02.

Design Education and Industry Collaboration: Exploring the Strategic Role of Chief Design Officer through a Multifaceted Pedagogical Approach

Educação em design e colaboração com a indústria: Uma exploração sobre o papel estratégico do Chief Design Officer através de uma abordagem pedagógica multifacetada

Gisela Pinheiro
ID+, DeCA, Universidade de Aveiro
grpinheiro@ua.pt

Teresa Franqueira
ID+, DeCA, Universidade de Aveiro
teresa.franqueira@ua.pt

This article presents an educational experimental endeavor undertaken within the scope of a doctoral research project, involving key stakeholders, including the University of Aveiro, Revigrés, and Design Factory Aveiro. The primary focus of the doctoral research is to assess the strategic significance of the role of a Chief Design Officer within the corporate landscape, with a specific emphasis on the Portuguese industry, notably the ceramic tile and flooring company, Revigrés.
As an integral part of the Project in Product Design II teaching team, the methodology already employed in the curricular unit was adapted to align with the research objectives. Following consultations with Revigrés, a project brief was formulated, providing students with a targeted challenge. Describing the journey taken with this experiment, this article draws parallels between the role of the academic teaching team, functioning as a scientific supervisor, project manager, and mediator between the company and students, and that of the Chief Design Officer. The latter is viewed as a design team leader, a strategic design visionary, and a bridge-builder aligning business objectives with market and societal needs.
This article meticulously details the entire process of this pedagogical experience, offering a comprehensive analysis that extracts meaningful results for both ongoing research and the partnering company. The insights gained contribute not only to academic research in design but also provide valuable implications for the strategic positioning of a Chief Design Officer in fostering innovation and collaboration between academia and industry.

Keywords *chief design officer, project in product design, education, industry.*

Este artigo apresenta uma experiência educativa experimental conduzida no âmbito de um projeto de investigação de doutoramento em curso, envolvendo a Universidade de Aveiro, a Revigrés e a Design Factory Aveiro. O objetivo principal da investigação de doutoramento consiste em avaliar o significado estratégico do papel de um Chief Design Officer no panorama empresarial, com ênfase na indústria portuguesa, nomeadamente na empresa de revestimentos cerâmicos e pavimentos Revigrés.
Integrada na disciplina de Projeto em Design de Produto II do Mestrado em Engenharia e Design de Produto da Universidade de Aveiro, a metodologia utilizada na unidade curricular foi adaptada aos objetivos desta investigação. Em concordância com os objetivos estratégicos da Revigrés, foi formulado um briefing de projeto, proporcionando aos alunos desafios concretos e aplicáveis ao contexto da empresa. Ao descrever o percurso desta experiência, este artigo estabelece um paralelismo entre o papel da equipa docente, que funciona como supervisor científico, gestor de projeto e mediador entre a empresa e os estudantes, e o do Chief Design Officer. Este último é visto como um líder da equipa de design, um visionário do design estratégico e um construtor de pontes que alinha os objetivos da empresa com as necessidades do mercado e da sociedade.
Este artigo detalha meticulosamente todo o processo desta experiência pedagógica, oferecendo uma análise abrangente que extrai resultados significativos tanto para a investigação em curso como para a empresa parceira. Os conhecimentos adquiridos contribuem não só para a investigação académica em design, mas também fornecem implicações valiosas para o posicionamento estratégico de um Chief Design Officer na promoção da inovação e da colaboração entre a academia e a indústria.

Keywords chief design officer, projeto em design de produto, educação, indústria.

1. Introduction

The pedagogical experiment outlined in this article arises from the collaborative synergy between an ongoing Ph.D. research endeavor, a Portuguese company, and the University of Aveiro (UA). The intrinsic focus of the doctoral research revolves around the pursuit of understanding and affirming the role of Chief Design Officers (CDOs) within corporate landscapes, manifested through a collaborative partnership with Revigrés—a prominent Portuguese manufacturer of ceramic tiles. Focused on exploring the strategic role of a CDO, the research leverages Revigrés as a platform for strategic experimentation.

During the prototyping phase of this Ph.D. research, a collaboration emerged between the Department of Communication and Art of the University of Aveiro and Revigrés. This partnership materialized through the development of an educational design activity within the Project in Product Design (PDP II) curricular unit of the Master's degree in Product Design and Engineering (MEDP) during the period from February to July of 2021.

Informed by a comprehensive literature review, interviews with CDOs, and an analysis of case studies, the ongoing Ph.D. research has drawn critical assumptions and insights, forming the foundation for the experimental activity described in this article.

A paramount insight gleaned during the theoretical construction of this Ph.D. research is the multifaceted skill set and responsibilities of the Chief Design Officer, emphasizing the cultivation of internal and external relationships within organizations as a catalyst for enhanced innovation fluidity. Another critical insight underscores the necessity of demonstrating results, meeting Key Performance Indicators (KPIs), and aligning with corporate strategic objectives by diversifying the company's product range—a perspective congruent with Revigrés' strategic objectives.

