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A HOLISTIC FRAME OF PRODUCT-SERVICE DESIGN MASTER PROGRAMMES IN PORTUGAL

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ABSTRACT
This paper presents a holistic overview of higher education in Portugal on Product-Service Design area. It is part of a PhD research focused on boosting the knowledge transfer among academia, markets and society. The purpose of this study is to share the results of the documental research fulfilled that began with the mapping of the master programmes currently available in our country to then make the horizontal and vertical articulations of each one. The analysis culminated in an unbiased mapping of different teaching-learning profiles and their proximity to the external agents. This systematic review allowed us to identify, summarise and confront evidences that led to a second study, at a later stage, in which we mapped the scientific production in this area of knowledge. In a global critical appraisal, we can understand that some curricula need to be revised, since they do not include scientific areas that are considered crucial to the training of a designer, namely management (of ideas, projects, business, teams, etc.) or the contact with good research practices that instils in students a set of principles that allow the structuring of a project, managing to go deeper in defining the problem and, consequently, generating more complete and innovative solutions. Since the master's degree is a cycle marked by specialisation, the student should have the opportunity to create his own programme, thus it is necessary more flexibility in the choice of some courses.

Keywords: Design Education, Design of Products and Services, Master programme

1 INTRODUCTION

In a changing world, Europe's graduates need the kind of education that enables them to engage articulately as committed, active, thinking, global citizens as well as economic actors in the ethical, sustainable development of our societies. [1]

During the last decades, Europe has made an effort to be the *Europe of knowledge*, promoting the transfer of culture and knowledge not only on higher education but also in all lifelong learning [2].
The creation of synergies and networks among education and research contributes to the development of the human capital necessary for knowledge management, in a way that, nowadays, scientific and technological knowledge plays a decisive role for innovation. The ability to respond quickly and effectively to society's demands, based on an effective transfer of information and knowledge between individuals, dictates the competitiveness of an organisation. It is in this transmission of experiences that new knowledge is generated, which is supported by continuous learning and congruent updating, being intrinsically linked to teaching-learning theories and processes to cultivate the activation and rescue of memory that is sometimes inactive [3].
In Design area, education and training should stress the multi and interdisciplinary that characterises the activity, through the establishment of a relationship between different knowledge [4], forming autonomous professionals, flexible and with high capacities of self-learning, adaptation and collaborative entrepreneurial spirit [5]. This way, courses or activities to stimulate design students to creativity [6] and to entrepreneurship [7] should be integrated in curricula making this the starting point of a process in which next generations of designers will act as important drivers of innovation and economic growth.
So, after the mapping of the master programmes currently available in our country and making the horizontal and vertical articulations of each one, we can underline fundamental questions on which we must reflect: what kind of education is promoted in these programmes? Where are we heading and what can be changed?

2 MAPPING THE PRODUCT-SERVICE DESIGN EDUCATION IN PORTUGAL

To provide a holistic view of the master' studies in Product-Service Design taught in Portugal, we consulted the data available on the official website of the *Direção-Geral de Estatísticas da Educação e Ciência* (DGEEC), organised according to National Classification of Education and Training Areas (CNAEF). This search encompassed master courses belonging to the subsystem of university and polytechnic education, public and private [8].

It began by filtering the data related exclusively to the second cycle of studies, namely those in which the word *Design* appeared associated with the denomination of the programme, having been considered those that belong to the subarea of *Industrial Design*, in a total of twenty master programmes currently in operation in our country.

2.1 Horizontal and vertical articulation of masters' programmes – the organization

According to Mozota [9] and Hespe [10], the tacit knowledge in Design is a whole meeting of knowledge that exist in between art, science and technology.

