinct. Their opinion drove WS1G4's idea that companies use marketing to “green wash” a perception of sustainability where there is none. Whilst WS2G1's idea was rooted in waste disposable and proposed a package produced with plant seeds that could be planted after the use.

The WS1G3's proposal of creating a school of easy assemblymen to provide Quality Education was deeply rooted in the group's members' personal motivation, as they elucidated during the presentation. Furthermore, the group wrote a manifesto based on their perspective on society, humanity, and the need for change. Their presentation raised our understanding of the importance of considering student's motivations and purpose in the nature of the projects they deal with. A similar argument was also posed by one participant during the validation workshops with specialists (see Table 37, Q3P12), as they proposed *Purpose* as a central competence for a purpose-driven approach.

Amongst the significant struggles, the groups declared to have faced was the difficulty of dealing with complex problems and thinking systemically. They understand that problems that need to be addressed exist, but they still lack the tools and competencies to deal with them. For example, one student stated that problems are "very easy" to find, while solutions involve dealing with a complexity level they are not used to. On the other hand, participants declared that the method used during the workshop guided them to find what could be an adequate solution.

While all groups from all workshops listed designers as part of the transdisciplinary team they would choose to work on their problems, group WS3G4 justification for it called our attention. The group explained that bringing a designer to the process could make the visual and communication more pleasing. Such affirmation illustrated that although they were designers thinking about solutions for complex problems during the workshop, they kept the designer's role related to beautification and styling.

6.3. Validation Workshops

Understanding the perspective of specialists of the Design and Sustainability fields was also paramount to validate the Design Competencies Framework.

Still following the logic of the opportunity sampling approach, we facilitated three sessions to present the instrument and discuss its relevance in supporting Design Education to develop the fourteen competencies identified in our study. The presentations happened via zoom and were recorded to capture qualitative data worth treating for the study.

6.3.1. Structure

All three sessions followed the same structure and were divided into four moments:

1. Presentation of the Research and results;
2. Discussion and Q&A;
3. Feedback (Validation);
4. Closing remarks.

First, we presented the structure of our research, background and context, research questions and hypothesis. Next, we presented the primary outcomes of our study, namely the fourteen competencies identified and the Design Competencies Framework designed to be a supporting instrument for Design Education and Design educators.

During this first part, we carefully justified how the competencies were identified in our research process, showing the data collection instruments used and the outcome of each one. Also, we presented the structure of the framework and its potential application in the Design Education environment, elucidated the approach tested with students during the participatory workshop.

After the initial presentation, we opened for the participants to question and discuss any presented aspect. This section functioned mainly in a Q&A format, where participants raised their hands to make comments or ask questions that we then answered. In some opportunities, the Q&A turned into a group discussion with participants sharing their opinions about the topics in question.

During the third moment, participants were asked to give individual feedback by filling an online questionnaire to collect specific data about the Design Competencies Framework. The structure of the questionnaire is presented in Table 34. After filling the form, participants could leave the session, continue online for closing remarks, or contribute with any further comment. However, due mainly to the participants' time constraints, most chose to leave the meeting after filling the questionnaire.

6.3.2. Data collection instrument

We designed a questionnaire (Q3) to gather both quantitative and qualitative data to validate the Design Competencies Framework and identify opportunities for future iterations to ensure a clear understanding of the tool. The data collected mainly focused on the participants' perspectives about the structure of the framework and its relevance towards supporting Design Education in developing the competencies for designers to become active agents of change.

The questionnaire was structured with four closed-ended and seven open-ended questions. All closed-ended questions were mandatory. In addition, two open-ended questions (Q3Q5 and Q3Q6) were also mandatory, while the other five were optional. Table 34 lists the structure designed for this instrument.

Table 34: Structure of the instrument Q3.

ID	Question	Nature	Type	Follow-up
Q3Q1	Accordingly to what was presented, do you consider the Design Competencies Framework a useful instrument to foster change on how design students are trained if aiming for designers as active agents of change?	Close ended	Yes/No	Yes
Q3Q1A	If possible, please explain your previous answer.	Open ended	Paragraph	No
Q3Q2	Do you consider that the Design Competencies Framework contains the basis to support Design Education on the development of the competencies identified in our investigation?	Close ended	Yes/No	Yes
Q3Q2A	If possible, please explain your previous answer.	Open ended	Paragraph	No
Q3Q3	Accordingly to what was presented, do you consider the Design Competencies Framework a useful instrument to train designers to tackle wicked problems, such as sustainability?	Close ended	Yes/No	Yes
Q3Q3A	If possible, please explain your previous answer.	Open ended	Paragraph	No
Q3Q4	Do you consider adequate the way the Areas were structured in the Framework?	Close ended	Yes/No	Yes
Q3Q4A	If possible, please explain your previous answer.	Open ended	Paragraph	No
Q3Q5	In your opinion what are the Strengths of the Design Competencies Framework?	Open ended	Paragraph	No
Q3Q6	In your opinion what are the Weaknesses of the Design Competencies Framework?	Open ended	Paragraph	No
Q3Q7	What, in your opinion, could be improved in a future iteration of the framework to make it more accessible to Design educators, making it easier to be adopted in the context of Design Education?	Open ended	Paragraph	No

Additionally, we collected personal information to comprehensively understand the participants' profiles (Table 35).

Table 35: Demographics questions at instrument Q3.

ID	Question	Nature	Type	Follow-up
Q3D1	Name	Open ended	Short Paragraph	No
Q3D2	Level of Education (College Degree/Master Degree/Doctoral Degree/Other)	Close ended with "Other"	Multiple Choice	No
Q3D3	Scientific area	Open ended	Short Paragraph	No
Q3D4	Professional practice (Professor or Lecturer/Other)	Close Ended with "Other"	Checkbox	No
Q3D5	Years of experience	Close ended	Checkbox	No
Q3D6	Country of Residency	Open ended	Dropdown	No
Q3D7	University (affiliation)	Open ended	Short Paragraph	No

6.3.3. Participants' Profile

To assure that the participants' profiles were relevant to provide the necessary feedback for this stage of our research, we collected the data related to their scientific area, professional practice, experience, and level of education.

Figure 63 summarises the level of education amongst the participants of the activity. Most of the part takers (83,3%) have at least a master's degree. Within these numbers, 38,9% also hold a Doctoral Degree. Only 16,7% had a post-graduation degree, all in Brazil.

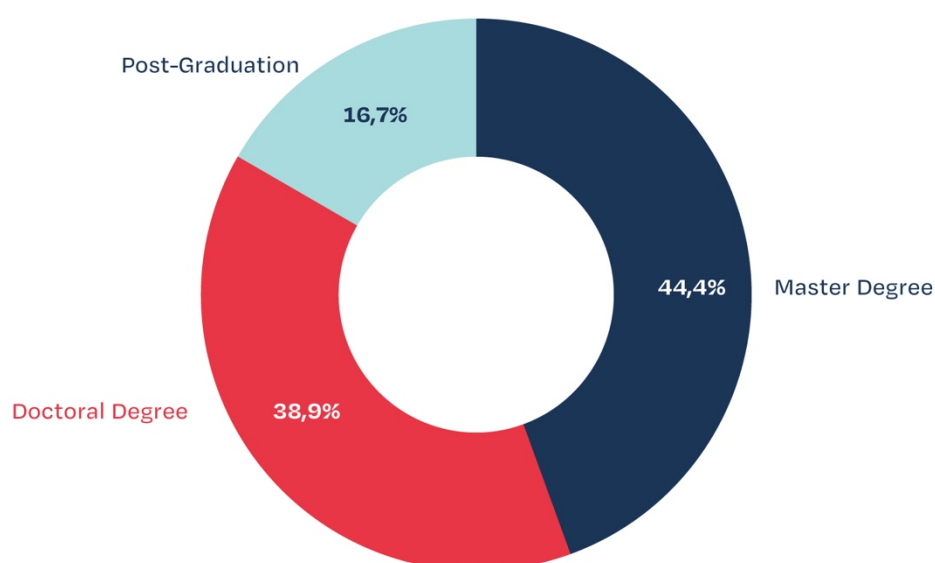


Figure 63: Summary of the level of education of the participants in the validation workshop.

Most of the participants have their practice within the Design scientific area. 66,7% described Design as their scientific area, whilst 22,4% combined Design with a second or third area, such as Anthropology or Animation. 11,2% declared to have their background in other areas, namely Sociology and Arts and Cultures. See Figure 64 for the complete overview of the answers.

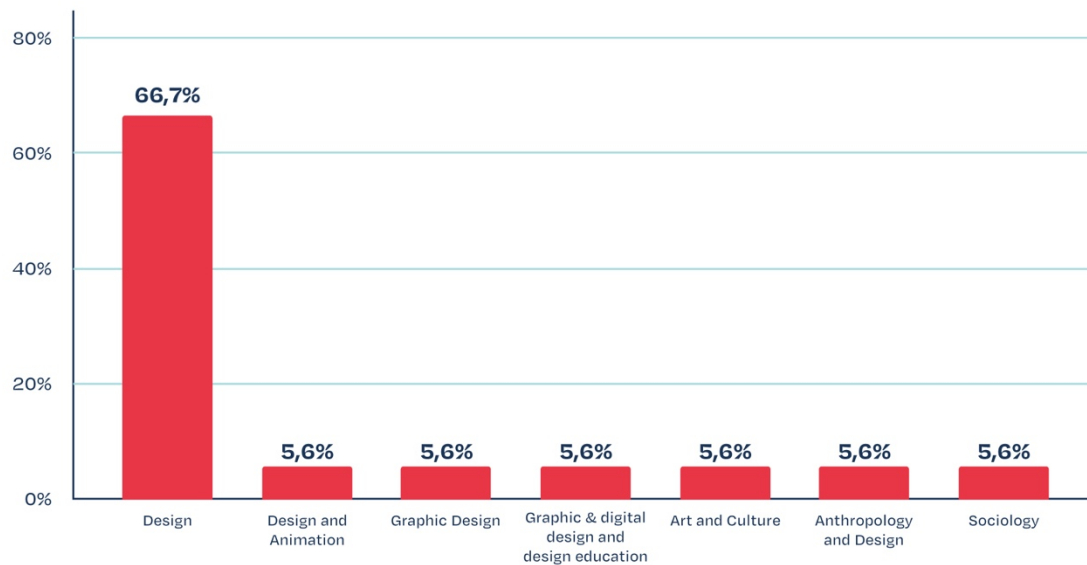


Figure 64: Summary of the scientific area of the participants in the validation workshop.

Regarding their professional practices, the majority (77,8%) of the participants were professors or lecturers. 44,4% were professionals, 11,1% PhD candidates, and 5,6% investigators. We have grouped all unique answers related to professional activity into the Professional tag for better visualisation of the Data (Figure 65).

For this question, the participants were able to select more than one option, if desired. Such possibility also reflects on the total numbers that excel 100% when added since there was a total of twenty-two answers from eighteen participants.

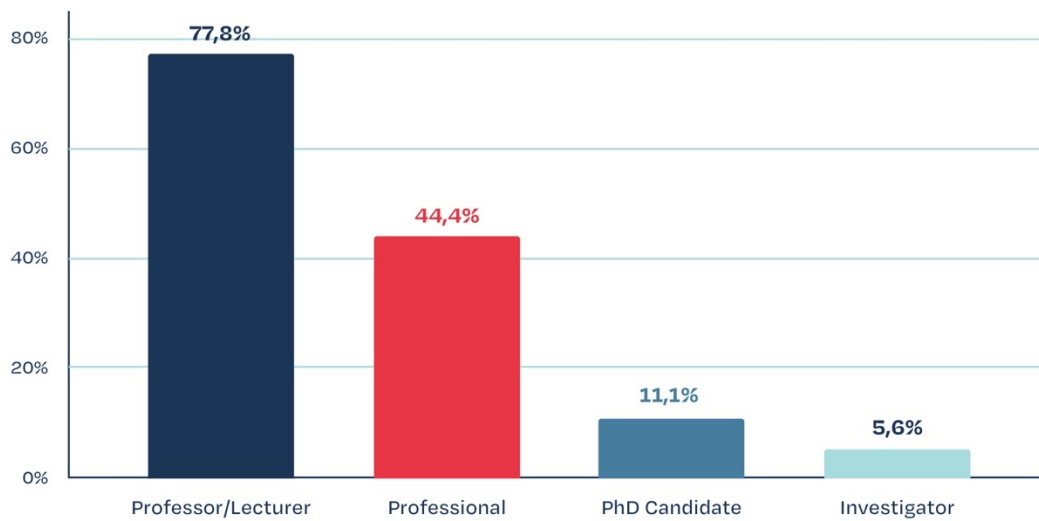


Figure 65: Summary of professional practice of the participants in the validation workshop.

Analysing the years of experience, 50% of the participants have at least fifteen years of professional experience (Figure 66). The other half was divided into three groups, where 22,2% had between 6 and 10 years of experience and 22,2% between 11 and 15 years. Only one participant (5,6%) declared having less than five years of professional experience.

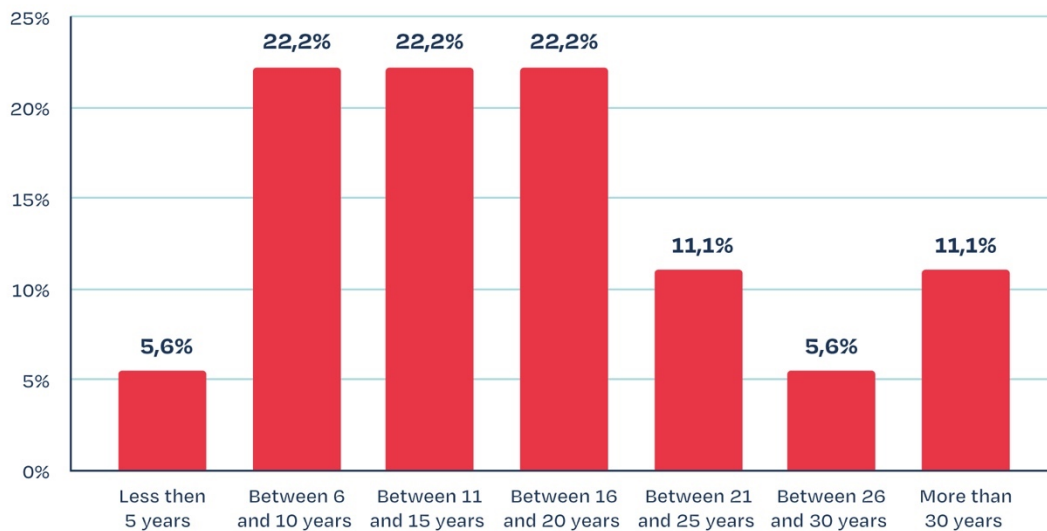


Figure 66: Summary of years of professional experience of the participants in the validation workshop.

Due to the online nature of the workshops, we were able to count on the participation of peers from countries other than Portugal. Participants from Brazil and Spain were also a part

of the group that discussed the framework's utility. However, as seen in Figure 67, nearly 70% of the participants have Portugal as their country of residency.

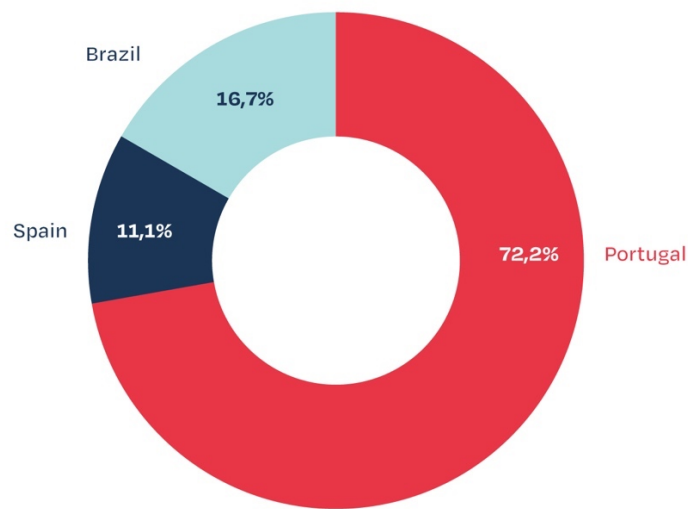


Figure 67: Summary of the country of residency of the participants in the validation workshop.

After analysing the collected data, it has become clear that the participants' profiles ensure that we are involved in the discussion professionals deeply related to Design Higher Education or Social Impact. Also, being composed mainly by professionals who are highly familiar with academic research gives credibility to the outcome, namely the Design Competencies Framework and the process that culminated in the instrument.

6.3.4. Results

The overall response from the consulted specialists reinforced our belief in the value of the Design Competencies Framework as an instrument to support Design Education transition to a practice that supports the development of the set of fourteen competencies. Amongst the participants, it was unanimous that the Design Competencies Framework poses as a relevant model to foster future designers that are agents of change and more capable of dealing with and solving complex problems. Also, they mostly agree with the competencies identified during our research and the Areas structure proposed in the framework. Next, we present a comprehensive analysis of the answers to each question of the questionnaire Q3.

Q3Q1: “Accordingly to what was presented, do you consider the Design Competencies Framework a useful instrument to foster change on how design students are trained if aiming for designers as active agents of change?”