Furthermore, a drawn conclusion highlights the CDO's role in leading a team of designers or individuals with diverse areas of expertise. Given the imperceptibility of the design function at Revigrés and having this research an emphasis on strategically implementing design function in companies, there arises a need to articulate and advocate for the value of design and the designer's role within the company.

This ongoing doctoral research is rooted in abstract theoretical constructs since it aims to question the role of the CDO in companies. Nevertheless, endeavors to develop multi and pluri-functional products for Revigrés, establishing a strategic process of radical innovation driven by design were set. Specific objectives involve consolidating the strategic positioning of the design function, aiding decision-making processes in corporate environments through the CDO's role, and fostering innovation within a business environment through design, grounded in a collaborative management model at Revigrés.

To validate the assumptions about the CDO and evolve Revigrés product range, a pivotal exploratory action was deemed imperative. Strategic possibilities were explored, with the initial proposition of establishing a multidisciplinary team to create multi and pluri-functional products. This avenue was dismissed due to financial constraints, prompting consideration of a more financially viable strategic alternative in alignment with ongoing findings. Another significant limitation of this research stems from the global impact of the COVID-19 pandemic, introducing constraints to the defined experimental acts and disrupting the relationship between the research team and Revigrés - a theme expounded upon throughout this article.

Against this backdrop, recognizing the need to fortify the relationship between the scientific realm of design at the University of Aveiro and Revigrés, this pedagogical activity was launched.

To attain the predefined objectives and test the assumptions outlined, the educational activity described in this article, engaged the University of Aveiro as an educational services provider, the research team as educators within the curricular unit, Revigrés as the company launching a project briefing, and Design Factory as the creative and workshop space. This educational endeavor aspired to contribute significantly to the ongoing Ph.D. research, offer insights beneficial to Revigrés, and contribute to the broader design education community.

1.1. Background:
Navigating the Role of Chief Design Officer and Shaping MEDP's Teaching in Project subjects

To comprehend the experimental activity expounded in this article, two interwoven analytical components underpin the background, elucidating the rationale behind this endeavor. The primary factor pertains to the overarching investigation into the role of a CDO, while the second delves into the pedagogical act of teaching Project in Product Design II in the MEDP at the University of Aveiro.

1.1.1. Design as a Strategic Resource: Unveiling the Chief Design Officer's Role

Within organizational studies, there is a burgeoning acknowledgment that design, as a process, strategy, and philosophy, yields substantial contributions. Design management's historical trajectory has consistently acknowledged and probed the profound connections between design, innovation, and organizational performance (Pinheiro & Franqueira, 2021). Scholars such as Brown (2009), Dorst (2015), and Verganti (2017) have extensively examined this nexus.

In discussions concerning the positioning of design within organizations, scholars have illuminated the pivotal role of design as a strategic resource (Hands, 2017; Brown, 2019; Borja de Mozota & Valade-Amland, 2020). Other studies delve into the intricate links between design and organizational cultures (Bertola & Teixeira, 2003; Lockwood, 2004; Elsbach & Stigliani, 2018). Moreover, research

underscores that the value of design in fostering corporate innovation is intricately tied to senior management's commitment (Design Council, 2014; Sheppard et al., 2018).
The role of the Chief Design Officer (CDO) is firmly established in large organizations, positioning design at the executive level. The CDO assumes leadership, defining the strategy, policy, and mission within the organizational context (Best, 2006; Holland & Lam, 2014; Quint et al., 2022; Porcini, 2023). Operating with a holistic view, the CDO considers the company, its culture, and broader societal implications (Stuhl, 2014). Essential characteristics encompass effective communication fostering more profound user experiences, inducing perceptual shifts (Pallister, 2015).
Recent studies, exemplified by Dalrymple, Pickover, & Sheppard (2020), delineate the aspirational nature of the CDO's role, emphasizing transformation over mere execution. Three key objectives take precedence: user experience, organizational impact, and leadership within the design team. Notably, the CDO's responsibilities are expansive yet quantifiable, necessitating interdepartmental interactions, with a focus on effective leadership rather than individual capabilities.

1.1.2. Teaching Project in Design in MEDP

In this investigation context, it is used the concept outlined by Franqueira (2022) where design aligns with a humanist vision rather than a purely technical one. While technical skills are acquirable through life and practice, the humanist approach and the triangulation of Knowledge (Knowing How to Think in order to Know How to Do), Technique (Knowing How to Do in order to Know How to Think), and Attitude (Knowing How to Observe, Knowing How to Be in order to Know How to Decide) should underscore design training.
The Project subject in Design courses embodies an experimental, learning-by-doing approach that defies easy systematization. Project courses, exemplifying experiential learning, elude measurability, tangibility, and objectivity inherent in traditional teaching criteria (Bot et al., 2005; Franqueira, 2022).
Inquiry-Based Learning processes, including Challenge-based learning, Problem-based learning, and Project-based learning, have been integral to teaching in Project subjects in Design courses (Yew & Goh, 2016; Leijon et al., 2021;Franqueira, 2022; Jia et al., 2023). These exercises, often challenging and problem-oriented, centralize questioning the context and embracing a degree of uncertainty about the final outcome.