Thus, after mapping the twenty master programmes, their curricula were analysed in order to do the horizontal and vertical courses' articulation. Our main objective was to be able to group the various courses in scientific areas, which would allow us to define the profile of each programme - more artistic or more technological. In this way, and because education plays a key role in awakening the student's sensitivity to issues that have to do not only with professional (technical) development, but with a whole collection of social and cultural knowledge, we defined six scientific areas – stated by the National Classification of Education and Training Areas (CNAEF), approved by Administrative Rule no. 256/2005 [8] - that encompass a set of disciplines that enable an holistic and transversal understanding of the problems: 'Project Design' (PD), 'Design and Representation' (DR), 'Materials and Design Technologies' (MDT), 'History and Theory of Design' (HT), 'Social and Human Sciences' (SHS) and 'Business' (B). Table 1 shows a description of these six defined areas, including covered (sub) areas as examples. A seventh area reserved for 'Electives' (E) was also added, covering other scientific areas.

Such designations resulted in careful observation of the designations of the scientific areas that are included in the official curriculum of the programmes, which were compiled for those that we found to be the most prolific and circumfluent.

Table 1. Set of scientific areas defined for this study (elaborated by authors)

Scientific Area	Covered Areas (some examples)	Specification
[PD] Project Design	Design Processes; Design Methodologies; Design Thinking; Design of Products and Services; etc.	Area dedicated to the methodological development of products, systems or services.
[DR] Drawing and Representation	Geometry; Manual Drawing; Digital Design (CAD); 3D modelling; Graphic Composition; Typographic Design; etc.	Area related to manual or digital representation.
[MDT] Materials and Design Technologies	Materials; Manufacturing Processes; Construction Systems; Mock-ups; Prototyping; etc.	Area related to technical and material experimentation.
[HT] History and Theory of Design	History and Theory; Aesthetics; Theory of Colour and Form; etc.	Area that provides training in the scope of Design Culture in the aspects of History, Theory and Design Critique.
[SHS] Social and Human Sciences	Research Methods; Sociology; Anthropology; Philosophy; Deontology; Psychology and Motor Behavior; Ergonomics; Anthropometry; Usability; Sustainability; etc.	Area focused on the analysis of the relationship between man and environment. It encompasses courses that combine the knowledge related to the project - theoretical and technical support.
[B] Business	Economics; Management; Business models; Entrepreneurship; Marketing; Innovation Management; etc.	Support area for the creation and implementation of an idea or business plan.

2.2 Horizontal and vertical articulation of masters' programmes – the crossing

The horizontal and vertical articulation of each programme and the assignment of the respective scientific areas to the courses were accomplished (figure 1). Then, a table was constructed whereby the sum of the number of ECTS of each programme was calculated, the weight that these subject areas have in the programme.

Figure 1. Structuring of master's programmes by scientific areas (elaborated by authors)

Subsequently, the sum of the various areas was added, which gave rise to table 2 and figure 2.
In an overall assessment, we can verify that all the masters selected have a predominant focus in the ‘Project Design' (61%). At the same time, the areas of 'Social and Human Sciences' (13.8%) and ‘Design Materials and Technologies' (9.4%) are those that immediately present themselves in a relevant degree, followed by ' Business' (4.6%), 'History and Theory of Design' (3.7%) and 'Design and Representation' (3.2%). There is also a portion reserved for 'Electives' with 4.2%.

Table 2. Structuring of Masters Courses by Scientific Areas (ECTS) (elaborated by authors)

	Project Design	Drawing and Representation	Materials and Design Technologies	History e Theory of Design	Social and Human Sciences	Business	Electives
UÉvora [D]	78	0	3	3	9	3	24
IPP-ESMAD [D]	90	0	15	10	5	0	0
ULusíada - Lisboa [D]	67,5	0	15	0	15	22,5	0
ULusófona [D]	56	16	20	0	22	0	6
UA-DECA [D]	58	6	6	0	20	6	24
FBAUL [DE]	77	0	3	6	19	3	12
IPCB - ESART [DIM]	80	0	28	3	6	3	0
ESAD [DP]	84	9	6	9	12	0	0
FAUL [DP]	64	0	21	7	17,5	10,5	0
IPL-ESAD [DP]	78	9	0	0	24	9	0
ULusíada – Fam. [DP]	75	0	7,5	7,5	22,5	7,5	0
ULusíada - Lisboa [DP]	75	0	7,5	7,5	22,5	7,5	0
ULusíada - Porto [DP]	75	0	7,5	7,5	22,5	7,5	0
UMinho [DPS]	85	0	0	0	35	0	0
IADE [DPE]	72	0	15	6	21	6	0
IPCA-ESD [DDP]	69	13	15	5	13	5	0
FEUP + FBAUP [DIP]	75	6	12	0	12	6	9
UBI [DI]	70	0	8	12	18	0	12
IPVC - ESTG [DI]	45	12	10	5	6	12	0
UA-DEM [EDP]	72	6	24	0	6	0	12