The first question of the questionnaire addressing the instrument accounted for understanding the participants' perspective regarding the relevance of the Design Competencies Framework for helping foster design students that are future agents of change. All participants believed that the instrument developed in this research was useful for such a goal.

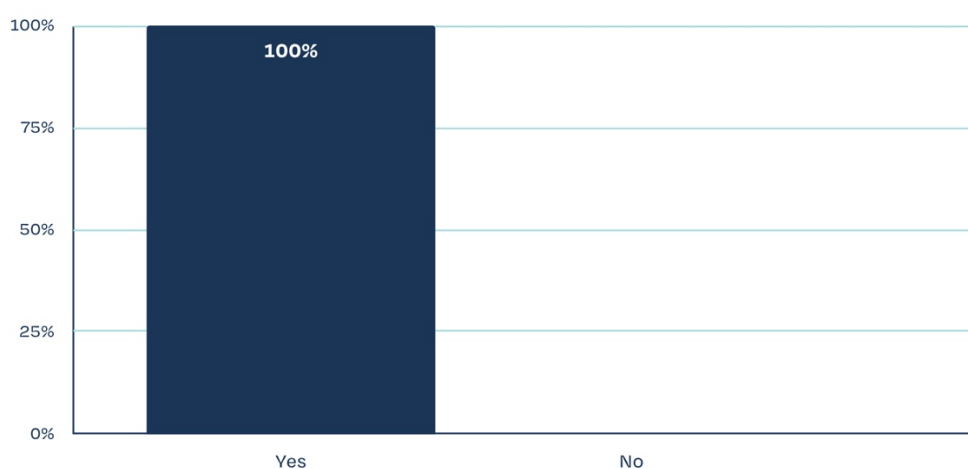


Figure 68: Results for question Q3Q1: "Accordingly to what was presented, do you consider the Design Competencies Framework a useful instrument to foster change on how design students are trained if aiming for designers as active agents of change?"

When asked to justify their answer (Q3Q1A), participants were very plural as to why they believe the Design Competencies Framework is helpful. The bottom-up strategy, where students helped co-designing the framework, was mentioned by participant Q3P1. Another specialist (Q2P2) affirms that *“bringing such open tools into frame context allows students to try new things, experimentar [sic] and innovate.*

As has already been previously stated, the general response for question Q3Q1 was overwhelmingly positive. However, we were able to collect valuable, constructive feedback from Q3Q1A. For example, one participant (Q2P3) raised the issue of how the framework should be applied; they argue that its application should be *"as an add-on to already running design programs, so that the teacher wouldn't need to change the core of the course program."* Furthermore, they continued saying that *"a weakness is the fact that a teacher needs to change the project briefing completely*

and if they framework could be used as an add-on, then we'd transforming a weakness into a strength". Moreover, for participant Q3P4, "it is not easy to aim for students to have all these competences. Therefore, we can have a limitation, maybe a minimum number of competences so that they can become designers with the skills we intend for".

Following (Table 36), we display selected statements from the item Q3Q1A.

Table 36: Selected statements from Q3Q1A: "If possible, please explain your previous answer."

Id	Answer
Q3P1	"has been created with a "bottom up strategy" together with students. It gives a complete overview about the competences and the toolkits available to develop these competencies."
Q3P2	"bringing such open tools into frame context allows students to try new things, experimental [sic] and innovate."
Q3P3	"My suggestion would be to consider apply it as an add-on to already running design programs, so that the teacher wouldn't need to change the core of the course program. I would also run this framework through a SWOT analysis to further explore the positives and negatives and build from that. Because in my view, a weakness is the fact that a teacher needs to change the project briefing completely and if they framework could be used as an add-on, then we'd transforming a weakness into a strength. Which other opportunities may we find by doing a SWOT analysis?..."
Q3P4	"I think it is not easy to aim for students to have all these competences. Therefore, we can have a limitation, maybe a minimum number of competences so that they can become designers with the skills we intend for. At least 2 from each section or well it might be another branch of the research."
Q3P5	"Yes, it is all very clear and concise, visually pleasing, and easy to follow allowing for the user to personalise as needed."
Q3P7	"I am interested in and believe that the movement generated by the circularity of this framework is important, promoting learning in each area and especially inter-areas, through the 'enablers'"
Q3P8	"The Design Competencies Framework seems to include the competencies needed to identify and understand the problems and challenges that society in the 21st century is facing, as well as addressing, transversally, the competencies that can be integrated in design education (even from other areas) and can be used in research and teaching applied to projects and practical experiences." (translated by the author).
Q3P10	"The competency approach supports the systematization of the process and provides a more holistic approach. On the other hand, it is important to be aware of the motivating factors and drivers (here with enablers) that affect their efficiency." (translated by the author).
Q3P11	"It is important to rethink teaching within the academy in order to develop skills in students that can go beyond professional performance." (translated by the author).
Q3P12	"the only way further is to bring coherent methodology and frameworks which are solving real world problems. What ou [sic] are proposing includes everything, problem formulation (resileience creation), strategy on how to solve things ans [sic] solutions and consequences (impact) that this is going to create in the world."
Q3P13	"It is in the education and training of designers (who are also citizens) that the seed of change lies, hence its [the framework] importance." (translated by the author)
Q3P15	"It properly identifies the competences and areas needed to work with a more holistic education and with the complexity of current problems". (translated by the author)
Q3P16	"I believe that the framework allows for a more holistic and less subjective interpretation when it comes to the designer's role in complex problems." (translated by the author)

Q3Q2: “Do you consider that the Design Competencies Framework contains the basis to support Design Education on the development of the competencies identified in our investigation?”

The second question (Q3Q2) collected the specialists’ opinions about if what was presented showcased the necessary basis for developing the fourteen competencies at stake. Again, identical to the results from Q3Q1, all eighteen participants answered *Yes* to the question (Figure 69).

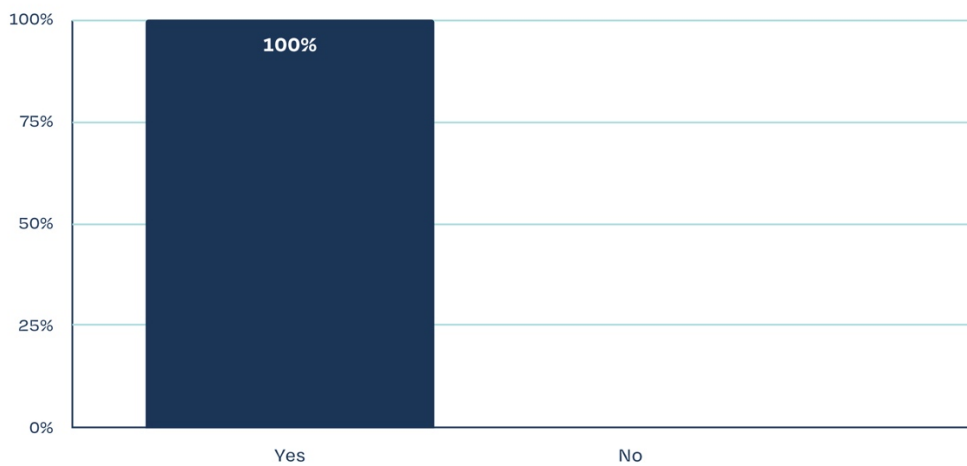


Figure 69: Results for question Q3Q2: “Do you consider that the Design Competencies Framework contains the basis to support Design Education on the development of the competencies identified in our investigation?”

To understand their answers, we asked participants to, if possible, explain their choice on item Q3Q2A, which made possible the assortment of qualitative data.

Participant Q3P4 raises some essential questions such as “*How we can implement the framework? would it work for mostly theoretical or practical classes? Should we make students read more (which they dislike the most)? Should we make them work on real problems and focus on more real world projects?*”. Participant Q3P7 questions how the physical space dimension (not present in the framework) could be a part of the structure, as it is, from their perspective, “*an informer of attitudes and consequently predispositions for learning*”.

One participant (Q3P12) suggested that the framework could reinforce a “*purpose driven action*”, where all competencies were led and guided by a central competence: *Purpose*. This is a suggestion which we intend to explore further at future iterations of the framework as we

believe that purpose can promote impactful solutions. This observation corroborates with what we observed during the student's choices of themes at the Participatory workshop. Table 37 showcases the answers from Q3Q2A.

Table 37: Selected statements from Q3Q2A: "If possible, please explain your previous answer".

Id	Answer
Q3P1	"It gives a complete framework about the competencies, in a clear and structured way."
Q3P2	"yes but i guess it needs clarification on the purpose, relevante [sic], contributos [sic] given an huge amount of tools already existent "
Q3P4	"In Design Education, as professors we intend our students to have most of these competences. That's why framework has the basis. I think the problem is: How we can implement the framework? would it work for mostly theoretical or practical classes? Should we make students read more (which they dislike the most)? Should we make them work on real problems and focus on more real world projects?"
Q3P5	"For me it is a beginning...and I would need to see more of it in use to consider how far it goes to aiding in education."
Q3P7	"Yes, although I emphasize that the specific role of space, as an informer of attitudes and consequently predispositions for learning, could be part of this structure." (translated by the author)
Q3P12	"As said in previous answers it covers the three parts and supports students and professors and also further on broad scale of designers. I would add Purpose as the center of all the competencies. Purpose driven action."
Q3P13	"I think it has the essentials. But as far as I could see it also presents the possibility for flexibility and adaptation." (translated by the author)
Q3P16	"I believe that the framework allows for a more globalised and less subjective perspective when it comes to the designer's role in complex problems." (translated by the author)

Q3Q3: "Accordingly to what was presented, do you consider the Design Competencies Framework a useful instrument to train designers to tackle wicked problems, such as sustainability?"

For item Q3Q3, 94,4⁰% of the specialists believe that the framework is a valuable instrument to help train designers to solve complex and ill-defined problems.

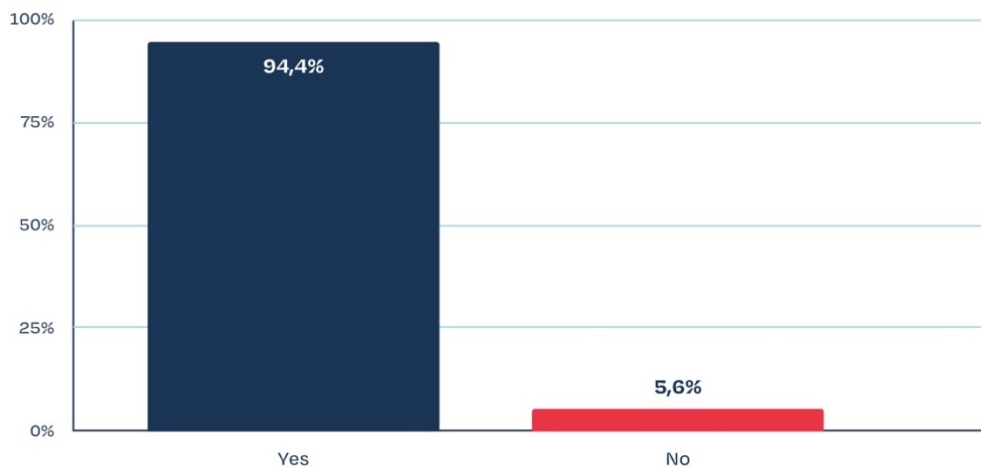


Figure 70: Results for question Q3Q3: “Accordingly to what was presented, do you consider the Design Competencies Framework a useful instrument to train designers to tackle wicked problems, such as sustainability?”

For question Q3Q3, we also presented a follow-up question (Q3Q3A), where we asked the respondents to elaborate on the answer from the previous question. For that, participant Q3P5 declares that *“Without doubt it will be a useful instrument. I teach a sustainable workshop to second year BA design (product, graphics and interiors) students and would love to have an archive of sources for all types of tools, projects and methodologies out there. The workshop is an introduction to the topic of sustainable Design and aims to empower the students to tackle the issue of sustainable / circular Design and one of the difficulties is engaging the students to find and use existing tools”*. Such comment is essential as we aim for the framework to become a valuable tool for design educators.

Participant Q3P7 sees the benefit of the framework once *“Complex problems and sustainability imply a new ethics and new approaches for designers, especially in their singular and activist position in favor of a better world for all” (translated by the author)*. For Q3P5, the framework is useful for students to get more profound knowledge and see problems from different perspectives by developing the different competencies. For the participant, *“sustainability is a very broad term, students are very limited to perceive the concept. Most of them are thinking sustainability is use of sustainable materials”*.

See Table 38 for a summary of all the answers from Q3Q3A.

Table 38: Answers from Q3Q3A: “If possible, please explain your previous answer”.

Id	Answer
Q3P1	“Some of the competencies and toolkits available are typical of design for sustainability”
Q3P2	“i [sic] guess its importante [sic] to measure impact and see what results can come back from it”
Q3P4	“Although sustainability is a very broad term, students are very limited to perceive the concept. Most of them are thinking sustainability is use of sustainable materials. With different competences, they can gain the knowledge deeper, see the problems from different perspectives (hopefully!)”
Q3P5	“Without doubt it will be a useful instrument. I teach a sustainable workshop to second year BA design (product, graphics and interiors) students and would love to have an archive of sources for all types of tools, projects and methodologies out there. The workshop is an introduction to the topic of sustainable design and aims to empower the students to tackle the issue of sustainable / circular design and one of the difficulties is engaging the students to find and use existing tools.”
Q3P7	“Complex problems and sustainability imply a new ethics and new approaches for designers, especially in their singular and activist position in favor of a better world for all.” (translated by the author)
Q3P8	“In general, I consider the DCF to be a very useful instrument to train conscious designs capable of solving complex problems, but at the same time I believe that it could be reinforced with certain skills oriented to the design of interventions and applied projects.” (translated by the author)
Q3P10	“The way it is presented, this framework is useful for any problem and not just problems oriented towards sustainability, however, from the presentation and discussion, one can see its relationship with sustainability.” (translated by the author)
Q3P11	“The possibility of creating a critical sense that goes beyond technical knowledge is essential for solving more complex issues/problems.” (translated by the author)
Q3P12	“It has everything to creat new mind-sets, new culture in education and build and emporwer new ways of teaching learning and collaborating. Absolute yes to create new conscious and responsible ‘breed’ of designers.”
Q3P13	“It is not only a useful tool, it must be put into practice urgently” (translated by the author)
Q3P16	“The instrument minimally allows future designers to see the creative process in a broad way and be aware of their actions in solving problems.” (translated by the author)

Q3Q4: “Do you consider adequate the way the Areas were structured in the Framework?”

Structure wise, it was also important to understand if choices made for the framework made sense to the consulted specialists. Therefore, on questions Q3Q4, we asked the participant to evaluate if the *Areas* of competencies proposed for the framework (*Build Resilience*, *Propose Solutions* and *Understand Consequences*) were adequate.

As shown in Figure 71, all participants consider adequate the overall structure proposed.

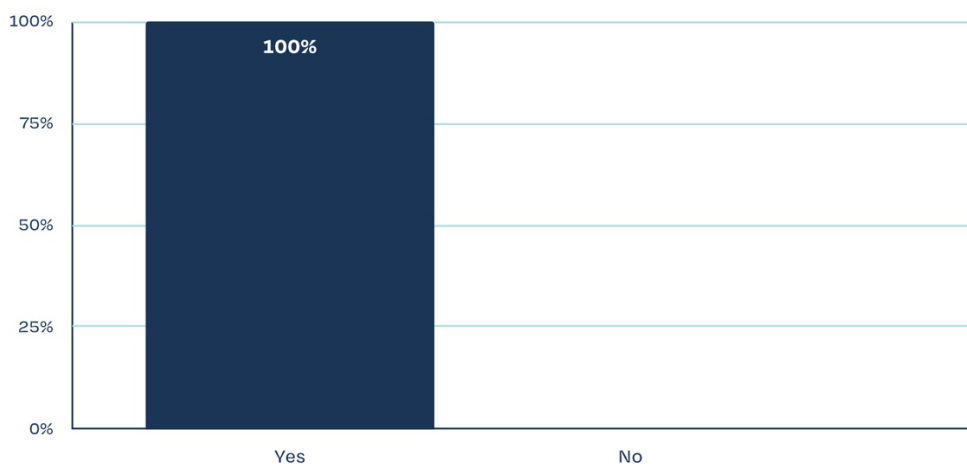


Figure 71: Results for question Q3Q4: “Do you consider adequate the way the Areas were structured in the Framework?”

The follow-up question Q4Q4A provided a space for participants to propose alternatives they believe could better fit how the *Areas* are structured. Next, we analyse and discuss selected answers, and Table 39 showcases all the answers received for this item.

Participants Q3P3 and Q3P17 made comments regarding how it was displayed visually. Both suggest that the structure should be circular and not linear. For example, participant Q3P2 states, “*i [sic] think solutions is too narrow i [sic] would prefer propose options. Instead of resiliente [sic] I would prefer observe and analyse*”. At the same time, Q3P17 declares, “*I think it’s appropriate, but I think it’s better to present the areas of competence in a circular, rather than linear, form - in the development of a solution, ethics or system thinking does not come after empathy, for example. This is mainly a matter of visual presentation of the structure, so as not to convey the message that the build resilience block is more important than the other two (translated by the author).*”

It is essential to state that the participants evaluated the *Areas* based on the image shown in Figure 60 of this Thesis. In our understanding, the framework does not propose a linear structure, as can be seen in image Figure 59. Additionally, on item 5.5, precisely at the Principles section, we state that all competencies and areas of the framework are treated equally. Hence, there is no level of importance, core competence or area.