Knowledge (Knowing How to Think to Know How to Do)

Various curricular units contribute significantly to knowledge acquisition, laying the theoretical foundations that coupled with visual culture and critical thinking, equip students for design practice. The ability to think is a prerequisite for effective project contemplation across various dimensions (functional, poetic, technical, economic, etc.). These contributions inform praxis, facilitating the materialization of ideas and concepts (Robison & Aronica, 2016; Franqueira, 2022).
Knowledge exchange, as opposed to knowledge transmission, transpires dialogically in Project in Design curricular unis. This interactive process involves questioning and reflection among students and educators. The design practices of each educator, informed by their professional experience, worldview, and technical skills, influence students. Similarly, the cultural context of each student and the knowledge they bring enrich the projects developed in an academic setting.

Technique (Knowing How to Do to Know How to Think)

Acquiring knowledge without practical application results in a deficient and ineffective learning process. In design, this deficiency hampers the production of applied knowledge essential for seeking creative, viable, and feasible solutions (Franqueira, 2022). Proficiency in doing things and mastering technical knowledge proves foundational for project development and the creative process. The ability to materialize ideas and comprehend existing possibilities is essential for ideation and creation (Jia et al., 2023).
From this perspective, the workshop, a hallmark of the Bauhaus model (Cross, 1983), is indispensable in Design courses. Its significance lies not in strict mastery of technique but in acquiring technical knowledge that explores the creative process's multiple materialization possibilities: material, plastic, sensorial, productive, technological, and technical.

Attitude (Knowing How to Observe, Knowing How to Be to Know How to Decide)

According to Franqueira (2022) beyond technical and scientific knowledge, the development of soft skills, termed here as Attitude, proves fundamental for students' academic and professional journey. This complementary training is increasingly integrated into curricula, especially in engineering courses, where emphasis traditionally leans towards technical and scientific content. The concurrent focus on behavioral and emotional components responds to their growing importance in the eyes of employers.
Moreover, training conducive to entrepreneurship and self-employment underscores the role of these skills. Developing students' competencies in creativity, time management, initiative, proactivity, conflict management, and teamwork has far-reaching implications for their training, better preparing them for the job market (Robinson, 2021; Michelwski, 2016)
The pedagogical dynamics employed in Design project courses cultivate these skills, instilling certain attitudes in students that distinguish them in comparison to other subject areas. For instance, in organizing working groups, students must assume a leadership role, and rotated among group members. This approach ensures everyone confronts the challenge of leadership or strives for improvement (Franqueira, 2022).

1.1.3. Strategic Guidelines for the Teaching-Learning Process in Design Project Courses

Numerous design institutions have either developed or adjusted their educational offerings, drawing inspiration from the Bauhaus model (Cross, 1983). The discourse surrounding the pedagogical approaches and nuances of the teaching and learning process in design has resonated throughout the design literature for the past four decades (Bayazit, 2004). Works by Nigel Cross (1982) and Cristopher Frlayling (1993) have notably revolutionized the exploration of the discipline, methodically unveiling key facets of design education, research, and practice. The spectrum of approaches to teaching design, particularly Design Projects, exhibits variations across institutions. These distinctions arise from the degree of innovation in curricula, the caliber of educators steering Project disciplines, and the infrastructural settings they provide (Franqueira, 2022). The creation of models, mock-ups, and prototypes proves integral to designer training, forming part of the ideation and project development process as tools for shaping and dematerializing ideas and propositions.

The research team contends that the link between workshop space and project disciplines is inseparable and indispensable in any design institution. This necessity does not stem from a perspective of technical instruction but from the viewpoint of students' independent and collective knowledge construction.

2. Methods

Design Education: Exploring Methods, Bridging Academia and Industry in MEDP Project Module

The University of Aveiro's Design degree amalgamates Industrial and Communication Design disciplines within the Bologna Process *framework*. Originating with distinct degrees in Industrial Design and Communication Design, a merger was proposed in 2001. This convergence involved faculty from specific areas, including Plastic Arts, Engineering, and Architecture. The historical context of design education mandates the inclusion of the Design Project in all courses, functioning as the linchpin for design training.

Related to the Design degree, for the second cycle of learning, UA offers students the MEDP. This master's is designed to impart the essential competencies necessary for product optimization and innovation, adopting a holistic approach that integrates considerations related to individuals, industry, society, and the environment (Pombo, 2023). The primary focus is on cultivating specialized expertise in the development and conceptualization of models and products capable of effectively addressing market demands for flexibility, speed, and precision.

To fulfill these objectives, the course strategically combines in-depth knowledge from two core scientific domains: Design and Mechanical Engineering. Notably, the Mechanical Engineering component is complemented by a transversal core competence in Project Management. This addition aims to reinforce the assimilated knowledge from the aforementioned scientific domains, fostering synergies between the two thematic areas. The MEPD is meticulously structured to provide students with a comprehensive skill set, enabling them to navigate the intricate landscape of product development with proficiency and innovation.