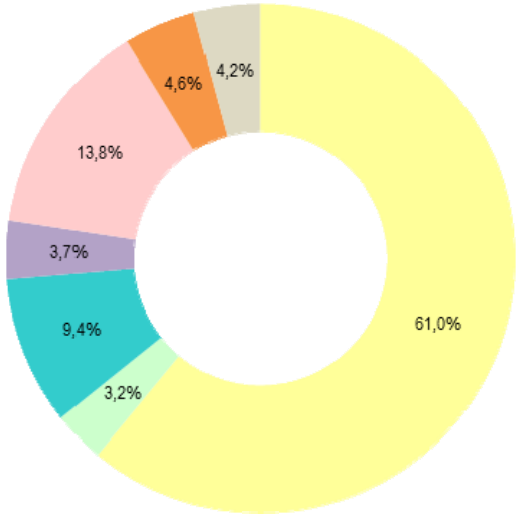

Figure 2. Structuring of Masters programmes by Scientific Areas (elaborated by authors)

From this diagnosis and the individual analysis of the programmes it was possible to map the different institutional profiles and to understand the areas that characterise them. However, through a critical observation of the general results, we can say that some areas need attention and an eventual curricular revision.

Specifically, 'Drawing and Representation' is found only in eight of the twenty courses. We assume that these subjects are more explored during the degree, but we cannot help admitting that a student from another area can do a master training in Design. It is suggested that, in this case, these courses exist even a small percentage, because designers have to be able to express their ideas in a clear and visual way to their clients or their partners.

In contrast, 'Materials and Design Technologies' exist in almost every course. It is hoped, however, that this existence be worked in a practical and experimental way, with workshop work and, if possible, in partnership with companies and technological centres.

Regarding courses classified as 'History and Theory of Design', in fact, they do not exist in all master programmes, and here we leave the same caveat that we left about 'Drawing and Representation'.
As for the 'Social and Human Sciences', which encompass so many and different disciplinary areas, they are very important and should serve to help characterise the programme and assist the student of Design in solving his or her Design problems.
We emphasise that the focus on 'Business', assuming itself as the area of support for the creation and implementation of ideas, is small. Thus, it is assumed that the stimulus to entrepreneurship and innovation is also scarce. This should be corrected and greater emphasis should be given to these areas, which in some of the programmes do not even exist in the curriculum.
In short, all the scientific areas are important, but some of them are absolutely fundamental in a second cycle of studies, in which the student is expected to be able to investigate in greater depth and solve problems with a level of detail superior to a bachelor's degree. It is also a cycle of specialisation, so there should be flexibility for the student to create their own profile. This is achieved through the creation of elective courses, which encompass these scientific areas, leaving the student with such a decision.