Most of the participants do agree with the structure presented. However, three participants (Q3P2, Q3P12 and Q3P13) propose a different solution to grouping competencies. Q3P2 suggest Observe and Analyse to replace Resilience; Q3P12 suggests moving the competency

System Thinking to the *Build Resilience* Area, and Q3P13 envisions the Collaboration as a part of *Propose Solutions*.

On item 5.5 under the section Relationship, we defend that although the competencies are posed in individual blocks, they are connected at many levels, having strong relationships that can blur the boundaries between them. Thus, providing an organisation model that is collectively understandable, we ensured to create the *Areas* proposed in a co-creative process with specialists from the Design field, focusing on education, Social Innovation or Sustainability (see 5.3.4).

Table 39: Answers from Q3Q4A: “If possible, please explain your previous answer”.

Id	Answer
Q3P1	“to me, this framework as it is structured works in a clear way because its [sic] presents a balanced alternation of convergent and divergent design approaches”
Q3P2	“i [sic] think solutions is too narrow i [sic] would prefer propose options. Instead of resiliente [sic] I would prefer observe and analyse”
Q3P3	“I would prefer to present it circularly and address the iterative process it may actually be. The fact that the context awareness is by then end, it may in fact lead to conclude that we need to go back to adaptability and flexibility and start again.”
Q3P4	“If I was involved in the card-sorting I might have sort them differently but now I don’t think they are inadequate.”
Q3P5	“However, I would need more information and to see it in action in order to evaluate correctly.”
Q3P10	“the way of structuring competences presents a structure that makes perfect sense, making its identification and objective clear.” (translated by the author)
Q3P11	“The more comprehensive the greater the possibilities.” (translated by the author)
Q3P12	“I would move systems thinking to build resilience to create a bogg [sic] picture to create reislience on a long term.”
Q3P13	“It’s adequate. Perhaps Collaboration could also be part of the Solution Proposal, which often results from collaborative projects and processes.” (translated by the author)
Q3P16	“I found it excellent, since in an organised fashion it is possible to visualize the fundamental human competences for understanding and solving problems.” (translated by the author)
Q3P17	“I think it’s appropriate, but I think it’s better to present the areas of competence in a circular, rather than linear, form – in the development of a solution, ethics or system thinking does not come after empathy, for example. This is mainly a matter of visual presentation of the structure, so as not to convey the message that the build resilience block is more important than the other two.” (translated by the author)

Questions Q3Q5, Q3Q6 and Q3Q7 were open-ended questions that focused on gathering feedback on the strengths, weaknesses, and improvements for future iterations of the framework, respectively.

Q3Q5: "In your opinion what are the Strengths of the Design Competencies Framework?"

Due to the qualitative characteristics of question Q3Q5, the answers were not numerically analysed. Instead, we proceeded with a semantic analysis to identify keywords and patterns in the comments to identify the core strengths of the framework, accordingly to the participants.

Following, we list the main strengths cited by participants. Finally, all the complete answers are displayed in Table 40.

- Clarity/Clearness (Q3P1; Q3P3; Q3P5; Q3P10; Q3P17).
- Interconnectivity (Q3P8; Q3P11; Q3P12; Q3P13; Q3P16).
- Simplicity (Q3P5; Q3P7; Q3P10).
- The competencies (Q3P4; Q3P15).
- Openness/Flexibility (Q3P9; Q3P16).

Table 40: Answers from Q3Q5: “In your opinion what are the Strengths of the Design Competencies Framework?”.

Id	Answer
Q3P1	“the complexity of the framework, and the clearness of the model”
Q3P2	“the strengths for me is [sic] understand consequences [sic] as the differentiated element in other frameworks and tools”
Q3P3	“Being a very clear step by step approach to promote change in design education with regards to sustainability and social impact.”
Q3P4	“In general, when students are creative, they have all to design. The framework shows that creativity is not the only competences that the design students should have but much more. Ethics is one of the competences that shines the most for me. Moreover, the methods that the framework will provide is another strength.”
Q3P5	“The framework is clear and easy to understand and put in to [sic] action. It is also very complete.”
Q3P7	“Its linearity and ease of reading and adaptability to current contexts” (translated by the author)
Q3P8	“Connection between competences, transversality and applicability to other areas oriented to change and social impact, structure presented in favor of change and not just problem identification, connection with the science of design.” (translated by the author)
Q3P9	“Its use as a basis for teaching while allowing changes by teachers to better suit their needs.” (translated by the author)
Q3P10	“Clarity, Simplicity and Communication” (translated by the author)
Q3P11	“The possibility of interconnection in the development of competencies.” (translated by the author)
Q3P12	“interconnectivity, holistic picture [sic], action oriented.”
Q3P13	“Systematization and clear identification of competencies and related issues.” (translated by the author)
Q3P14	“The inherent idea of a cycle (construction/proposals/effects)” (translated by the author)
Q3P15	“The identified competences, the three areas and the selection of 185 tools to foster competences.” (translated by the author)
Q3P16	“The possibility of making tangible issues that hitherto seem subjective in a project evaluation; The flexibility of the instrument; The creation of a connection between a wide range of existing tools and the possibility of using them for the development of competences;” (translated by the author)
Q3P17	“Clarity and rigor.” (translated by the author)
Q3P18	“Systematisation of the process and justification for creating the necessary groups of needed competencies.” (translated by the author)

Q3Q6: “In your opinion what are the Weaknesses of the Design Competencies Framework?”

More importantly, we also aimed to understand which weakness could be associated with the framework from the perspective of the specialists. Thus, the answers from item Q3Q6, alongside Q3Q7, can guide subsequent iterations and future developments of the framework and improve and identify parts still unclear, especially to Design educators.

For some participants is still not clear how the framework will be fully used in the educational context (Q3P5; Q3P15; Q3P18). Participants Q3P1 and Q3P2 see a need for impact

assessment of the use of the tool. This point of view relates to the noticed absence of competencies assessment and process monitorisation, commented by participants Q3P4 and Q3P14, respectively. It is important to note that while defining the structure of the Design Competencies Framework on Item 5.2, we have decided to leave out a dimension that could account for proficiency level and, consequently, assessment of the competencies, at least for the first iteration of the framework. We understand the value of such a dimension and envision its addition in a future iteration.

It was also clear that it might be necessary to make some of the principles and guidelines more straightforward since some of the comments pose the framework in a vision opposite to what we envision to it, such as inflexibility (Q3P2) or not being iterative (Q3P3). In addition, for participants Q3P9 and Q3P13, it was not clear how the *Enablers* relate to the competencies. Finally, participant Q3P8 highlights the need to reinforce the process of problem-finding, which are supported by many of the competencies identified.

Most of the feedback given by the specialists during the validation sessions provide opportunities for improvement of the framework. First, an evident aspect to be addressed in the future regards the communication of the framework elements, once some of the weaknesses pointed by the participants are part of the framework, but it was not clear to some participants. Secondly, we also identified that other cited weaknesses result from decisions regarding what to leave out the framework's structure for its first iteration.

See Table 41 for all the feedback provided by the participants for item Q3Q6.

Table 41: Answers from Q3Q6: “In your opinion what are the Weaknesses of the Design Competencies Framework?”.

Id	Answer
Q3P1	“the difficulty in evaluating the impact. Even though can be solved bringing the evaluation on a higher level (normative) as has been done with the INVALSI tests (Italy)”
Q3P2	“theres a huge amount of frameworks/tools in the field ... its hard to implement one or to exclude others ... i would prefer to open the context to a new way of thinking such as measuring impact for change instead of proposing something that is also inflexible and might not create value.”
Q3P3	“I have addressed it on previous questions: 1- not being considered as an add on this implying massive change in teachers [sic] programs/briefings. 2 - not being presented as iterative.”
Q3P4	“The framework will be very powerful if it also provides an assessment as we spoke in the workshop. The access to the framework should be thought well so that it will be assessed easily.”
Q3P5	“I was unable to see how it works. The workshop canvas didn’t explain much. Often when I teach using tools like those offered in the Circular Design Guide by IDEO & the Ellen MacArthur Foundation surprising results emerge, some positive, some not so...”
Q3P7	“With the exception of LEARN TO LEARN (first block), I think that the self-determined dimension that the current teaching of Design will have to follow in order to survive the informal torrent of alternatives for rendering in design is lacking” (translated by the author)
Q3P8	“The proposed structure could be further strengthened toward problem finding, which is very complex and might need some of the competencies mentioned. Many of the competences highlighted are connected with each other or that may mean that they are equally relevant in other structures in which they are not present.” (translated by the author)
Q3P9	“I would pose as a weakness, but it’s not very clear how enablers will take advantage of the competencies of the three major areas” (translated by the author)
Q3P10	“The link between competencies and the SDGs”
Q3P11	“I don’t see any weaknesses.” (translated by the author)
Q3P12	“I don’t see it as weakness but as an opportunity that you scale it up for concrete summer schools, bootcamps and educational programs especially fr [sic] professors and future deisgners [sic].”
Q3P13	“The unclarity regarding the Enablers, either in the identification or in the number listed.” (translated by the author)
Q3P14	“It is necessary to coordinate and monitor the process across the 3 domains of the cycle” (translated by the author)
Q3P15	“I understand that the difficulty is in using it that should be improved.” (translated by the author)
Q3P16	“I honestly don’t see any weaknesses, only the need for the evolution of this research in order to allow the instrument to be really implemented, making it possible to actually evaluate the benefits achieved, as well as the real changes in the educational scenario and consequently in the practice of design.” (translated by the author)
Q3P17	“Risk of mechanization of the framework application process.” (translated by the author)
Q3P18	“The operationalization in a real context, and the need for it to only be applied (at least in its fullness) in an integrated manner in a course (or rather, to be a course). Which may limit its applicability. In this sense, it may be important to consider/test the effectiveness of the framework when used partially” (translated by the author)

Q3Q7: “What, in your opinion, could be improved in a future iteration of the framework to make it more accessible to Design educators, making it easier to be adopted in the context of Design Education?”

Finally, we took the opportunity to ask for insights into how to improve the framework in the future to become a better and more complete tool in supporting Design Education. While some suggestions go beyond our goals for this study, others are feasible and were

implemented in the final version presented in the Appendix section of this Thesis. However, we will not discuss the comments received for this item. Instead, they will compose a backlog for improvements for future iterations.

Next, we present the answers received for item Q3Q7 (Table 42).

Table 42: Answers from Q3Q7: “What, in your opinion, could be improved in a future iteration of the framework to make it more accessible to Design educators, making it easier to be adopted in the context of Design Education?”.

Id	Answer
Q3P1	“Creating a free assessment model for the students, that doesn’t affect the teacher’s evaluation on the subjects.”
Q3P2	“to open the education context to important things such as pratica impact”
Q3P3	“Answered above”
Q3P4	“A copy of printed version can be sent to different design schools. A poster (https://www.nngroup.com/articles/ten-usability-heuristics/) presentation can be done to make the information simpler to educators.”
Q3P5	“In your presentation I did not see what happened when you applied the framework with the students and teachers”
Q3P7	“As a structure, it always needs an “application manual” to becoming effective and efficient, particularly with regard to “pedagogical practices.” (translated by the author)
Q3P8	“I also believe that some of the skills are not traditionally linked to the area of design, so the reinforcement of these skills in design education can be difficult to perform and need training for trainers. One of the challenges for changing design education as a leading area in the paradigm shift is its application in the context of education, especially formal, so it can be very relevant that this DCF be transmitted to the Professor/Lecturer body and leader of the structures of teaching through awareness-raising actions and training of trainers.” (translated by the author)
Q3P10	“communicating this connection to the SDGs better, besides that, it seems very good.” (translated by the author)
Q3P11	“Its practice and experimentation at Design schools with the possibility of publishing the material.” (translated by the author)
Q3P13	“I think there is room in the future to develop a proposal for a TOOLKIT for Teachers. Not all educators/ teachers are sensitive to these problems or are aware of what it means to introduce these issues into teaching. The “mindset” of educators also lacks change, so skills will be needed to assist in the widespread implementation of this Framework in teaching Design. This work is an excellent start, but that’s it. It’s the beginning of the change.” (translated by the author)
Q3P14	“Create a diagram with evidence of the mechanics and logistics of the cycle in its 3 dimensions” (translated by the author)
Q3P15	“As I mentioned during the workshop with the teachers, the next step is to make the use of the Framework easier for students and teachers, creating work areas as an organiser or worksheet.” (translated by the author)
Q3P16	“Well, Design education is sometimes understood, by students and even by some educators, as learning to manipulate technological tools, however, the framework proposal goes far beyond this, as it challenges professionals in the field to develop skills that enable them to solve problems, and not necessarily master computer programs.” (translated by the author)
Q3P18	“The weaknesses that are found based on the previous question. Without losses, I think that whenever it is possible to give concrete examples of the application of the Framework, it will be a great asset, as nothing beats a practical example for comparison. This can be in the form of a ‘tutorial’ in multiple formats (print; video; interactive; ‘all the above’...).”

6.4. Key takeaways

Overall, the response from the consulted specialists and the results from students that participated in the participatory workshop showed that the Design Competencies Framework is built upon a solid foundation with a comprehensive but straightforward structure. They see the instrument as an asset to foster change and train designers to deal with wicked problems, hence becoming agents of change.

Students were able to discuss and ideate design proposals directly influenced by the real problems they were presented. Also, the influence of the themes proposed, their solutions, and the quality of the discussion regarding Design and designer's impact on society was evident in all group's presentations.

During the discussion of the results, students reinforced the need to develop the competencies identified in our research, such as context awareness, system thinking, complex problem solving, environmental awareness, and adaptability & flexibility. In addition, it became clear that the shift in focus of the brief from project-based to problem-based drove the proposal of solutions that allowed for deeper discussion regarding the role of the designer in society. Thus, there is a great opportunity for Design Education to address complex societal challenges and to build the confidence students need to become agents of change.

Likewise, the professionals, researchers, and academics who took part in the validation workshop declared the high relevance of the Design Competence Framework as a valuable instrument to assist Design Education in developing the fourteen competencies we identified and listed in our research. The nearly unanimous result and enthusiasm with the possibility to count with the support of a tool like the Design Competencies Framework helped us validate the importance of our research.

However, we also identified opportunities to iterate in future versions of the framework and implement changes to make it easy to implement and replicate as often as possible. Therefore, creating a digital version of the Design Competencies Framework is critical to allow easy updates and constant feedback from future users. Also, it is essential to consider how to communicate to Design schools the existence of the framework and its applicability.

The Design Competencies Framework does not intend to be a *Do It Yourself (DIY)* type of instrument. Hence, its usage relies heavily on the know-how and experience of teachers and

professors. Without proper guidance, students may not understand tools and methods presented in the framework once many tools require approaches beyond the skills, competencies, and knowledge seen today in most design schools. Therefore, design professors must be sensitised on the importance of the Design Competencies Framework and perhaps trained to use it and adapt to their local context appropriately.

6.5. **Chapter Summary**

This chapter presented how we proceeded with validating the instrument developed during our research, namely the Design Competencies Framework. We aimed to understand and analyse the relationship between the problem-based approach and its potential to drive design solutions addressing social and environmental problems. Also, we described how we proceeded to validate the framework with subject matter experts. The results from both moments showed that the Design Competencies Framework is built on a solid foundation and supported the need for such a tool to assist Design Education. Finally, the validation process disclosed opportunities for future iterations of the framework based on the rich feedback received from both moments of collaboration.

Conclusions and future developments

This chapter provides the final discussion and main conclusions of our research. It is composed of five sections. First, it presents the study's purpose, the research approach and findings regarding the research questions and hypothesis. Next, it claims the contribution to knowledge for the Design field, pointing its direct beneficiaries of such contribution. Third, it presents and discusses the limitations found during the study, followed by the proposal of future developments and research. Finally, it closes with remarks about the work done during the research and the Thesis's content.

1. Discussion

On the purpose of the study

Throughout our research, we explored the need for designers to adapt to a world's new paradigm embedded in a profound crisis in the economic, social, and environmental spheres. We claim that Design Education must respond to a scenario of complexity, properly fostering in Design students the mindset to become agents of change.

It was the purpose of this Thesis to identify a set of new Design competencies for designers to remain relevant and, more importantly, lead the way to a better future. Moreover, we set a goal to identify the competencies and understand how Design Education can integrate them into their *curricula* so that students are indeed exposed to necessary *stimuli* to develop such competencies.

We understand that we have accomplished the study's purpose with the development of a new co-Designed competencies framework. The document resulted from a collaborative endeavour that counted with the participation of 283 Design students from four different

countries and eighteen specialists from the Design field, focused on Education, Social Innovation, or Sustainability. The Design Competencies Framework envisions to support Design educators to better understand what competencies Design students should develop during the Design courses to be more prepared for a paradigm-shifting world.