The inception of the MEDP in 2010 stemmed from the necessity to provide postgraduate training tailored to students' profiles and specific needs. Differing from the University's Master's in Design (MDes) which is generic, the MEDP intertwines Design and Engineering, fostering a partnership between the Department of Communication and Art and the Department of Mechanical Engineering. In MEDP the Project curricular units span two years, exclusively constituting the practical facet of the course. Since its establishment in 2011, the Product Design Project curricular units within the MEDP have undergone a transformative journey. Recognizing the need for a dynamic connection with the industrial landscape, these units strategically forged partnerships and protocols with industries in the Aveiro region. This deliberate integration created a distinctive ecosystem, fostering applied, externally oriented research with a multidisciplinary approach. In the initial six years of MEDP's operation, a critical evaluation brought to light significant challenges. The courses, integral to the MDes, faced limitations in consolidating specific knowledge, particularly in the domains of Drawing and Product Design. The amalgamation of students from diverse scientific backgrounds, including those with a rudimentary understanding of Design, resulted in notable disparities. The teaching services' distribution, specifically in Project I and Project II, led to an imbalance. While teachers from Industrial Design adapted methodologies for MEDP students, the overall teaching-learning process fell short in achieving robust outcomes or instilling specific competencies in Product Design. A pivotal transformation was proposed to rectify these challenges, centered on adapting to Product Design and embracing a new methodological approach (Franqueira, 2022).

Teaching-Learning Methodology

Anchored in the Design Council's Double Diamond model, this visionary shift sought active involvement of regional companies from the project's inception. The envisaged collaboration aimed to harmonize academia and industry in crafting proposals. Integral to this transformation was a robust alliance with the Design Factory Aveiro project, capitalizing on its equipped infrastructure for prototype development and testing (ibidem, 2022).

The Project subjects' teaching-learning processes are characterized by qualitative, interactive, and less conventional methodologies, fostering critical and creative thinking. The pedagogical approach is rooted in the interactive production of knowledge, distinguishing Project disciplines in design training. Students construct knowledge through experimentation, research, action, reflection, and dialogue.

The classroom organization prioritizes collective and collaborative work, eschewing traditional models. Classrooms feature tables grouped into "islands" to facilitate collaborative work, with teachers actively engaged in monitoring projects. Instead of having a “fixed desks” teachers move between student groups, aligning with project development requirements. This model promotes dynamic interactions, enhancing the learning environment.
The workshop space evolves into an additional classroom during project development stages. Workshops, equipped for model and prototype construction, facilitate exploration of formal, dimensional, ergonomic, and technical project aspects. The practical dimension significantly impacts the quality of students' work. With the advent of Design Factory Aveiro (DFA), equipped with advanced tools, until 2022, students benefit from enhanced learning experiences, exploring new techniques and materials.
DFA operates as a hub stimulating collaboration among business, design, scientific, and civil society entities. It aims to develop innovative products and services with high added value, contributing to economic and social development. Activities at the DFA revolve around research, training, and communication, employing interdisciplinary methodologies to materialize innovative solutions.
The Design Factory concept, rooted in design's significance and autonomy, has gained international prominence, with 35 Design Factories forming the Design Factory Global Network. Design Factories catalyze a paradigm shift, fostering creative methodologies, interdisciplinary interaction, and the materialization of innovative products and services. The DFA, situated within the Science and Innovation Park, functions as a catalyst for economic and social development through science activities, cultural mediation, and collaborative endeavors involving diverse stakeholders.

Integrated Approach: Bridging Academia and Industry

The imperative to integrate academia with society propels the teaching-learning process, tailored to contextual needs. In MEDP this integration unfolds progressively, fostering student-market interaction and introducing design to the business community. The synergy with other disciplinary areas and promotion of multidisciplinarity align with the overarching teaching strategy.
Exercises rooted in real challenges or proposals play a pivotal role in students' training, fostering transversal skills. Direct engagement with clients sharpens communication, negotiation, and project narrative skills. Real-world immersion includes study visits, ethnographic research, and practical exposure to technologies and production processes, elevating students' problem-solving aptitude.
For this reason, the methodological proposed changes in MEDP curricula were not merely structural but represented a paradigm shift in the interaction between academia and industry (Franqueira, 2022). By involving regional companies from the project's inception, the adapted approach aimed to fuse theoretical insights with practical industrial needs. This collaborative endeavor was closely aligned with the DFA, emphasizing a seamless transition from project development to the materialization and rigorous testing of prototypes. This strategic merger fortified the link between academia and industry, ensuring that projects were not merely academic exercises but resonated with real-world applications and challenges.