3 CONCLUSION

This paper presents a holistic frame of Product-Service Design education in Portugal, focusing on master level. This mapping was the first step of research done during a PhD study. It allowed to have a comprehensive view about how the master programmes are structured - what kind of courses they offer and in which areas of knowledge - to predict what kind of skills these professionals will have and what kind of gaps they will present.
Some authors [9] [10] [14] argue that the industrial designer must be a professional who must have a holistic knowledge that crosses several areas of knowledge, endowed with three types of competences - theoretical, immaterial (cognitive) and technical - and being able to cross them in the development of new solutions. The first two are related to soft skills (increasingly valued by employers) and the last specificity is related to the specialty of this professional compared to others.
From this point of view, and based on the diagnosis completed, we can say that some programmes need to rethink their curricula, namely in the integration of courses related to (i) history and theory of Design, (ii) business, and (iii) knowledge of the Design materials and technologies. Obviously it will be an added value for the training of the professional if he has the opportunity to choose other courses more targeted to his future prospects, according to the premises of the Bologna Agreement. For this reason, programmes that do not offer electives should consider doing so in order to offer the student looking for design training the versatility and flexibility to create their own professional profile.
Designers must be able to think on the one hand, but they must have the right tools to be able to realise their ideas on the other. The combination of theoretical and technical knowledge is crucial, so, it would be interesting to stimulate entrepreneurship and consolidate knowledge in this field through courses related to business management and creation.
In the current post-industrial context, higher education institutions need to transfer knowledge to the economy and to society as a whole, while receiving inputs from markets and society that are conducive to the construction of new knowledge, providing an effective relation between the vertices of the knowledge triangle - education, research and innovation [11], because the knowledge that is generated only makes sense if it is effectively applied.
According to Laranja [12], the problems of productivity, competitiveness, and economic and social development of the Portuguese economy are on the agenda in recent years, and the concepts of entrepreneurship and innovation came to occupy the order of the day. There has been an effort to articulate the agents of knowledge with economic agents and civil society, and public policies must accompany these concerns, since science, technology and innovation cannot be separated [12]. It is therefore necessary to ensure that knowledge transfer takes place in an effective and protected manner, safeguarding the interests and rights of both parties.
In Design area, Calvera [13] believes that the process of approaching the academy to external agents must begin with the instruction of Design students about the social and economic context in which Design will operate. The author argues that it is from the knowledge of the environment and users that designers can have the energy and confidence necessary to create and implement something new. As a result, higher education institutions have become more concerned with teaching-learning processes rather than with outcomes and goals as goals give way to competencies.

So, after this documental research, we articulated different agents from academia (and also from markets) to understand what do they this to improve it. The PhD thesis resulted in a toolkit that links academia, markets and society the one we would like to present in a future paper.

REFERENCES

[1] European Commission. Modernisation of Higher Education: Improving the quality of teaching and learning in Europe's higher education institutions. Luxembourg, 2013.

[2] Dias, A. C., Almendra, R., Moreira da Silva, F. Design Education facing Europe 2020 – a reflection on demands: FAULisbon as the case study. In *Challenges for Technology Innovation: An Agenda for the Future - Proceedings of the International Conference on Sustainable Smart Manufacturing (S2M 2016)*, CRC Press, 2017.

[3] Fazenda, I. C. Interdisciplinaridade: história, teoria e pesquisa. Papirus Editora, Campinas, 2008.

[4] Magalhães, A. (1998). *O que o desenho industrial pode fazer pelo país? Por uma nova conceituação e ética do desenho industrial no Brasil.* Rio de Janeiro: Arcos.

[5] Jacquinot, G. Apprivoiser la distance et supprimer l'absence? Ou les défis de la formation à distance. *Revue Français de Pédagogie*, 1993.

[6] Matté, V. A. Educação Superior em Design: aspectos relevantes na formação do profissional. In *Pensando Design 2*, UniRitter (Ed.), Porto Alegre, 2008.

[7] Hartmann, D. Turning Technology into Business Using University Patents. In *Technology Innovation Management Review*, 2014, pp.37-43.

[8] Diário da República. Portaria n.º 256/2005, 16 de Março. *Classificação Nacional das Áreas de Educação e Formação*. Lisboa, 2005.

[9] Mozota, B. B. Design and competitive edge: A model for design management excellence in European SMEs. *Design Management Journal* (Vol. 3), Academic Review. Boston, 2003.

[10] Hespe, M. Industrial Design: Conceptual careers in the making. Libraries Australia, 2007.

[11] European Commission. *Knowledge Triangle and Innovation*. Available: http://ec.europa.eu/education/policy/higher-education/knowledge-innovation-triangle_en [Accessed on 16 March 2016].

[12] Laranja, M. Uma nova política de inovação em Portugal. Almedina, Coimbra, 2007.

[13] Calvera, A. Treinando pesquisadores para o design: algumas considerações e muitas preocupações académicas. *Revista Design em Foco, III*, 2006, pp. 97-120.

[14] Gomes, A. C. Designer - A construção contínua de competências. Guimarães: Escola de Engenharia da Universidade do Minho, 2009.