The integration of the Design Competencies Framework with Active Learning methodologies, namely Problem Based Learning, allows the model to achieve its most significant potential. Designers should not be comfortable solving just problems but solving real ones. Design educators should tailor academic projects that address the UN's 17 Sustainable Development Goals while involving the local community in the process.

Research approach

This study was set to explore and seek new insights into how Design Education can promote change towards a more sustainable world. Like any other *exploratory* study, there has been a constant need to adapt and evolve into different directions during the path of this research as new information was brought to our attention. However mainly *exploratory*, the work described in this Thesis has elements of *community change or action research* and *explanatory* research. These elements are justified by our intent to provide guidance and enable change in society and the use of participatory approaches promoting discussion with Design students as a form to clarify the relationship amongst our variables.

Structurally, the research was composed of three central research moments. While those moments were laid in a linear visualisation, the nature of an *exploratory* study expects research moments not to be as linear, moving back and forth in different research stages, in a iterative way.

The first moment accounted for the definition of our study. It contained our research questions and resulted in state of the art originated from a preliminary data collection from primary and secondary sources. It is also essential to notice that there has been a need to reference the literature as new concepts rose continually. Hence, the theoretical information was gathered and analysed for the study's whole duration, not being limited to the first moment.

The second research moment – headed by our hypothesis – defined and built the instruments to collect data based on a mixed methodology. During this moment, we also collected and

analysed the data from different instruments, both qualitative and quantitative. The primary outcome of the second phase was the creation of the Design Competencies Framework.

A reflection of the results and achievements of this study composed the third and final research moment. By looking back at the information gathered and outcomes accomplished, we understood the contribution of our research to the Design field. Additionally, we could envision future work to be done as a complement and evolution of our current findings.

We found that our research procedures allowed us to gather the necessary data to address our research questions adequately. The opportunity to collect data from different sources, contexts, and realities gave the research a rich number of insights that supported our study to the Design Competencies Framework's development.

On research questions and hypothesis

Our study aimed to answer four research questions and used a mixed methodology approach to address them. At the final stage of our research, and based on our findings, we answered all four questions. Next, we present a summarised answer to each of our research questions.

What is the set of competencies needed for the designer in a paradigm-shifting world?

We used a mix of qualitative and quantitative research instruments, such as questionnaires, secondary data, exploratory interviews and participatory workshop, to address this question. After data analyses, we have identified a total of fourteen competencies that designers must develop during their academic path to develop the mindset to become future agents of change (Appendix 1:). The set of competencies was consolidated in the Design Competencies Framework. On item 5.5 of this Thesis, Figure 60 summarises the competencies already presented in our study, grouped in three distinct areas.

How can Design Education contribute to generating Social Impact?

Higher education itself is keen to promote Social Impact. During our literature review, we have established the connections between both parts. Graduates from higher education institutions tend to contribute to social cohesion, being more engaged citizens (OECD, 2018).

In Design Higher Education, we concluded that some institutions are still focusing on academic projects from a market perspective. However, there is an excellent opportunity for

Design Education to contribute to Social Impact. The adoption of a problem-based approach (PBL), that is, the integration of real problems in academic projects, is a fundamental pillar empower change. In line with Ferreira (2020b) and her proposed ReAct model, professionals' mindsets are shaped in the university, thus Design Education, to foster Social Impact, must promote a discussion towards that end.

Furthermore, we established that Social Impact is the outcome of developing the competencies laid in our study. Again, we point to the Design Competencies Framework as an asset to help Design schools act towards this goal.

What active methodologies must be considered to promote a teaching-learning process that supports the development of new competencies for designers?

Design Education configures the promising territory for active learning methodologies. The project-based nature of Design allows for teachers to explore an unconventional learning environment. PBL is a viable approach to challenge students with real problems in the educational space. Being problem-focused, student-centred, self-directed and self-reflective (Jonassen, 2011), it drives the development of competencies as an outcome of resolution wicked problems (Ertmer & Glazewski, 2016), especially if combined with Design Thinking as a framework for project development (Ferreira, 2020a).

How can designers become more socially responsible agents, aware of the importance of their civic action and active role towards Innovation, social wellbeing, and Sustainability?

The ability to become aware of their duty and role in society derives directly from the capacity to develop the competencies presented on the clusters *Build Resilience* and *Understand Consequences* (Table 43).

Table 43: Build Resilience and Understand Consequences competency areas.

Build Resilience	Understand Consequences
Collaboration	Context Awareness
Empathy	Environmental Awareness
Learn to Learn	Ethics
Adaptability and Flexibility	System Thinking
Critical Thinking	Envision Design Outcomes

On Item 5.5 of this Thesis, we define both areas. Competencies such as collaboration, empathy, critical thinking, context, and environmental awareness, to name a few, are crucial for designers to become conscientious leaders towards change.

At last, after revisiting and answering our research questions, we believed to have confirmed our hypothesis, which stated that *A new co-design competencies framework is needed in Design Education to foster the competencies necessary for designers to respond to complex problems and become agents of change.*

2. Contribution to knowledge

Throughout this study, it became evident that society faces growing complex challenges that affect how designers should act professionally. The need for change has become apparent in the discourse of many other authors and researchers. Moreover, the Design field has started to show evidence of the need to Design to adapt to these new demands, with the appearance of initiatives towards a more impactful and sustainable practice.

In Design Education, the literature elucidates the eminent need to rethink Design Education to bring to life designers that are not only focusing on economic aspects. Still, Design Education fails to adapt to this new paradigm fast enough and provide professional capable of addressing the new societal and environmental challenges. While the need for change has been made clear, we believed that Design Education still lack the necessary resources to support the change. As important as pointing out the need for change is elucidate how to achieve the expected outcomes.

The present Thesis' contribution to knowledge lies in showing how Design Education could be addressed to foster the designer's profile in need. Identifying the Design competencies crucial to that profile and how Design Education can incorporate them in their learning approach. We understand that our study contributes to the body of work already found in the literature, as it directly addresses the gaps in knowledge identified by our research, as stated in the first chapter of this Thesis.

The claim of the contribution to knowledge is supported by the two main results of our research. In response to our second gap of knowledge, we identified fourteen Design competencies for Sustainability and Social Impact. Identifying such competencies allows Design Education to better know how to prepare future designers and what type of mindset to expect as an outcome of their educational process. Second, we structured the Design Competencies Framework, a model to support education transitioning into a path that responds to the need claimed by the literature and reinforced by the current *status quo*. The framework presents the fourteen competencies in clusters organised by affinity areas, accordingly to the desired outcome: build resilience, propose solutions, and understand consequences. Also, it showcases a vast number of Design tools to help foster the competencies outlined.

Regarding to its beneficiaries we can consider that the authors, have been immensely affected by our research. We have started this study with over a decade of professional and teaching experiences. From that, we have personally felt the need for the change in the Design Educational System. However, it was still not clear *what* should change and *how* to achieve such changes. Both of those questions were made clear to us during the research process. Furthermore, with this Thesis, we have grown our professional mindset from being aware of the need to change to actors change, a significant milestone.

Design educators have on this Thesis, and especially on Design Competencies Framework, an essential guide to support their practice towards fostering an impactful mindset in Design students. They will be capable of referencing the framework to plan projects and redesign *curricula* that consider the Design competencies identified to respond to the world's demands.

Design Students will benefit from our research by developing new and adequate competencies in their future practice, thus remaining relevant to society as creative professionals. They will naturally navigate their academic path, addressing complex issues as

they are exposed to society's challenges. Finally, students will be able to become aware of their role in society and the impact of their work on people's lives, based on their learning processes.

The present study also provides a perspective on how the future of Design practice could be understood. The Design industry may take our research as a starting point to acknowledge the need to discuss the future of Design. The Design Competencies Framework may also serve as a guide to a learning path for designers who lack the necessary competencies to address the contemporary challenges faced.

3. Limitations of the study

While we understand that we have accomplished the overall objectives outlined for our research, we also recognise that the study's self-financed nature also posed limitations worth mentioning.

The first limitation is related to the composition of our sample. The sampling strategy adopted was based on convenience, which naturally implicates limitation as it allows for selecting cases or subjects that are easiest to obtain (Saunders & Bristow, 2019). We have tried to minimise this limitation by targeting a sample from different international in diverse contexts and realities available at the moment and on a COVID-19 context.

Secondly, the Design Competencies Framework is the product of a well-defined and structured research methodology. The sources of information were plural, and it was refined continuously throughout our study. However, the framework is yet to be fully explored. As part of the process of validation have presented the concept to specialist on the fields of Design, Design Higher Education, and Sustainability. Whilst the feedback regarding the importance of the instrument and interest in using it was overwhelming, we have not been able to apply it in a full academic environment. One main reason for it was, again, the outbreak of the COVID-19 pandemic, which led to the suspension of classes for most of the year 2020-2021. Nonetheless, in the next section of this chapter, we envision future developments for the current research, which address this limitation.

4. Future developments

As stated earlier, we have achieved the expected outcomes laid for our study. We were able to answer our research questions, validate our hypothesis and, more importantly, contribute to the body of knowledge of the Design field. Our study was mainly exploratory, and we were often confronted with new information that, at times, did not fit the scope of our research but posed as opportunities for future developments. Also, some of the limitations faced during the research's journey can be addressed by upcoming investigations.

A first and more immediate future development is elaborating an online version of the Design Competencies Framework. An internet-supported option may allow for easy and free access for any party interested. The development of a website is also an important step in supporting Design Education to address the necessary change. We believe that our research's real benefit lies in our findings' public availability in the simplest and most accessible way possible, which this initiative may empower.

A subsequent stage to our research will be to partner with a Design institution to put into long use the framework developed during our study. Such a partnership will allow evaluating the outcomes in the students' mindset and solidate the study. It will also provide the necessary feedback for the development of new and improved versions of the framework.

Finally, further research into competencies assessment is desirable in future developments, considering the evolutionary process in design (Ferreira, 2008b). The possibility of assessing students' maturity in the competencies may lead to the possibility of understanding each student's unique mindset. The access to this information can help teachers tailor their paths accordingly to the students' needs. Moreover, it will allow for adding a fourth dimension to the framework, which will account for the level of proficiency of each competency.

While all the future developments identified in this section have a close relationship with our present work, it was not possible to address all of them during our research. The nature of a doctoral study, time constraints, and lack of opportunities prevented the current work to tackle those issues. However, they do underline a promising ground for future research, either for other researchers or us.

5. Closing remarks

Historically, Design has been part of businesses' strategy to promote sales and economic growth. It has helped nurture consumption for decades and focused on a linear economy where resources are considered to be endless. In this setting, the role of Design in products and messages are often limited to beautification and cosmetic styling. This is a paradigm that must be taken down and replaced with a new approach to Design. One that is aware of the consequences of its actions. In our perspective, Design should transition to a new paradigm.

The new paradigm is fed by the countless profound crisis in many different spheres of our society and made clear and public by the Agenda 2030 presented by the United Nations (2015). Such a scenario challenges designers today with far more complex problems than one could have imagined a while back. However, most of the Design sector is still addressing the problems from a purely economic perspective. This type of practice results from a Design Education that struggles to adapt and still floods the market with designers trained with an outdated or limited mindset for problem-solving. Consequently, designers are equipped to solve problems that no longer exist while they fail to identify and address the real problems that isolate our society.

Nonetheless, while Design Education could be part of the problem, it is also a powerful driver for change. An educational environment is where people get exposed to new knowledge and where their ideas are confronted and mature. At higher education institutions, future professionals define their intellectual roots that will shape their career and ethos. Design is a critical profession that shapes the world of tomorrow. This emphasises the importance of Design Education, leading the path to a paradigm transition. The inclusion of Social Impact and Sustainability as core elements in Design Education is paramount to fostering tomorrow's designers.

The complex challenges faced by society are a rich source of Design opportunities that can and must be tackled inside the academic environment. There have been successful endeavours of such nature in individual practices of professors that already understood the need for change. Likewise, the educational market has witnessed a growing offer of courses by non-formal institutions and at graduate levels, such as master's degrees. However, the undergraduate level, where the students' mindset is potentialized, still struggles to respond and change. Active learning methodologies, such as problem-based learning combined with

Design Thinking can help shape the designers that will propose a solution to the many problems that ravage our community and planet.

However, adopting the PBL approach itself does not automatically grant the desired mindset for future designers. First, Design educators must understand the competencies they need to foster in their pupils. We have dedicated most of this research's time in identifying and understanding the set of competencies necessary for the designers to become agents of change. While education struggles to adapt faster, we hope to contribute to the process by providing a clear picture of future designers' competencies and point to tools and methods that lecturers and professors must address.

This research's main contribution lies in introducing a new Design Competencies Framework; a comprehensive model built to facilitate the development of competencies crucial to designers to become agents of change and complex problem solvers. Based on three principles: Equality, autonomy and openness, Design Competencies Framework presents the foundations for professors to find their way to work best with the proposed model. Its structure is divided into three dimensions, namely Areas, Competencies and Enablers. The areas congregate a group Competencies by affinity and goals: *Build Resilience*, *Propose Solutions* and *Understand Consequences*. At the third level live the *Enablers*, which are Design tools, methods, and techniques to develop the Design Competencies showcased in the framework.

The Design Competencies Framework provides a clear connection between the competencies that future designers should acquire to become agents of change towards a more sustainable world and the means to develop them. Such connection is crucial for Design educators to easily integrate the framework in their practice while addressing real complex problems in the classroom.

We believe that this research's value is underpinned by its potential to support transformation in Design Education. Nevertheless, without the adoption of our findings, the impact on the future of Design is reduced. We genuinely hope that this research, its outcomes, and data will become a valuable resource for educators committed to transitioning Design Education and, consequently, Design to a leadership position towards a better and more sustainable future for all.

Bibliography

- Acumen Academy. (n.d.). *Our Story*. Retrieved August 6, 2020, from <https://www.acumenacademy.org/our-story>
- AIGA. (n.d.). *What is Design?* Retrieved August 3, 2020, from <https://www.aiga.org/what-is-design>
- AIGA. (2017). AIGA Designer 2025: Why design education should pay attention to trends. *AIGA Design Educators Community*. <https://educators.aiga.org/wp-content/uploads/2017/08/DESIGNER-2025-SUMMARY.pdf>
- Ajzen, I. (2005). *Attitudes, Personality and Behavior* (2nd ed.). Open University Press. <https://doi.org/10.1037/e418632008-001>
- Akama, Y., Ivanka, T., Duque, M., Sanin, J., Jacob, V., Akama, Y., Ivanka, T., Duque, M., & Sanin, J. (2014). *Designing future designers: a propositional framework for teaching sustainability*. https://www.academia.edu/12680043/Designing_future_designers_a_propositional_framework_for_teaching_sustainability
- Alemanno, A. (2018). How to Counter Fake News? A Taxonomy of Anti-fake News Approaches. *European Journal of Risk Regulation*, 9(1), 1–5. <https://doi.org/10.1017/err.2018.12>
- Alt, L., & Pinheiro, T. (2011). *Design thinking Brasil: empatia, colaboração e experimentação para pessoas, negócios e sociedade* (1st ed.). Elsevier Brasil.
- Amsterdam University of Applied Sciences. (n.d.). *Design Method Toolkit*. Retrieved February 15, 2019, from <https://toolkits.dss.cloud/design/>
- Armstrong, L., Bailey, J., Julier, G., & Kimbell, L. (2014). *Social Design Futures: HEI Research and the AHRC*. 85.
- Assadourian, E. (2017). EarthEd: Rethinking Education on a Changing Planet. In E. Assadourian & L. Mastny (Eds.), *EarthEd: Rethinking Education on a Changing Planet* (1st ed.). Island Press.
- Bacigalupo, M., Kampylis, P., Punie, Y., & Brande, L. Van den. (2016). *EntreComp: The Entrepreneurship Competence Framework*. <https://doi.org/10.2791/593884>
- Baerten, N. (2013). Seven reflections of Design for Social Innovation: Students and a

- Neighborhood. In E. Manzini & E. Staszowski (Eds.), *Public and Collaborative: Exploring the intersection of Design, Social Innovation and Public Policy* (pp. 39–50). DESIS Network.
- Ball, J. (2019). *The Double Diamond: A universally accepted depiction of the design process*. Design Council Website.
- Barnes, V., & Preez, V. du. (2015). Mapping Empathy and Ethics in the Design Process. In A. Breytenbach & K. A. Chmela-Jones (Eds.), *Ethics and accountability in Design: Do they matter? - DEFSA Conference Proceedings* (pp. 1–11). Design Education Forum of Southern Africa.
https://www.academia.edu/19538158/Mapping_Empathy_and_Ethics_in_the_Design_Process?email_work_card=title
- Bender, W. N. (2014). *Aprendizagem baseada em projetos: educação diferenciada para o século XXI* (1st ed.). Penso.
- Berman, D. B. (2009). *Do Good Design: How Designers Can Change the World*. New Riders in association with aiga Design Press.
- Bernarda, J. G., & Ferreira, A. M. (2016). Collaborative design methodologies empowers resilience of communities. In E. Duarte, C. Duarte, & F. Carvalho Rodrigues (Eds.), *Design Doctoral Conference'16: TRANSversality - Proceedings of the DDC 3rd Conference* (pp. 136–143). UNIDCOM/IADE. <http://unidcom.iade.pt/ddc16/wp-content/uploads/2016/07/Proceedings-e-Book.pdf>
- Bhamra, T., & Lofthouse, V. (2008). *Design for Sustainability: A Practical Approach* (1st ed.). Routledge.
- Bonwell, C. C., & Eison, J. a. (1991). Active Learning : Creating Excitement in the Classroom. *Learning*, 80819(719), 1–6. <https://doi.org/ED340272>
- Brown, T. (2009). *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation*. HarperCollins. <https://books.google.pt/books?id=x7PjWyVUoVAC>
- Buchanan, R. (1992). Wicked Problems in Design Thinking. *Design Issues*, 8(6), 5–21.
<https://doi.org/10.2307/1511637>
- Camocho, D., Ferreira, A. M., & Vicente, J. (2018). TRANSition to circular and sustainable economy through design. *Design Doctoral Conference '18*, 31–37.
- Camocho, D. G., Vicente, J., & Ferreira, A. M. (2020). Circular and Sustainable Design: A systemic design model for the transition to a circular and sustainable economy. *DISCERN: International Journal of Design for Social Change, Sustainable Innovation and Entrepreneurship*, 1(1 SE-), 1–11.
<https://www.designforsocialchange.org/journal/index.php/DISCERN-J/article/view/33>
- Cardoso, R. (2012). *Design para um mundo complexo* (1st ed.). Cosac Naify.
- Cato, M. S. (2009). Green Economics: An Introduction to Theory, Policy and Practice. In *Green Economics*. Earthscan.