The Dynamics of MEDP Project in Product Design II Curriculum

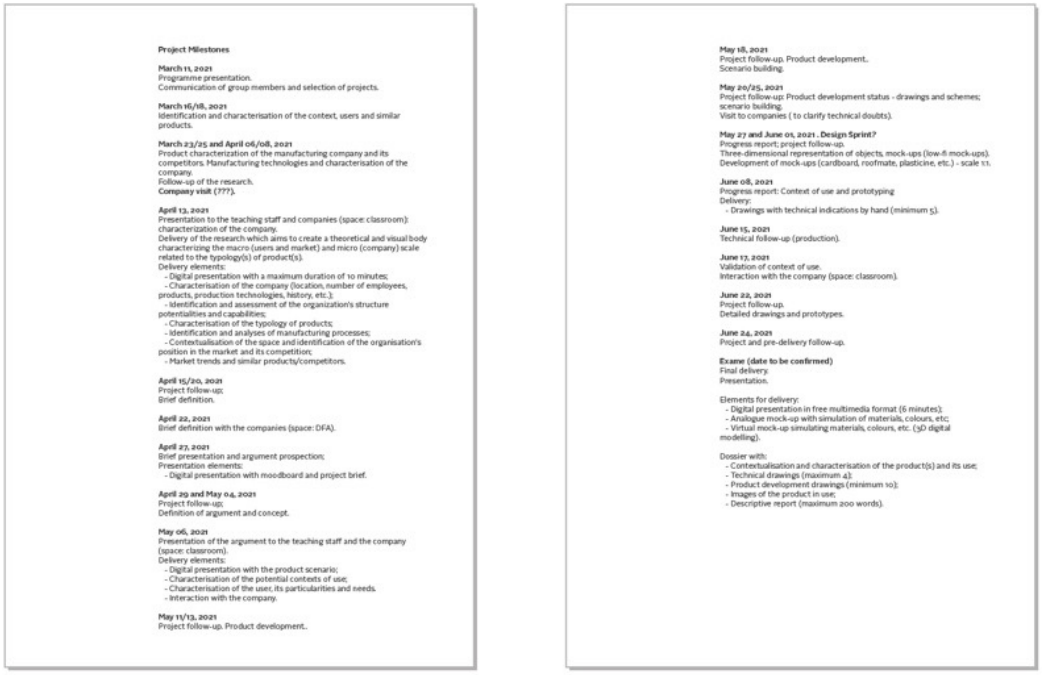
The experimental activity conducted within the ongoing Ph.D. research unfolded in the second semester of the first year of the MEDP specifically within the curricular unit of Project in Product Design II.. This subject, falling under the scientific domain of Design, demands a weekly commitment of 7 hours and awards students 12 ECTS.
The PDP II course is an evolutionary step from Project in Product Design I, emphasizing project development within a business context. The course structure has evolved since its inception, with refinements made particularly since the academic year 2017-2018 (Franqueira, 2022). Commencing with the establishment of connections and partnerships with various companies in the Aveiro region (limited to a maximum of 3 companies), the interactive process involves defining the project brief through collaborative adjustments between companies and teaching team.
Companies commit to 8 points of contact (4 in the classroom and 4 at the company), ensuring ongoing dialogue between students, companies, and teachers. The project unfolds over the semester, initiating with a research phase where students explore methodologies applied to the project. Students, paired in advance by teachers to ensure complementary skills, form groups of two or three students. Groups typically consist of students from different institutions, maintaining gender parity and diverse perspectives. The first class launches the briefs jointly presented by companies and teaching staff. Subsequently, students study the briefs and, within a day, rank their preferences for company collaboration.
To balance project distribution among companies, the teaching team assign student groups based on their preferences. Each company is allocated 6 to 8 students in accordance with the number of students enrolled in the subject. The classroom layout aligns with the companies, creating three major areas where students collaborate on projects and receive participatory and collective guidance. This arrangement facilitates effective time management when companies are present in the classroom.
The curriculum's timeline, shared with students and companies, outlines interaction and student visits to companies, along with scheduled classes where companies visit the university. This timeline, along with the project brief, is disseminated to students and companies.
The objectives of this curriculum unit include consolidating skills from PPD I, fostering students' interpretation of social, technological, and productive realities. Students are expected to develop the ability to communicate and articulate an individual discourse grounded in defining and executing

work programs and research phases. Autonomy in conceiving an original design brief and research methodology, along with writing a project brief, is also emphasized.
Evaluation is comprehensive and participatory, reflecting applied learnings, student commitment, attendance, and innovation capability. The assessment is comprising four elements: 1st phase (20%), 2nd phase (30%), 3rd phase (35%), and classroom participation (15%). Additional training opportunities are provided to strengthen ties between the academic and professional realms, involving workshops, real-life problem debates, on-site activities, and potential periods at companies.
The teaching methodology follows the Design Council's Double Diamond design diagram, structured in project phases: Discover, Define, Develop, and Deliver. The first two phases emphasize exploration and definition, while the latter two focus on development and execution. Evaluation remains participatory and pivotal, reflecting applied learnings, student commitment, attendance, and innovation. Additional dimensions, such as workshops and on-site activities, enhance the connection between academia and the professional domain.
The contents studied are tailored to selected projects, guiding students in defining work programs. Emphasizing diverse process approaches, including ethnographic, bibliographic, and laboratory practices, enhances the discovery and definition of the study object.
General content areas include research methods and process autonomy critical for project development are grounded in the axes of innovation and knowledge. Tools for analyzing and systematizing information in product design research, examination of market trends, benchmarking tools, concept narratives, and other communication instruments are integral to the curriculum.
The learning outcomes revolve around the programmatic content enabling students to acquire process knowledge for the initial stages of their project research. This involves aligning project specificity with research methods geared towards critical analysis and systematic information consolidation.

3. Results

Pedagogical Adaptability: Navigating Challenges in PDP II for the Academic Year 2020/2021

In the academic year 2020/2021, the second semester witnessed the enrollment of 27 students in the PDP II course, with one dropout during the period, resulting in 26 students actively participating. Among them, three students were part of the Erasmus+ program, requiring a tailored approach to teaching due to their foreign status. The practical nature of PDP II classes transitioned from digital to in-person format only on April 18. The module was facilitated by five teachers, each possessing distinct professional backgrounds related to industrial/product design.
Three Portuguese manufacturing companies collaborated with MEDP during the semester: Company A (coffee machines), Company B (wines and sparkling wines), and Revigrés (ceramic tiles). The distribution of students among these companies was meticulous, with 9 students assigned to Company A, 8 to Company B, and 9 to Revigrés. Teams were carefully formed, considering a mix of knowledge, genders, and skills, and briefings were chosen based on students' preferences.
Despite the challenges posed by the Covid-19 pandemic, which prompted the closure of physical university spaces initially, the teaching team adapted swiftly. The initial online classes evolved into a physical model when restrictions eased. Collaborative digital tools, notably Miro, were embraced by most teams for virtual collaboration.
Field trips, a key component of the syllabus, were disrupted, necessitating a shift to a virtual model for interactions with companies. The teaching team compensated by organizing online lessons and visits, fostering connections between students and real-world contexts. When the university reopened for in-person classes, PDP II was among the first to resume physical sessions.
Teaching activities commenced with comprehensive presentations of the course, including details about assessment, materials, and methodology. The involvement of company representatives in these sessions facilitated personal interactions with students, aligning with the course's emphasis on soft skills.
Over the subsequent sessions, students delved into characterizing their assigned companies, analyzing contexts, users, and products. Ethnographic research skills and critical thinking were paramount. A virtual company visit was organized to compensate for the suspension of physical visits.
The first set of activities culminated in formal presentations to the teaching staff, where students delivered comprehensive research characterizing both macro (users and market) and micro (company) scales. The progressive assessment considered the entire duration of work leading up to the submission, emphasizing qualitative evaluations.
The second assessment stage focused on refining the brief, argument, and project concept. A workshop at Design Factory Aveiro facilitated co-creation of the brief, fostering alignment between student goals and company expectations. This collaborative process provided companies with insight into ongoing projects.
The final assessment stage revolved around product development, with crucial interactions between students and companies to address technical uncertainties. The students, equipped with a nuanced understanding of their projects, presented detailed digital and analogue mock-ups, technical drawings, and a comprehensive descriptive report.
Throughout the process, the close relationship between students and teachers, facilitated by continuous monitoring and digital communication, ensured a supportive learning environment. The collaboration between teachers and companies, mediated by specific teaching team members, maintained a streamlined flow of information. Openness, collaboration, availability, and adaptability defined the interactions among teachers, students, and company representatives.



Project Milestones

March 11, 2021
Programme presentation.
Communication of group members and selection of projects.

March 16/18, 2021
Identification and characterisation of the context, users and similar products.

March 23/25 and April 06/08, 2021
Product characterization of the manufacturing company and its competitors. Manufacturing technologies and characterisation of the company.
Follow-up of the research.
Company visit (???).

April 13, 2021
Presentation to the teaching staff and companies (space: classroom): characterization of the company.
Delivery of the research which aims to create a theoretical and visual body characterizing the macro (users and market) and micro (company) scale related to the typology(s) of product(s).
Delivery elements:
- Digital presentation with a maximum duration of 10 minutes;
- Characterisation of the company (location, number of employees, products, production technologies, history, etc.);
- Identification and assessment of the organization's structure potentialities and capabilities;
- Characterisation of the typology of products;
- Identification and analyses of manufacturing processes;
- Contextualisation of the space and identification of the organisation's position in the market and its competition;
- Market trends and similar products/competitors.

April 15/20, 2021
Project follow-up;
Brief definition.

April 22, 2021
Brief definition with the companies (space: DFA).

April 27, 2021
Brief presentation and argument prospection;
Presentation elements:
- Digital presentation with moodboard and project brief.

April 29 and May 04, 2021
Project follow-up;
Definition of argument and concept.