- Caulier-grice, J., Mulgan, G., & Murray, R. (2010). *The open book of social innovations. Social innovator series: ways to design, develop and grow social innovations* (Vol. 30, Issue 8). The Young Foundation and NESTA. <https://doi.org/10.1371/journal.pcbi.0030166>
- Chapman, J., & Gant, N. (Eds.). (2007). *Designers, Visionaries and Other Stories: A Collection of Sustainable Design Essays*. Earthscan.
- Chevallier, A. (2016). *Strategic Thinking in Complex Problem Solving*. Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780190463908.001.0001>
- Chochinov, A. (2007). *1000 Words: A Manifesto for Sustainability in Design*. <https://www.core77.com/posts/40586>
- Coursera. (n.d.). *About Coursera*. Retrieved August 6, 2020, from <https://about.coursera.org/>
- Couto, R. M. de S. (2008). *Escritos sobre ensino de Design no Brasil* (1st ed.). Rio Books.
- Creative Commons. (n.d.). *About The Licenses*. Retrieved August 27, 2020, from <https://creativecommons.org/licenses/>
- Creswell, J. W. (2009). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (3rd ed.).
- Creswell, J. W., & Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches* (5th ed.). SAGE.
- Cross, N. (1982). Designerly Ways of Knowing : Design Discipline. *Design Studies*, 3(4), 221–227. https://larossa.co/cross_1982_designerlywaysofknowing.pdf
- Cross, N. (2011). *Design Thinking: Understanding How Designers Think and Work*. Berg Publishers.
- d.school. (n.d.). *About — Stanford d.school*. Retrieved September 14, 2020, from <https://dschool.stanford.edu/about>
- Dam, R. F., & Siang, T. Y. (2018). *Design Thinking: Getting Started with Empathy*. Interaction Design Foundation.
- Danish Ministry of Science Technology and Innovation. (2005). *A Framework for Qualifications of the European Higher Education Area*. Danish Ministry of Science, Technology and Innovation. [https://doi.org/ISBN 87-91469-53-8](https://doi.org/ISBN%2087-91469-53-8)
- Davis, M. (2018a). *Trend 1: Complex Problems*. Design Futures. <https://www.aiga.org/aiga-design-futures/complex-problems/>
- Davis, M. (2018b). *Trend 4: Core Values Matter*. Design Futures. <https://www.aiga.org/aiga-design-futures/core-values-matter/>
- Dawson, J., & Oliveira, H. (2017). Bringing the Classroom Back to Life. In E. Assadourian & L. Mastny (Eds.), *EarthEd: Rethinking Education on a Changing Planet* (1st ed.). Island Press.
- Deiglmeier, K., Miller, D. T., & Phills, J. (2008). Rediscovering social innovation. *Stanford Social Innovation Review, Fall*, 34–43. <https://doi.org/10.1111/j.1369-7625.2010.00656.x>

- Delors, J., Al-Mufti, I., Amagi, I., Carneiro, R., Chung, F., Geremek, B., Gorham, W., Kornhauser, A., Manley, M., Quero, M. P., Savané, M.-A., Singh, K., Stavenhagen, R., Suhr, M. W., & Nanzhao, Z. (1996). *Learning: The Treasure within: Report to UNESCO of the International Commission on Education for the Twenty-First Century*. UNESCO Publishing.
- Design Council. (2015a). *Design Methods Step 2: Define*. Design Council Website. <https://www.designcouncil.org.uk/news-opinion/design-methods-step-2-define>
- Design Council. (2015b). *What is the framework for innovation? Design Council's evolved Double Diamond*. <https://www.designcouncil.org.uk/news-opinion/what-framework-innovation-design-councils-evolved-double-diamond>
- Design for Europe. (2016). *Designing for public services: a practical guide by Nesta & IDEO*. <http://designforeurope.eu/news-opinion/designing-public-services-practical-guide-nesta-ideo>
- DESIS Network. (2013). *Public & Collaborative: Exploring the Intersection of Design, Social Innovation and Public Policy* (E. Manzini & E. Staszowski (Eds.)).
- Doorley, S., Holcomb, S., Klebahn, P., Segovia, K., & Utley, J. (2018). *Design Thinking Bootleg*. Hasso Plattner Institute of Design. <https://dschool.stanford.edu/resources/design-thinking-bootleg>
- Draganidis, F., Chamopoulou, P., & Mentzas, G. (2006). An Ontology Based Tool for Competency Management and Learning Paths. *Proc of IKNOW'06*, 06(6), 1–10. <https://doi.org/10.1.1.85.6716>
- Dubberly, H. (2014). A Systems Literacy Manifesto. *RSD3 2014 Symposium — Relating Systems Thinking and Design, October*, 6. http://www.dubberly.com/wp-content/uploads/2016/02/systems_literacy.pdf
- Dunne, A., & Raby, F. (2013). *Speculative everything: design, fiction, and social dreaming*. MIT Press.
- Earnest, J., & Melo, F. F. E. de. (2001). Competency-bases engeneering curricula – an innovative approach. *International Conference on Engineering Education*. <https://doi.org/10.1097/NCQ.0b013e3181f63845>
- Ellen MacArthur Foundation. (n.d.). *What is Circular Economy?* Retrieved August 7, 2020, from <https://www.ellenmacarthurfoundation.org/circular-economy/what-is-the-circular-economy>
- Epstein, M. J., & Yuthas, K. (2014). *Measuring and Improving Social Impacts: A Guide for Nonprofits, Companies and Impact Investors*. Berrett-Koehler Publishers.
- Ertmer, P. A., & Glazewski, K. D. (2016). Essentials for PBL implementation: Fostering collaboration, transforming roles, and scaffolding learning. In A. Walker, H. Leary, C. E. Hmelo-Silver, & P. A. Ertmer (Eds.), *Essential readings in problem-based learning* (Issue January, pp. 89–106). Purdue University Press. https://www.researchgate.net/publication/290445020_Essentials_for_PBL_Implementation_Fostering_Collaboration_Transforming_Roles_and_Scaffolding_Learning?enrichId=rgreq-4890f1a54ac4f5ed851048024ea2229b-

XXX&enrichSource=Y292ZXJQYWdlOzI5MDQ0NTAyMDtBUzozMTgxN

- European Consortium for Accreditation. (2014). *Higher education in Europe*.
http://ecahe.eu/w/index.php/Higher_education_in_Europe
- Fenn, T., & Hobbs, J. (2015). Wicked ethics in Design. *Ethics and Accountability in Design: Do They Matter?* - DEFSA Conference Proceedings2, 127–135.
- Ferreira, A. M. (2003, August). Design e Inovação: Valores para o século XXI. *Revista de Arte, Ciência e Cultura Do IADE Instituto de Artes Visuais, Design e Marketing*.
- Ferreira, A. M. (2005). Quantificação da Inovação no Processo Evolucionário do Design. *Idade Da Imagem, Revista de Arte, Ciência e Cultura Do IADE, Ano IV, 3*(Maio/Agosto), 24–34.
- Ferreira, A. M. (2008a). *Caracterização e Quantificação da Inovação no Processo Evolucionista do Design: Análise de um Século da Prática Médico-Cirúrgica em Portugal*. Universidade da Beira Interior.
- Ferreira, A. M. (2008b). *Evolução do Conceito e da Prática do Design*. Universidade da Beira Interior.
- Ferreira, A. M. (2020a). *Relatório sobre proposta de criação de curso de “Mestrado em Design e Inovação Sustentável”, documento elaborado para a obtenção do título de Agregado em Design*. IADE - Universidade Europeia.
- Ferreira, A. M. (2020b). *Sumário pormenorizado da Lição intitulada “Design e Inovação Sustentável: modelo de Ensino/Aprendizagem ReACt – Research, Act and Change”, documento elaborado para a obtenção do título de Agregado em Design*. IADE - Universidade Europeia.
- Ferreira, A. M., & Sabino, A. (2020). Empreendedorismo Social, Desenvolvimento Sustentável e Universidades: o caso de estudo ‘Figueira memory’. In R. Soares, L. Pimentel, & A. Sabino (Eds.), *O Livro do Empreendedorismo - Guia teórico-prático para criar um negócio de sucesso* (pp. 37–51). Actual Editora.
- Ferreira, A. M., Savva, S., & Souleles, N. (2020). *Future Trends in Education for a More Sustainable Human Systems Design: The CREATION Project* (p. 6).
- Ferreira, A. M., Souleles, N., & Savva, S. (2020). Social Design, Innovation and Ergonomics: Reflections on Education, Transdisciplinarity and New Blurred Models for Sustainable Social Change. In R. H. M. Goossens & A. Murata (Eds.), *Advances in Social and Occupational Ergonomics* (pp. 37–48). Springer International Publishing.
- Ferreira, A. M., Souleles, N., & Savva, S. (2019). Upscaling Local and National Experiences on Education for Social Design and Sustainability for All to a Wider International Arena : Considerations and Challenges. *The Learning Network on SustainabilityMi*, 1–4.
- Findeli, A. (2001). Rethinking Design Education for the 21st Century: Theoretical, Methodological, and Ethical Discussion. *Design Issues*, 17(1), 5–17.
<https://doi.org/10.1162/07479360152103796>
- Fink, A. (2014). *Conducting Research Literature Reviews: From the Internet to Paper* (4th ed.).
<https://doi.org/10.1002/nha3.10270>

- Folha de São Paulo. (2019). *Ranking de universidades Folha 2019*.
<https://ruf.folha.uol.com.br/2019/ranking-de-universidades/principal/>
- Franqueira, T., & Gomes, G. (2017). Design for social innovation supported by social based technologies. *International Conference on Distributed, Ambient, and Pervasive Interactions, 10291 LNCS*, 45–60. https://doi.org/10.1007/978-3-319-58697-7_4
- Franqueira, T., Gomes, G., & Gonçalves, S. (2012). Participatory Design in Public Services: Strategies to enhance children's healthier behaviours. *Cumulus Helsinki Conference 2012*.
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.475.6658&rep=rep1&type=pdf>
- Franqueira, T., & Sampaio, J. N. (2015). Design Workshops for Social Innovation. In J. A. de Souza & G. A. Dandolini (Eds.), *IV International Conference on Design, Engineering, Management for innovation - IDEMi 2015* (pp. 53–68).
- Freach, J. (2019). *Behold and Beware, Design Toolkits*. School of Design and Creative Technologies - The University of Texas at Austin.
<https://designcreativetech.utexas.edu/hold-and-beware-design-toolkits>
- Freitas, S. F. de. (1999). A influência de tradições acríicas no processo de estruturação do ensino/pesquisa de design. In *Design*. UFRJ.
- Frensch, P. A., & Funke, J. (Eds.). (2014). *Complex Problem Solving: The European Perspective*. Psychology Press.
- Frog Design. (n.d.). *Collective Action Toolkit*. Frog Design. Retrieved January 17, 2020, from frogdesign.com/cat
- Fry, T. (2009). *Design futuring: sustainability, ethics, and new practice*. Berg.
- Fuad-Luke, A. (2007). Re-defining the Purpose of (Sustainable) Design: Enter the Design Enablers, Catalysts in Co-design. In J. Chapman & N. Gant (Eds.), *Designers, Visionaries and Other Stories: A Collection of Sustainable Design Essays* (pp. 18–55). Earthscan.
- Fuad-Luke, A. (2009). Design Activism: beautiful strangeness for a sustainable world. In *Design Activism: Beautiful Strangeness for a Sustainable World*. Earthscan.
<https://doi.org/10.4324/9781849770941>
- Funke, J. (2012). Complex Problem Solving. In N. M. Seel (Ed.), *Open Learning Environments* (pp. 682–685). Springer. https://doi.org/10.1007/978-1-4419-1428-6_685
- Funke, J. (2019). Problem Solving. In R. J. Sternberg & J. Funke (Eds.), *The Psychology of Human Thought: An Introduction* (1st ed., pp. 155–176). Heidelberg University Publishing.
<https://doi.org/https://doi.org/10.17885/heup.470.c6672>
- Furniss, L. (2015). *Beyond Discipline: Design Practice and Design Education in the 21st Century*.
http://thead.ac.uk/wp-content/uploads/2015/11/BeyondDiscipline_web1.pdf
- Gardiner, E. (2014). *It's time to experiment with social impact*. Design Council.
<https://www.designcouncil.org.uk/news-opinion/it-s-time-experiment-social-impact>

- Hartikainen, S., Rintala, H., Pylväs, L., & Nokelainen, P. (2019). The concept of active learning and the measurement of learning outcomes: A review of research in engineering higher education. *Education Sciences*, 9(4), 9–12. <https://doi.org/10.3390/educsci9040276>
- Heimlich, J. E., & Ardoin, N. M. (2008). Understanding behavior to understand behavior change: a literature review. *Environmental Education Research*, 14(3), 215–237. <https://doi.org/10.1080/13504620802148881>
- Heller, C. (2014). *The Social Innovation Revolution*. Print Magazine. <https://www.printmag.com/post/cheryl-heller-social-innovation-revolution>
- Howard, Z. (2015). *Understanding design thinking in practice: A qualitative study of design led professionals working with large organisations* [Swinburne University of Technology]. <https://zaanahoward.com/writing-and-speaking/phd/>
- ideo.org. (n.d.-a). *ideo.org*. Retrieved January 19, 2020, from <https://www.ideo.org/>
- ideo.org. (n.d.-b). *One Million Stories of Impact: Celebrating the impact of problem solvers who have harnessed the power of Design Kit's tools*. Retrieved August 6, 2020, from <https://www.ideo.org/perspective/one-million-stories-of-impact>
- IDEO.org. (2015). *The field guide to human-centered design : design kit*. IDEO. <https://www.designkit.org/resources/1>
- IDEO, & Ellen MacArthur Foundation. (n.d.). *The Circular Design Guide*. Retrieved August 6, 2020, from <https://www.circulardesignguide.com/>
- Instituto Federal Fluminense. (2016). *Informações e documentos sobre o Programa de Bolsa Permanência*.
- Jackson, C. (n.d.). *What is planet-centric design?* Retrieved June 25, 2020, from <https://www.wecreatefutures.com/blog/what-is-planet-centric-design>
- Jeffcott, C., & Ferreira, A. M. (2021). Characterising Futuring Strategies for Biodiverse Speculative Design and Systems Design. In W. Karwowski, T. Ahram, D. Etinger, N. Tanković, & R. Taiar (Eds.), *Human Systems Engineering and Design III: Proceedings of the 3rd International Conference on Human Systems Engineering and Design (IHSED2020): Future Trends and Applications, September 22-24, 2020, Juraj Dobrila University of Pula, Croatia* (pp. 277–282). Springer. https://doi.org/10.1007/978-3-030-58282-1_44
- Jonassen, D. H. (2011). *Learning to Solve Problems: A Handbook for Designing Problem-Solving Learning Environments*. Routledge.
- Jones, P. (2017). The Systemic Turn: Leverage for World Changing. *She Ji: The Journal of Design, Economics, and Innovation*, 3(3), 157–163. <https://doi.org/https://doi.org/10.1016/j.sheji.2017.11.001>
- Julier, G. (2013). Design Culture. In *The Culture of Design* (3rd ed.). SAGE. https://uk.sagepub.com/sites/default/files/upm-assets/66158_book_item_66158.pdf
- Kemmis, S., McTaggart, R., & Nixon, R. (2014). *The Action Research Planner*. Springer. <https://doi.org/10.1007/978-981-4560-67-2>