May 06, 2021
Presentation of the argument to the teaching staff and the company (space: classroom).
Delivery elements:
- Digital presentation with the product scenario;
- Characterisation of the potential contexts of use;
- Characterisation of the user, its particularities and needs.
- Interaction with the company.

May 11/13, 2021
Project follow-up. Product development..

May 18, 2021
Project follow-up. Product development..
Scenario building.

May 20/25, 2021
Project follow-up: Product development status - drawings and schemes;
scenario building.
Visit to companies (to clarify technical doubts).

May 27 and June 01, 2021 . Design Sprint?
Progress report; project follow-up.
Three-dimensional representation of objects, mock-ups (low-fi mock-ups).
Development of mock-ups (cardboard, roofmate, plasticine, etc.) - scale 1:1.

June 08, 2021
Progress report: Context of use and prototyping
Delivery:
- Drawings with technical indications by hand (minimum 5).

June 15, 2021
Technical follow-up (production).

June 17, 2021
Validation of context of use.
Interaction with the company (space: classroom).

June 22, 2021
Project follow-up.
Detailed drawings and prototypes.

June 24, 2021
Project and pre-delivery follow-up.

Exame (date to be confirmed)
Final delivery.
Presentation.

Elements for delivery:
- Digital presentation in free multimedia format (6 minutes);
- Analogue mock-up with simulation of materials, colours, etc;
- Virtual mock-up simulating materials, colours, etc. (3D digital modelling).

Dossier with:
- Contextualisation and characterisation of the product(s) and its use;
- Technical drawings (maximum 4);
- Product development drawings (minimum 10);
- Images of the product in use;
- Descriptive report (maximum 200 words).

Figure 1. Timetable for the organization of Project in Product Design II classes and the teachers involved
(academic year 2020 to 2021)

Revigrés MEDP Briefings: Fostering Innovation with Smart Tiles

In the academic year 2020/2021, the PDP II curricular unit engaged 26 students, collaborating with three companies, including Revigrés. The research team, comprising the doctoral student, supervisor, and company liaisons (CEO, Operations Director, and Head of R&D), defined two briefings for Revigrés. The first challenge involved the development of Smart Tiles, focusing on creating ceramic tiles for indoor and/or outdoor spaces with technological features to enhance user comfort and well-being. The second briefing centered on Revigrés Point of Sale Displays, encouraging the design of displays for Revigrés products in sales spaces and specialty fairs. Considering the participation of three companies and the number of students, the second proposal was excluded based on student project preferences.

Aligned with the doctoral proposal's scope for developing multi and plural-functional products, the Smart Tiles briefing emphasized creating intelligent tiles with a profound connection to the environment and user interaction. The project's main objectives encompassed the design and development of ceramic tiles incorporating technology, emphasizing creativity and innovation to add value to Revigrés in national and international markets. The acquisition and application of research methods and process autonomy were integral to the project's critical development, grounded in scientific and experimental research and industry collaboration.

ME :DP MESTRADO EM ENGENHARIA E DESIGN DE PRODUTO

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2020/21

revigres

REGENT
TERESA FRANQUEIRA

TEACHERS
AFONSO BORGES
ALEXANDE KUMAGAI
GISELA PINHEIRO
PAULO NEVES

Project in Product Design II

REVIGRÉS PROPOSAL
SMART TILES
Collaboration between Revigrés and the Master in Product Engineering and Design, University of Aveiro

The aim of the project is to design ceramic tiles for wall and/or floor to be placed in indoor and/or outdoor spaces, with technological functions that foster the comfort and well-being of the user.
The proposal must have a special attention to the relationship between the product and the environment where it is embedded, as well as, its interaction with users and the inclusion of technology.

The project has as main objectives:
- design and development of ceramic tiles that incorporate technology, taking into consideration factors such as creativity and innovation to generate added value for Revigrés national and international markets.
- acquisition and application of research methods and process autonomy in the critical development of the project, structured on the basis of scientific and experimental research and collaboration with industry.

Assignments to be developed:
- Analyse and characterise the Revigrés manufacturing unit - list competencies, opportunities and constraints, technological capabilities and find ways to enhance differentiating elements;
- Research products and identify the specific industrial processes of Revigrés, as well as technological components that can be integrated in the company's ceramic products;
- Analyse similar products (national and international), respective companies and markets;
- Definition of the argument (narrative, users, spaces, technology, materials, marketing, etc.);
- Developing scenarios through the characterisation of defining elements, such as: product typology, cultural context, user-type, technologies and materials, constraints and specificities, identifying opportunities and projectual intentions, etc;
- Definition of the proposal's technical and production specifications;
- Drawings for prototype making, usability tests and productive optimisation.