- Kershaw, A., Dahl, S., & Roberts, I. (2016). *Designing for Public Services* (I. Roberts (Ed.)). IDEO, Nesta, Design for Europe. [http://files/198/Design Thinking for Public Service Excellence.pdf](http://files/198/Design%20Thinking%20for%20Public%20Service%20Excellence.pdf)[http://files/200/Design Thinking for Public Service Excellence.pdf](http://files/200/Design%20Thinking%20for%20Public%20Service%20Excellence.pdf)<http://www.nesta.org.uk/event/labworks-2015-global-lab-gathering-london><http://5a5f89b8e10a225a44ac-ccbed124c38c4f7>
- Kim, K. H., & Pierce, R. A. (2013). Convergent Versus Divergent Thinking. In E. G. Carayannis (Ed.), *Encyclopedia of Creativity, Invention, Innovation and Entrepreneurship* (pp. 245–250). Springer New York. https://doi.org/10.1007/978-1-4614-3858-8_22
- Kindon, S., Pain, R., & Kesby, M. (2007). Participatory Action Research: Origins, approaches and methods. In S. Kindon, R. Pain, & M. Kesby (Eds.), *Participatory Action Research Approaches and Methods: Connecting people, participation and place* (pp. 9–19). Routledge.
- Koskinen, I., Zimmerman, J., Binder, T., Redstrom, J., & Wensveen, S. (2011). *Design Research Through Practice* (1st ed.). Morgan Kaufmann.
- Kuang, C., & Fabricant, R. (2019). *User Friendly: How the Hidden Rules of Design Are Changing the Way We Live, Work, and Play*. Farrar, Straus and Giroux. <https://books.google.pt/books?id=orVuDwAAQBAJ>
- Lasky, J. (2013). Design and Social Impact: A Cross-Sectoral Agenda for Design Education, Research, and Practice. In *Design and Culture* (Vol. 7, Issue 1). The Smithsonian's Cooper-Hewitt, National Design Museum, in conjunction with the National Endowment for the Arts and The Lemelson Foundation. <https://doi.org/10.2752/175470715x14153615623880>
- Lawson, B. (2005). How designers think: The design process demystified. In *Design Studies* (4th ed.). Elsevier.
- Leavy, P. (2017). *Research Design: Quantitative, Qualitative, Mixed Methods, Arts-Based, and Community-Based Participatory Research Approaches*. The Guilford Press.
- Leite, J. de S. (2006). Tudo pelo social: o debate sobre mercado e sociedade na educação de design. In *Design Método* (1st ed., p. 184). Novas Idéias.
- Leopold, T. A., Ratcheva, V., & Zahidi, S. (2016). *The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution*. <https://doi.org/10.23943/princeton/9780691172811.003.0009>
- Leopold, T. A., Ratcheva, V., & Zahidi, S. (2018). *The Future of Jobs Report 2018*. http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf
- Littlejohn, D., & Davis, M. (2019). *Accountability for anticipating design outcomes*. Core 77. https://www.researchgate.net/publication/335501721_ACCOUNTABILITY_FOR_ANTICIPATING_DESIGN_OUTCOMES
- Loewe, S. (2019). Toward a Critical Design Thinking : Propositions to Rewrite the Design Thinking Process. *Dialectic*, 2(2), 1–19. <https://doi.org/http://dx.doi.org/10.3998/dialectic.14932326.0002.208>

- Lubart, T., & Thornhill-Miller, B. (2017). Creativity: An Overview of the 7C's of Creative Thought. In R. J. Sternberg & J. Funke (Eds.), *Psychology of Human Thought* (1st ed., pp. 277–305). Heidelberg University Publishing.
<https://doi.org/10.17885/heiup.470.c6678>
- Machi, L. A., & McEvoy, B. T. (2016). *The Literature Review: Six Steps to Success* (3rd ed.). Corwin.
- Manzini, E. (2007). The Scenario of a Multi-local Society: Creative Communities, Active Networks and Enabling Solutions. In J. Chapman & N. Gant (Eds.), *Designers, Visionaries and Other Stories: A Collection of Sustainable Design Essays* (pp. 76–95). Earthscan.
- Manzini, E. (2011). Design school as agents of (sustainable) change: a design labs network for an open design program. In *Researching design education: 1st symposium for design education researchers* (pp. 9–16). CUMULUS Association.
- Manzini, E. (2014). Making Things Happen: Social Innovation and Design. *Design Issues*, 30(1), 57–66. https://doi.org/https://doi.org/10.1162/DESI_a_00248
- Manzini, E. (2015). Social innovation and design – Enabling, replicating and synergizing. In P. Stebbing & U. Tischner (Eds.), *Changing - Paradigms: Designing for a Sustainable -Future* (pp. 328–337). Cumulus Think Tank.
<http://www.cumulusassociation.org/category/academics/special-publications/>
- Manzini, E., & Coad, R. (2015a). *Design, When Everybody Designs: An Introduction to Design for Social Innovation*. MIT Press. <http://www.jstor.org/stable/j.ctt17kk7sv>
- Manzini, E., & Coad, R. (2015b). *Design, When Everybody Designs*. MIT Press.
- Manzini, E., & Jégou, F. (2003). *Sustainable Everyday: Scenarios of Everyday Life*. Edizioni Ambiente.
- Margolin, V. (2014). *Design e risco de mudança* (1st ed.). Verso da História, ESAD.
- Marques, S. K. (2019). *Sustainable ID: New paradigm of interior design and sustainable makeover scenarios for temporary accomodation establishment*. Universidade de Lisboa.
- Martin, R. (2009). Transforming the Corporation: The Design of Procter & Gamble - How Design Thinking Turned the Business Around. In *The Design of Business: Why Design Thinking Is the Next Competitive Advantage* (p. 30). Harvard Business Publishing.
- Martin Stuchtey. (2019). *How Things Look Today*. Ellen MacArthur Foundation.
<https://www.youtube.com/watch?v=SCs5BoZwcZk&feature=youtu.be>
- Mau, B., & Institute Without Boundaries. (2004). *Massive Change*. Phaidon.
- Mcaloone, T. C., & Andreasen, M. M. (2002). Defining Product Service Systems. *Design for X Beitrage Zum 13*, 13(3), 51–60. <https://doi.org/10.1162/074793602320223253>
- McDonough, W., & Braungart, M. (2002). *Cradle to cradle: Remaking the way we make things* (1st ed.). North Point Press.

- McMahon, M., & Bhamra, T. (2016). Mapping the journey : visualising collaborative experiences for sustainable design education. *Internal Journal of Technology and Design Education*, 27(4), 595–609. [https://dspace.lboro.ac.uk/dspace-jspui/bitstream/2134/20778/3/Mapping the Journey revised Feb16.pdf](https://dspace.lboro.ac.uk/dspace-jspui/bitstream/2134/20778/3/Mapping%20the%20Journey%20revised%20Feb16.pdf)
- Meadows, D. H. (2009). *Thinking in Systems* (D. Wright (Ed.)). Earthscan.
- Melles, G. (2008). New pragmatism and the vocabulary and metaphors of scholarly design research. *Design Issues*, 24(4), 88–101. <https://doi.org/10.1162/desi.2008.24.4.88>
- Moreira, M. (2015). Distinct Approaches To Design Education : Preparing Future Designers for an Amplified Practice of Design. *Nordes 2015: Design Ecologies*, 6(6), 1–6. <https://doi.org/10.13140/RG.2.1.5168.9440>
- Moreira, M. (2019). Making design education (even more) complex : exploring complexity for an amplified mindset of design. *International Journal of Art and Design Education*, September, 1–26. <https://doi.org/10.1111/jade.12266>.
- Morgan, D. L. (2007). Paradigms Lost and Pragmatism Regained: Methodological Implications of Combining Qualitative and Quantitative Methods. *Journal of Mixed Methods Research*, 1(1), 48–76. <https://doi.org/10.1177/2345678906292462>
- Mulgan, G., Tucker, S., Ali, R., & Sanders, B. (2007). *Social Innovation: What It Is, Why It Matters and How It Can Be Accelerated*.
- Muratovski, G. (2015). *Research for Designers: A Guide to Methods and Practice*. SAGE Publications.
- Musa, F., Mufti, N., Latiff, R. A., & Amin, M. M. (2012). Project-based Learning (PjBL): Inculcating Soft Skills in 21st Century Workplace. *Procedia - Social and Behavioral Sciences*, 59(2006), 565–573. <https://doi.org/10.1016/j.sbspro.2012.09.315>
- NASAD. (2020). Specific Professional Baccalaureate Degrees in Design. In *NASAD Handbook 2019-20* (pp. 118–129). National Association of Schools of Art and Design. <https://nasad.arts-accredit.org/wp-content/uploads/sites/3/2019/12/NASAD-Handbook-2019-20.pdf>
- Nora Fleming. (2018, September 19). *Designing a Public School From Scratch* | Edutopia. Edutopia Website. <https://www.edutopia.org/article/designing-public-school-scratch>
- Norman, D. (2009). *The Design of Future Things*. Basic Books.
- Norman, D. (2010). *Why Design Education Must Change*. <http://www.core77.com/posts/17993/why-design-education-must-change-17993>
- Norman, D. (2011). *Living with Complexity*. MIT Press.
- Norman, D. (2019). *Why I Don't Believe in Empathic Design*. Xd Ideas. <https://xd.adobe.com/ideas/perspectives/leadership-insights/why-i-dont-believe-in-empathic-design-don-norman/>
- Normoyle, C. (2019). A Blended Perspective : Social Impact Assessment in Graphic Design. *Dialectic*, 2(2), 1–23.

- <https://doi.org/http://dx.doi.org/10.3998/dialectic.14932326.0002.205>
- Nunes, V. G. A. (2017). Designing more responsible behaviours through Design Education: Reflections on a Brazilian pilot experience in Social Innovation for Sustainability. *The Design Journal*, 20(sup1), S1014–S1025.
<https://doi.org/10.1080/14606925.2017.1353045>
- NYC Opportunity. (n.d.). *Civic Service Design: Tools + Tactics*. Retrieved August 6, 2020, from <https://www1.nyc.gov/assets/servicedesign/>
- NYC Opportunity. (2017). *What is Civic Service Design?* <https://civicservicedesign.com/what-is-civic-service-design-9fd9deebef99>
- Oblo, & POLI.design. (2019). *Service Design Tools*. <https://servicedesigntools.org/tools>
- OECD. (2014). *PISA 2012 Results: Creative Problem Solving: Vol. V*.
<https://doi.org/http://dx.doi.org/10.1787/9789264208070-en>
- OECD. (2017). Benchmarking Higher Education System Performance: Conceptual framework and data. *OECD Internal Documents*, 97.
<http://www.oecd.org/education/skills-beyond-school/benchmarking-higher-education-systems-performance.htm>
- OECD. (2018). The Future of Education and Skills: Education 2030. In *OECD Education Working Papers* (p. 23). <https://doi.org/10.1111/j.1440-1827.2012.02814.x>
- Papanek, V. (1971). *Design for the Real World: Human Ecology and Social Change* (3rd ed.). Thames & Hudson Ltd.
- Pinheiro, C., Farinha, I., & Ferreira, A. M. (2017). Impact practices: Communication & Design Case studies. *Proceedings of the 9th International Conference Senses and Sensibility 2017*, 98–105.
- Plattner, H., Meinel, C., & Leifer, L. (Eds.). (2011). *Design Thinking: Understand – Improve – Apply*. Springer. <https://doi.org/10.1007/978-3-642-13757-0>
- Pollet, M. (2020, July). New study forecasts the EU’s population will plummet by millions more than expected. *Euronews*. <https://www.euronews.com/2020/07/31/new-study-forecasts-the-eu-s-population-will-plummet-by-millions-more-than-expected>
- Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education*, 93(3), 223–232. <https://doi.org/10.1002/j.2168-9830.2004.tb00809.x>
- Prior, S. D., Shen, S.-T., & Karamanoglu, M. (2007). The problems with design education in the UK. *International Association of Societies of Design Research*.
[http://www.sd.polyu.edu.hk/iasdr/proceeding/papers/the problems with design education in the uk.pdf](http://www.sd.polyu.edu.hk/iasdr/proceeding/papers/the%20problems%20with%20design%20education%20in%20the%20uk.pdf)
- Pryce, V., & Whitaker, B. (2011). Restarting Britain: Design education and growth. In *Design Commission*.
http://www.policyconnect.org.uk/apdig/sites/site_apdig/files/report/284/fieldreportdownload/design-commission-restarting-britain-design-education-and-growth.pdf

- Reed, B. (2007). Shifting from “sustainability” to regeneration. *Building Research and Information*, 35(6), 674–680. <https://doi.org/10.1080/09613210701475753>
- Ridley, D. (2012). *The Literature Review: A Step-by-Step Guide for Students* (2nd ed.). SAGE.
- Rocha, H., & Ferreira, A. M. (2019). Future Designers as Actors of Change: Exploring Design Education Scenarios focused on Social Innovation and Sustainability. *Convergências - Revista de Investigação e Ensino Das Artes*, VOL XII(24). <http://convergencias.esart.ipcb.pt/?p=article&id=364>
- Rocha, H., Ferreira, A. M., & de Azevedo, J. (2018a). Paradigm shift in Design Education: An overview on issues and possibilities for change. *Design Research Society 2018 - Catalyst*, 7, 12. <https://doi.org/10.21606/dma.2017.541>
- Rocha, H., Ferreira, A. M., & de Azevedo, J. (2018b). Benchmarking Higher Education in Design for Social Innovation and Sustainability: State of Art and future challenges. *Design Doctoral Conference '18*, 8.
- Rocha, H., Ferreira, A. M., & de Azevedo, J. (2019). Envisioning the Next Generation of Designers : In Emilia Duarte (Ed.), *Design Doctoral Conference'19: TRANSformation. Proceedings of the DDC 6th Conference*. EDIÇÕES IADE.
- Rocha, H., Ferreira, A. M., & de Azevedo, J. (2017). Paradigm shift in Design Education to drive Strategic Innovations, Sustainable Solutions and Social Change. *IADE Design Doctoral Conference'17*, 8.
- Rocha, H., Ferreira, A. M., Souleles, N., Farinha, I., & Pinheiro, C. (2017). *DISCERN PROJECT: Sensing Change in/by Design Education*.
- Russ, J. (2019). *Sustainability and Design Ethics* (2nd ed.). Taylor & Francis Group.
- Sambade, A., & Ferreira, A. M. (2017). Co-designing the Future : How Designers and Research Labs play an important role to Social Engagement and Sustainability. *Proceedings of the 9th International Conference Senses and Sensibility 2017*, 9.
- Sanders, E. B.-N. (2002). *From user-centered to participatory design approaches*. <https://doi.org/10.1201/9780203301302.ch1>
- Sanders, E. B.-N. (2013). Perspectives on Participation in Design. *Wer Gestaltet Die Gestaltung?* <https://doi.org/10.14361/transcript.9783839420386.65>
- Sanders, E. B.-N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *CoDesign*, 4(1), 5–18. <https://doi.org/10.1080/15710880701875068>
- Sanghi, S. (2007). *The handbook of competency mapping: understanding, designing and implementing competency models in organizations*. Response Books.
- Santos, V. A. M. (2018). *Quantificação da criatividade no processo de design: inovação e ideação de artefactos através dos processos analógico e digital*. IADE - Universidade Europeia.
- Saunders, M., & Bristow, A. (2019). Understanding research philosophy and approaches to theory development. In M. Saunders, P. Lewis, & A. Thornhill (Eds.), *Research methods for*

- business students* (8th ed., p. 46). Pearson Education Limited.
https://www.academia.edu/42304065/Research_Methods_for_Business_Students_Chapter_4_Understanding_research_philosophy_and_approaches_to_theory_development_-8th_edition
- Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (5th ed.). Pearson Education Limited.
[https://eclass.teicrete.gr/modules/document/file.php/DLH105/Research Methods for Business Students%2C 5th Edition.pdf](https://eclass.teicrete.gr/modules/document/file.php/DLH105/Research%20Methods%20for%20Business%20Students%205th%20Edition.pdf)
- Schumpeter, J. A. (1976). *Capitalism, Socialism and Democracy* (1st ed.). Routledge.
<https://doi.org/https://doi.org/10.4324/9780203202050>
- Shedroff, N. (2009). *Design Is the Problem: The Future of Design Must Be Sustainable*. Louis Rosenfeld.
- Silveira, F. (2016). Design & educação: novas abordagens. In *A revolução do design: Conexões para o século XXI* (1st ed.). Editora Gente.
- Souleles, N. (2017). Design for social change and design education: Social challenges versus teacher-centred pedagogies. *The Design Journal*, 20(sup1), S927–S936.
<https://doi.org/10.1080/14606925.2017.1353037>
- Souleles, N., Savva, S., & Ferreira, A. M. (2017). The challenge of embedding design for social change and innovation in Higher Education curricula and the role of DISCERN (DesIgn for Social Change and innovation through a EuRopean Network). *9th International Conference Senses and Sensibility 2017*.
- Spencer, L. M., & Spencer, S. M. (1993). *Competence at Work: Models for Superior Performance*. Japan Productivity Center. John Wiley & Sons, Inc.
- Spinuzzi, C. (2005). The Methodology of Participatory Design. *Technical Communication*, 52, 163–174.
- Stebbing, P. (2015). The paradigm shift in design. In P. Stebbing & U. Tischner (Eds.), *Changing - Paradigms: Designing for a Sustainable -Future* (Issue 1, p. 552). Cumulus Think Tank. <http://www.cumulusassociation.org/wp-content/uploads/2016/01/Changing-Paradigms-book-pdf-version-2016.pdf>
- Strobel, J., & van Barneveld, A. (2009). When is PBL More Effective? A Meta-synthesis of Meta-analyses Comparing PBL to Conventional Classrooms. *Interdisciplinary Journal of Problem-Based Learning*, 3(1). <https://doi.org/10.7771/1541-5015.1046>
- Design Thinking and Innovation at Apple, (2012).
- Tripathi, P. P., Ranjan, J., & Pandeya, T. (2010). PAKS : A Competency based model for an Academic Institutions . *International Journal of Innovation, Management and Technology*, 1(2). <http://www.ijimt.org/papers/40-M425.pdf>
- Tschimmel, K. C. (2010). *Sapiens e Demens no pensamento criativo do design* [Universidade de Aveiro]. <http://hdl.handle.net/10773/1270>

- UNESCO. (2015). Rethinking Education: Towards a global common good? In *UNESCO Publishing*.
<http://www.unesco.org/new/fileadmin/MULTIMEDIA/FIELD/Cairo/images/RethinkingEducation.pdf>
- UNESCO. (2017). *Education for Sustainable Development Goals: learning objectives*. United Nations Educational, Scientific and Cultural Organization - Educational Sector.
<https://unesdoc.unesco.org/ark:/48223/pf0000247444>
- UNESCO. (2020). *Embracing a culture of lifelong learning: contribution to the Futures of Education initiative*. UNESCO Institute for Lifelong Learning.
<https://unesdoc.unesco.org/ark:/48223/pf0000374112>
- United Nations. (n.d.). *Sustainable Development Goals*. Retrieved February 23, 2019, from
<https://sustainabledevelopment.un.org/sdgs>
- United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*.
<https://sustainabledevelopment.un.org/post2015/transformingourworld/publication>
- Universidade de Lisboa. (n.d.). *Design for Sustainability*. Retrieved August 5, 2020, from
<https://www.ulisboa.pt/en/curso/mestrado/design-sustainability>
- van Engelenburg, S., Janssen, M., & Klievink, B. (2019). Designing context-aware systems: A method for understanding and analysing context in practice. *Journal of Logical and Algebraic Methods in Programming*, 103, 79–104.
<https://doi.org/https://doi.org/10.1016/j.jlamp.2018.11.003>
- Vezzani, V., & Gonzaga, S. (2017). Design for Social Sustainability. An educational approach for insular communities. *The Design Journal*, 20(sup1), S937–S951.
<https://doi.org/10.1080/14606925.2017.1353038>
- Vezzoli, C., Indraprastha, A. S., Kohtala, C., Srinivasan, A., Diehl, J. C., Moi Fusakul, S., Xin, L., & Sateesh, D. (2014). *Product-Service System Design for Sustainability* (Issue March).
- Vezzoli, C., & Manzini, E. (2008). Design for Environmental Sustainability. In *Design for Environmental Sustainability*. <https://doi.org/10.1007/978-1-84800-163-3>
- Villalba, E. (2008). On Creativity: Towards an Understanding of Creativity and its Measurements. *JCR Scientific and Technical Reports*, 1–37. <https://doi.org/10.2788/2936>
- Vincit. (2019). *Planet Centric Design toolkit*. Vincit.
[https://cdn2.hubspot.net/hubfs/6362597/Oppaat EN/Planet Centric Design toolkit - 25.11.2019.pdf?__hstc=8133293.77e47c407eeb80d35f16a04e595f9c24.1611575775115.1611575775115.1611575775115.1&__hssc=8133293.1.1611575775118&__hsfp=3233813646&hsCtaTracking=8251](https://cdn2.hubspot.net/hubfs/6362597/Oppaat%20EN/Planet%20Centric%20Design%20toolkit%20-%2025.11.2019.pdf?__hstc=8133293.77e47c407eeb80d35f16a04e595f9c24.1611575775115.1611575775115.1611575775115.1&__hssc=8133293.1.1611575775118&__hsfp=3233813646&hsCtaTracking=8251)
- Vuorikari, R., Punie, Y., Carretero, S., & Brande, L. Van den. (2016). *DigComp 2.0: The Digital Competence Framework for Citizens. Update Phase 1: The Conceptual Reference Model*.
<https://doi.org/10.2791/11517>
- WDO. (2021). *Defining Design Activism with Teresa Franqueira*. World Design Organization

Website. <https://wdo.org/defining-design-activism-with-teresa-franqueira/>

Yoo, Y., & Kim, K. (2015). How Samsung Became a Design Powerhouse. *Harvard Business Review*, 8.

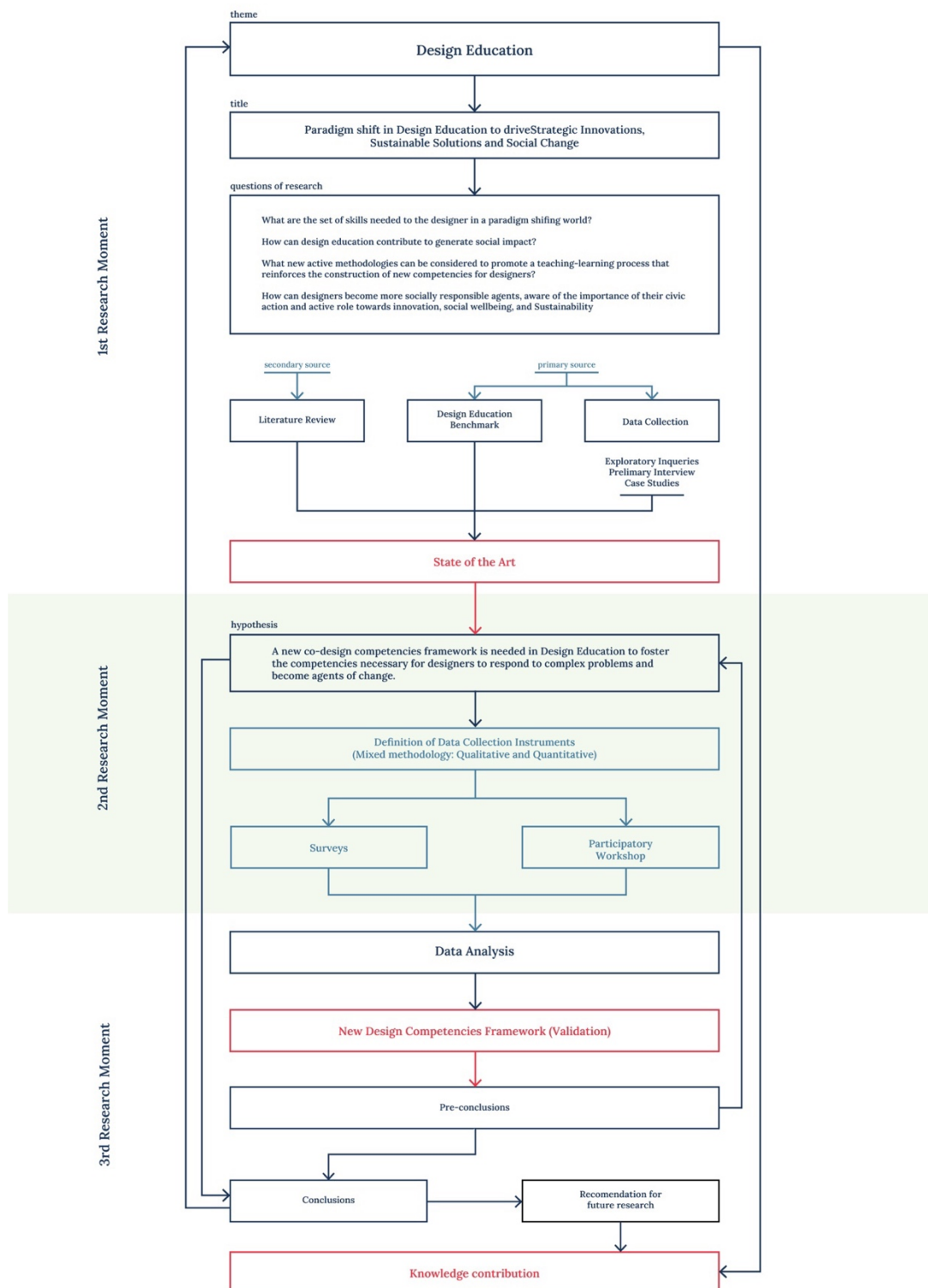
Appendices

Appendix 1: The Design Competency Framework

To access the Design Competency Framework, scan the QR Code below or access the following link: <https://bit.ly/DesignCompetenciesFramework>



Appendix 2: Research Design



Appendix 3: Instrument Q1

QUESTINÁRIO	
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Olá, tudo bom?

Gostaria de saber sua opinião sobre o Ensino do Design no IFF. Para isso, agradeço sua resposta honesta a um conjunto de breve de questões. Lembre-se que não há uma resposta certa ou errada e que o questionário é anônimo.

Curso: _____ Ano _____

Gênero: ☐ Feminino ☐ Masculino

1. Durante curso, já participou em algum projeto de caráter social?

☐ Sim ☐ Não

2. Acredita que os projetos desenvolvidos por você tem impacto na sociedade?

☐ Sim ☐ Não

3. Algum dos projetos desenvolvidos partiram de necessidades reais da sociedade?

☐ Sim ☐ Não

4. Sobre o Ensino de Design e a cultura projetual promovida no IFF, considera adequada a situação de crise em que o mundo se encontra?

☐ Sim ☐ Não

5. Você acredita que o designer, em sua atividade profissional, tem influência na mudança da sociedade?

☐ Sim ☐ Não

6. A formação em Design oferecida no IFF abrange um pensamento voltado para a Sustentabilidade e Responsabilidade Social?

☐ Sim ☐ Não

7. O tema específico da sustentabilidade é abordado pelos professores nas disciplinas do curso?

☐ Sim ☐ Não

a) Com que frequência?

☐ nunca ☐ quase nunca ☐ às vezes ☐ quase sempre ☐ sempre

b) Em que contexto, disciplina, ou situação? Dê exemplos.

--

Appendix 4: Instrument Q2

Pesquisa sobre Ensino do Design e seu impacto na inovação social e sustentabilidade

*Obrigatório

E-mail *

Seu e-mail

Propósito do Estudo

O propósito desta pesquisa é o de perceber o papel do design na sociedade hoje e como o ensino do design é visto neste contexto. O estudo faz parte do processo de Doutorado em Design do aluno Hugo Rocha.

Como preencher o questionário?

Este é um questionário online. Lhe será solicitada a resposta a 12 questões e deverá levar 5-10 minutos a responder.

Confidencialidade e Direitos dos Participantes

Todas as informações reunidas serão mantidas confidenciais de acordo com a Lei. Todas as respostas serão tratadas de forma anônima. A participação é totalmente voluntária e é possível desistir do questionário em qualquer ponto do seu preenchimento. Os resultados deste estudo poderão ser publicados e/ou partilhados com partes interessadas, como instituições de pesquisa. No entanto, não será identificado. Não existem riscos ou desconfortos associados à resposta a este questionário. Não haverá compensações e/ou benefícios diretos pela sua participação no estudo mas ficaremos muito agradecidos pelo tempo despendido e pelas suas opiniões, as quais serão informações valiosas para a investigação em curso.

Contato para Informações

Para mais informações sobre o estudo, pode enviar um e-mail para Hugo Rocha em hugorrocha@gmail.com

Consentimento do participante

Clicando no botão abaixo "Eu consinto em participar nesta pesquisa" atesta que leu todas as informações fornecidas acima, estando informado sobre o propósito deste estudo, e que aceita participar na pesquisa. Desde que nenhum detalhe ou identificação pessoal seja divulgado, aceita que suas respostas anônimas possam ser utilizadas na pesquisa acadêmica e vir a ser divulgadas. Se não deseja participar por favor feche a janela de seu navegador para sair neste momento.

Queres participar nesta pesquisa? *

☐ Sim

☐ Não

Próxima

Página 1 de 5

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Pesquisa sobre Ensino do Design e seu impacto na inovação social e sustentabilidade

*Obrigatório

Pesquisa sobre Ensino do Design e seu impacto na inovação social e sustentabilidade

Ano: *

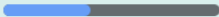
- ☐ 1º Ano (1º e 2º Períodos)
- ☐ 2º Ano (3º e 4º Períodos)
- ☐ 3º Ano (5º e 6º Períodos)

Gênero: *

- ☐ Feminino
- ☐ Masculino
- ☐ Não Binário
- ☐ Prefiro não responder
- ☐ Outro: _____

[Voltar](#)

[Próxima](#)

 Página 2 de 5

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Pesquisa sobre Ensino do Design e seu impacto na inovação social e sustentabilidade

*Obrigatório

Pesquisa sobre Ensino do Design e seu impacto na inovação social e sustentabilidade

Durante o curso, você participou em algum projeto de características sociais? *

- ☐ Sim
- ☐ Não

Dê exemplos

Sua resposta

Durante o desenvolvimento dos projetos de Tecnologia em Design Gráfico, teve contato com membros da comunidade, externa ao IFF, participando ou contribuindo para o desenvolvimento da sua solução? *

- ☐ Sim
- ☐ Não

Comentários

Sua resposta

[Voltar](#)

[Próxima](#)

 Página 3 de 5

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Pesquisa sobre Ensino do Design e seu impacto na inovação social e sustentabilidade

*Obrigatório

Pesquisa sobre Ensino do Design e seu impacto na inovação social e sustentabilidade

De acordo com cada afirmação a seguir, indique a opção com a qual concorda mais:

"O ensino do design contribui para o desenvolvimento social, cultural e ambiental das sociedades" *

1 2 3 4 5
Concordo plenamente ☐ ☐ ☐ ☐ ☐ Discordo plenamente

Porquê?

Sua resposta

"A colaboração entre Instituições de Ensino, empresas e/ou outras organizações da sociedade civil promove a inovação de produtos e serviços" *

1 2 3 4 5
Concordo plenamente ☐ ☐ ☐ ☐ ☐ Discordo plenamente

Porquê?

Sua resposta

"O ensino do design tem um papel importante na obtenção de soluções inovadoras e na definição de caminhos para superar os desafios sociais atuais, tais como a degradação ambiental, alterações climáticas, envelhecimento da população, extremismos, migração em massa, etc." *

1 2 3 4 5
Concordo plenamente ☐ ☐ ☐ ☐ ☐ Discordo plenamente

Porquê?

Sua resposta

"Os projetos desenvolvidos por mim durante o curso de Design Gráfico são inovadores, tem uma natureza social e contribuem para a sustentabilidade" *

1 2 3 4 5
Concordo plenamente ☐ ☐ ☐ ☐ ☐ Discordo plenamente

Porquê?

Sua resposta

"A tecnologia hoje é uma importante ferramenta do design e deve ser usada para facilitar a inovação social." *

1 2 3 4 5
Concordo plenamente ☐ ☐ ☐ ☐ ☐ Discordo plenamente

Porquê?

Sua resposta

"O uso das Tecnologias podem influenciar positivamente o ensino do design no âmbito da inovação social." *

1 2 3 4 5
Concordo plenamente ☐ ☐ ☐ ☐ ☐ Discordo plenamente

Porquê?

Sua resposta

[Voltar](#)

[Próxima](#)

Página 4 de 5

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Google Formulários

Pesquisa sobre Ensino do Design e seu impacto na inovação social e sustentabilidade

Pesquisa sobre Ensino do Design e seu impacto na inovação social e sustentabilidade

Sob a ótica da contribuição do Design para a Inovação social e Sustentabilidade, gostaríamos de ouvir um pouco mais da sua opinião. Use o campo a seguir para deixar sua contribuição.

Sua resposta

[Voltar](#)

[Enviar](#)

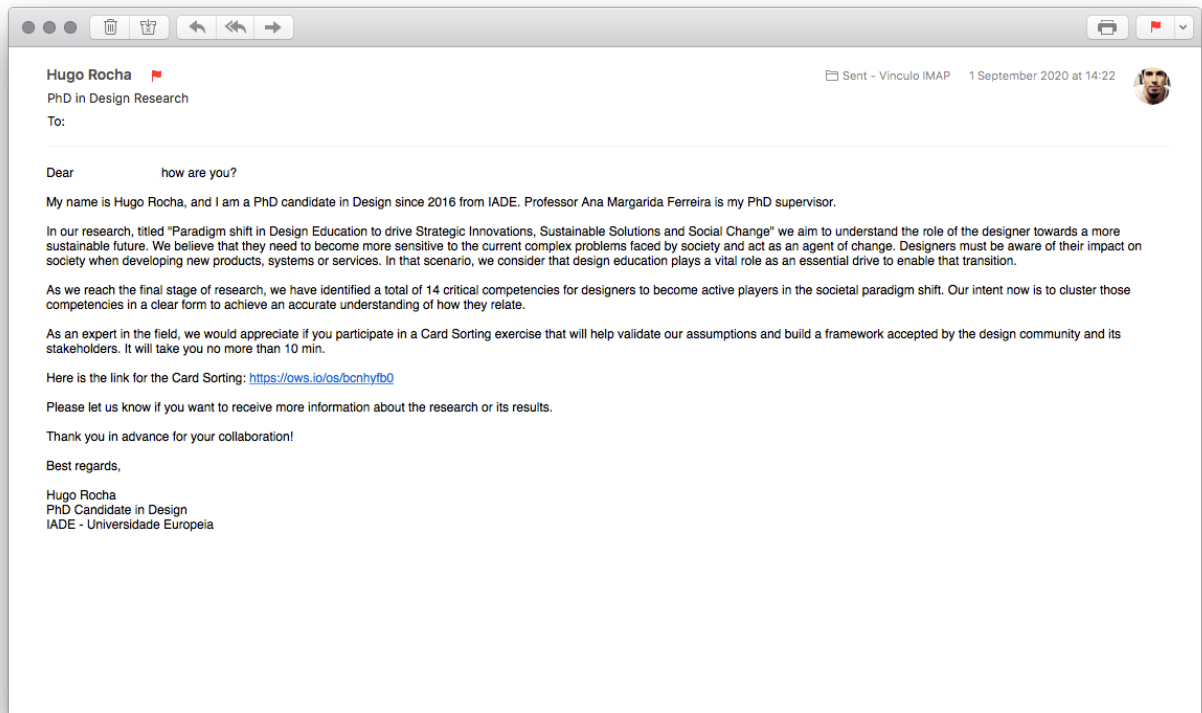
 Página 5 de 5

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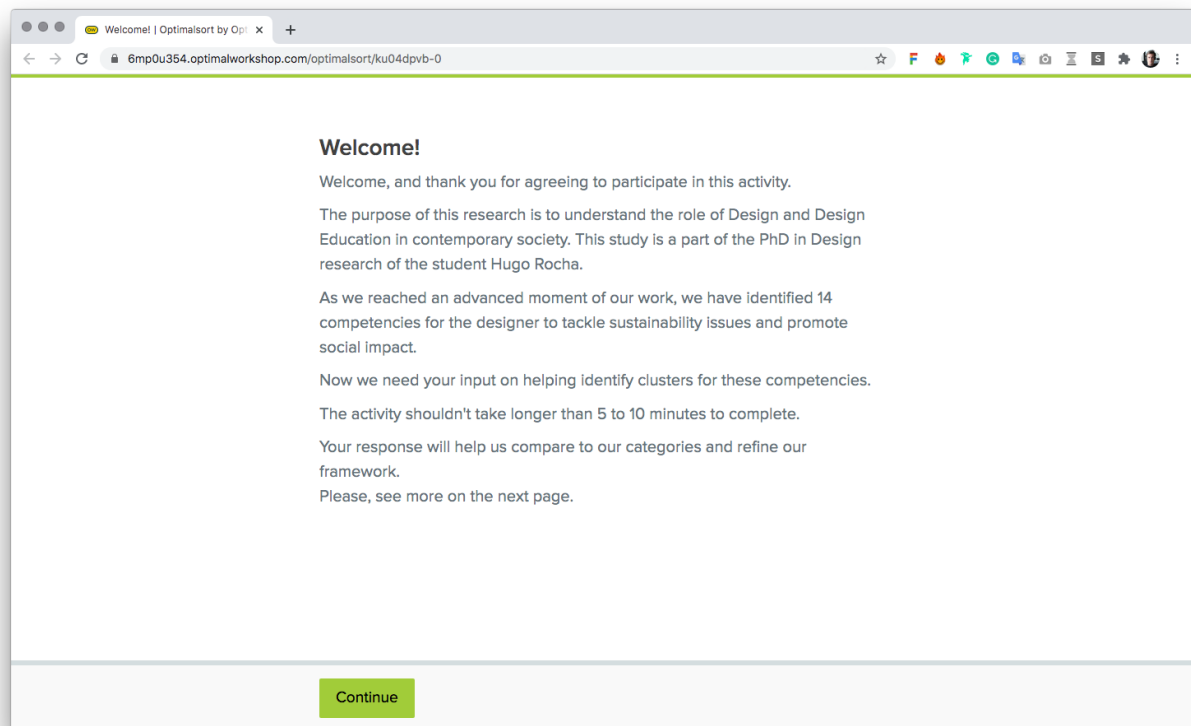
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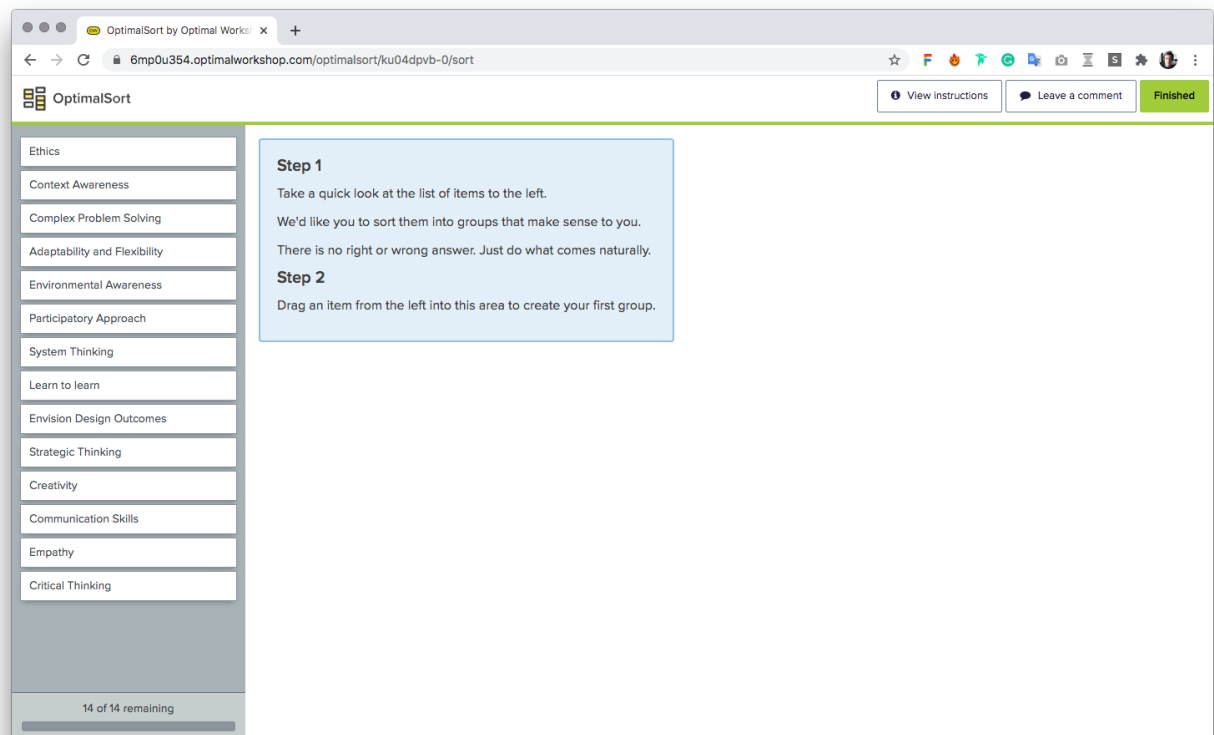
Appendix 5: E-mail sent to specialists with the invitation to participate in the card sorting activity.



Appendix 6: Welcome page for the card sorting activity.



Appendix 7: Online card sorting activity.



Appendix 8: List of *Enablers*

To access the complete list of Enablers, see pages 106-120 of the Design Competency Framework by scanning the QR Code below or accessing the following link:

<https://bit.ly/DesignCompetenciesFramework>



Appendix 9: Interview Guides - Paris College of Art

Hugo Rocha	Paris College of Art - MA Design for Social Impact - Interview Guide
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Roteiro de entrevista _Estudantes

What brought you to the MA Design for Social Impact?

What is your background?

What is the role of design in the world today?

What is the relationship between design and consumption?

How is the course structured? Classes, projects, lectures?

How are you challenged by the projects of the course?

What kind of skills and competencies have you gained (or expect to) throughout the course?

How do you learn about the theme/problem in question?

How is your involvement with the community and users? Give me some examples.

During the course, do you work with real problems or real themes?

How does dealing with real projects influence how you design?

What are the main difficulties faced during the design process?

Roteiro de entrevista

_Linda Jarvin

How is the course structured? Classes, projects, lectures?

What is the teaching/learning methods?

What is your role in the course?

How does the common theme (shelter) work across the disciplines?
Are they integrated? How?

How is the community involved in the design process?

How do you select the theme for each year?

How are the briefs designed?

What is the actuation of the teachers in society? Are they usually more academic or also have a professional profile? Can you give some examples?

Do do you evaluate the results and impact of the developed projects?
If so, how?

Appendix 10: Publications

Rocha, H., & Ferreira, A. M. (2020). Design Higher Education in a paradigm-shifting world: defining the competencies for a designer as agent of change. *Discern: International Journal of Design for Social Change, Sustainable Innovation and Entrepreneurship*, 1(1).

Rocha, H., & Ferreira, A. M. (2019). Future Designers as Actors of Change: Exploring Design Education Scenarios focused on Social Innovation and Sustainability. *Convergências - Revista de Investigação e Ensino Das Artes*, VOL XII(24). Retrieved from <http://convergencias.esart.ipcb.pt/?p=article&id=364>

Rocha, H., Ferreira, A. M., & de Azevedo, J. (2019). Envisioning the Next Generation of Designers: In E. Duarte (Ed.), *Design Doctoral Conference'19: TRANSformation. Proceedings of the DDC 6th Conference*. Lisbon: EDIÇÕES IADE.

Rocha, H., Ferreira, A. M., & de Azevedo, J. (2018). Paradigm shift in Design Education: An overview on issues and possibilities for change. *Design Research Society 2018 - Catalyst*, 7, 12. <https://doi.org/10.21606/dma.2017.541>

Rocha, H., Ferreira, A. M., & de Azevedo, J. (2018). Benchmarking Higher Education in Design for Social Innovation and Sustainability: State of Art and future challenges. In *Design Doctoral Conference '18* (p. 8). Lisbon, Portugal: IADE - Universidade Europeia, Edições IADE.

Rocha, H., Ferreira, A. M., & de Azevedo, J. (2018, June). Paradigm shift in Design Education to drive Strategic Innovations, Sustainable Solutions and Social Change (Poster). *Encontro Ciência'18 - Encontro Entre a Ciência e Tecnologia Em Portugal*. Lisbon, Portugal.

Rocha, H. (2017). Curators: what can Design learn from contemporary art? In *9th International Conference Senses and Sensibility 2017* (p. 7). Funchal, Portugal.

Rocha, H., Ferreira, A. M., & de Azevedo, J. (2017). Paradigm shift in Design Education to drive Strategic Innovations, Sustainable Solutions and Social Change. In *IADE Design Doctoral Conference'17* (p. 8). Lisboa.

Appendix 11: Workshops facilitated

Margarida, A., Farinha, I., Pinheiro, C., Souleles, N., & Rocha, H. (2017). Senses & Sensibility for Social Innovation and Sustainable Behavior: Sensing New Design [Higher Education] Landscapes. In *9th International Conference Senses and Sensibility 2017*. Funchal.

Workshop “DISCERN PROJECT: Sensing Change in/by Design Education”, with IADE-UE, UNIDCOM/ID:Co.Lab, Cyprus University of Technology (CUT)/Art+Design eLearning Lab, Paris College of Art (PCA), Dialogue Café, Gestools – 23/10/2017 at Madeira Interactive Technologies Institute (M-ITI), Madeira Tecnopolo, Madeira, Funchal.

Making Sense Out of Data. Facilitated by Maria Azevedo Coutinho, Hugo Rocha, Hélène Veiga Gomes and Laura Korculanin. Workshop – 27/10/2018, at WWNA’19, Lisbon, Portugal.

Diseño de la educación para el impacto social y la sostenibilidad: contemplar la próxima generación, Workshop – 14/03/2019 at DIME 2019 – Semena del Diseño de Mérida, Mérida, Spain.

Design Education for Social Impact and Sustainability: Envisioning the Next Generation. Workshop – 13/11/2019 at Cyprus University of Technology, Limassol, Cyprus.

O Ensino do Design para o Impacto Social e Sustentabilidade: formando as futuras gerações. Workshop – 22/01/2020 at Instituto Federal Fluminense, Campos dos Goytacazes, Brazil. Promoted by Curso Superior de Tecnologia em Design Gráfico.

Appendix 12: Attendance in national and international conferences

4th Design Doctoral Conference 2017 – TRANScendency – 21-23/06/2017 at IADE – Universidade Europeia, Lisbon, Portugal. Promoted by UNIDCOM/IADE.

Design Beyond Borders: Senses & Sensibility 2017, Conference – 24-27/10/2017 at Universidade da Madeira, Funchal, Portugal. Promoted by UNIDCOM/IADE and Universidade da Madeira.

Opening up to an ERA of Social Innovation, High-Level Conference – 27-28/11/2017 at Calouste Gulbenkian Foundation, Lisbon, Portugal. Promoted by the European Commission, the Portuguese Government and the Calouste Gulbenkian Foundation.

5th Design Doctoral Conference 2018 – TRANSgression – 20-22/06/2018 at IADE – Universidade Europeia, Lisbon, Portugal. Promoted by UNIDCOM/IADE.

DRS2018 Catalyst, Conference – 25-28/06/2018 at University of Limerick, Limerick, Ireland. Promoted by Design Research Society.

Encontro Ciência'18 – Encontro com a Ciência e Tecnologia em Portugal – 2-4/07/2018 at Centro de Confressos de Lisboa, Lisbon, Portugal. Promoted by República Portuguesa – Ministro da Ciência, Tecnologia e Ensino Superior.

Why The World Needs Anthropologists: Designing the Future, Conference – 26-27/10/2018 at Fundação Museu do Oriente, Lisbon, Portugal. Promoted by EASA's Applied Anthropology Network.

DIME 2019 – Semana del Diseño de Mérida – 11-14/03/2019 at Universidad de Extremadura, Mérida, Spain. Promoted by DIEX – Asociación de Diseñadores de Extremadura.

6th Design Doctoral Conference 2019 – TRANSformation – 22-25/06/2019 at IADE – Universidade Europeia, Lisbon, Portugal. Promoted by UNIDCOM/IADE.

7th Design Doctoral Consortium 2020 - TRANSdisciplinary – 23-25/06/2020, Online Event. Promoted by UNIDCOM/IADE

Appendix 13: Oral communications

Case study projects of applied design research: Paradigm shift in Design Education to boost Strategic Innovations, Sustainable Solutions and Social Chang – 24/05/2020 at Fundação Calouste Gulbenkian, Lisbon, Portugal. Promoted by Dialog Café and Fundação Calouste Gulbenkian.

Oral communication about the DISCERN Project part of UNIDCOM Cluster *Design for Social Innovation and Sustainability* during the 12^a Semana Internacional, IADE – Universidade Europeia – 12/04/2018 at IADE/UE, Lisbon, Portugal.

UX Talk - Design with empathy, Oral Communication – 02/04/2019 at UX Week, Lisbon, Portugal. Promoted by Ironhack and Beta-i.

Designing with Empathy during RECONNECTE, Oral Communication – 21/01/2020 at Instituto Federal Fluminense, Campos dos Goytacazes, Brazil.

Appendix 14: Complementary formation

Moving Life in circles: communication & design in a circular economy. Workshop at Design Beyond Borders: Senses & Sensibility 2017 – 24-27/10/2017 at Universidade da Madeira, Funchal, Portugal. Promoted by UNIDCOM/IADE and Universidade da Madeira.

Seminarios & Workshops – Apoio e promoção da investigação, Workshops: *Pesquisa bibliográfica em bases de dados; Acesso aberto e privacidade dos dados; Direitos de Autor; Escrita Científica 1; Escrita Científica 2* – from November’17 to January’18 at IADE/Universidade Europeia. Promoted by UNIDCOM/IADE.

Seminarios & Workshops – Apoio e promoção da investigação, Workshops: *Introdução à análise exploratória de dados no processo de investigação com a ferramenta SPSS; I can get no... Publication.* Rolling Stones from our research career – from January to April’18 at IADE/Universidade Europeia. Promoted by UNIDCOM/IADE.

HCD and Design Thinking, Workshop – 06/06/2018 at IADE/Universidade Europeia, Lisbon, Portugal. Promoted by UNIDCOM/IADE.

Co-designing social innovation: A culturally grounded practice, Workshop – 25/06/2018 at DRS 2018, Limerick, Ireland. Promoted by Design Research Society.

Design Education as a Catalyst for Change, Discussion Panel – 26/06/2018 at DRS 2018, Limerick, Ireland. Promoted by Design Research Society.

Ethics through Design, Discussion Panel – 28/06/2018 at DRS 2018, Limerick, Ireland. Promoted by Design Research Society

Appendix 15: Other research related activities

DISCERN - International Journal of Design for Social Change, Sustainable Innovation and Entrepreneurship. Editorial Assistant.

<https://www.designforsocialchange.org/journal/index.php/DISCERN-J/index>

UnReleased – Design Research Podcast. Co-Producer and Editor. Promoted by UNIDCOM-IADE. *<http://unreleased.unidcom-iae.pt/>*

5th Design Doctoral Conference 2018 – TRANSgression – 20-22/06/2018, Member of Organizing Committee. Promoted by UNIDCOM/IADE *<http://ddc2018.unidcom-iae.pt/people/>*