Figure 2. Sample of an individual exercise sheet of Project in Product Design II for the brief established in partnership with Revigrés
(academic year 2020 to 2021)

Key milestones in the project included analyzing and characterizing the Revigrés manufacturing unit, identifying competencies, opportunities, constraints, and technological capabilities. Researching products, understanding specific industrial processes, and identifying integrable technological components were crucial. Analyzing similar products on a national and international scale, examining respective companies and markets, played a pivotal role. The definition of the project's argument, encompassing narrative, users, spaces, technology, and materials, was a significant step.
Developing scenarios involved characterizing defining elements such as product typology, cultural context, user types, technologies, materials, constraints, specificities, and identifying opportunities and project intentions. Further steps included defining the proposal's technical and production specifications, creating drawings for prototype development, conducting prototypes, usability tests, and optimizing production processes.

Insights gained for the ongoing Ph.D. research

Integrated into the referred ongoing Ph.D. research, the pedagogical exploration described in this article underscores parallelisms between the educational responsibilities of the teaching team and the strategic leadership of the CDO highlighting the interconnected nature of design education and industry innovation.
Also, PDP II multifaceted *framework* that aims to outline a holistic and industry-responsive design education approach reveals critical insights.
The educational role of the CDO aligns with the responsibilities of the teaching team in guiding and adapting to the needs of their respective domains. Just as the teaching team navigates the challenges of the pedagogical landscape, the CDO adapts and guides design teams to meet organizational circumstances dynamically. Both entities play a pivotal role in steering their respective domains through the uncertainties of external factors, such as the challenges posed by the COVID-19 pandemic.
Furthermore, the teaching team and the CDO act as bridges, connecting different realms to achieve common objectives. The teaching team bridges the needs of educational students with the expectations of the collaborating companies, ensuring that projects align with both educational goals and industry requirements. Similarly, the CDO acts as a diplomatic bridge, preserving and nurturing relationships between design teams and stakeholders, and aligning innovation initiatives with the strategic goals of the organization.
The preservation and nurturing of relationships emerge as a common theme, where both the teaching team and the CDO contribute to maintaining strong connections. The CDO is instrumental in preserving relationships with internal and external organizations, ensuring ongoing collaboration and mutually beneficial partnerships. The teaching team fosters relationships through personal interactions in-class sessions, providing a platform for aligning student and company goals.
Innovation alignment with strategic goals is another key insight gained. The CDO, as a design leader, ensures that projects emphasize creativity, innovation, and value addition to companies, aligning with their strategic objectives. The teaching team, in parallel, establishes a bridge between academia and industry, defending the educational process and students' learning goals while aligning projects with companies' pronounced objectives.
Strategic tool selection for product range extension is a shared responsibility, where the CDO serves as a strategic leader in identifying and implementing the right tools and methodologies. This aligns with the teaching team's role in educating students on design tools, methodologies, processes, and mindsets, ensuring a well-rounded understanding of the tools needed for successful project execution.
Leadership in team dynamics and collaboration is a common thread, emphasizing the importance of effective leadership in both educational and industry settings. The CDO plays a pivotal role in leading and nurturing design teams, fostering a collaborative environment that encourages creativity and innovation. Similarly, the teaching team emphasizes effective communication and collaboration within the design team, extending to external partnerships with educational institutions, research centers, and industry collaborators.
The overarching theme is the CDO serves as a bridge for holistic innovation. This involves not only the transfer of knowledge but also the cultivation of a dynamic and collaborative ecosystem that stimulates innovation. The CDO's strategic parallelism with the teaching team's role in the educational process aims to bridge the gap between theoretical insights and practical industrial needs, creating a seamless transition from project development to the materialization and testing of prototypes.
In conclusion, the insights gained from the ongoing Ph.D. research highlight the intertwined nature of design education and industry innovation, with the CDO playing a central and transformative role in shaping a holistic approach that aligns with the needs of both realms.

Insights gained for Revigrés

Revigrés emerges as an innovative company that not only leverages strategic collaborations and adapts to challenges but also shows that can place a strong emphasis on opening possibilities for design-driven innovation.
Innovation through education, in the context of this Ph.D. research, stands out as a defining feature of Revigrés' approach. The collaboration with the MEDP program from the University of Aveiro exemplifies Revigrés' commitment to multifaceted innovation. Engaging with students in the PDP II course, the company not only contributed to the academic development of future designers but also infused fresh perspectives and innovative ideas into its product development process. This educational

collaboration served, within this research as a dual-purpose initiative, nurturing emerging talent while simultaneously driving innovation within the company.
On the other hand, the strategic collaborations with educational institutions, notably the MEDP program, highlight Revigrés' proactive approach to addressing design challenges. By strategically partnering with academia, the company gains access to a pool of creative solutions and facilitates a dynamic exchange between students and industry professionals. This collaboration fosters an environment of continuous learning and adaptability, ensuring that Revigrés remains at the forefront of innovative design practices.
Revigrés' adaptability amid challenges, demonstrated during the academic year 2020/2021, showcases the company's resilience and commitment to collaboration despite external disruptions. With the research team ability to navigate obstacles, such as the impact of the COVID-19 pandemic, underscores Revigrés' dedication to its partnerships and determination to overcome challenges for the sake of continued innovation.
A key aspect for Revigrés involves the expansion of its product range, exemplified by the Smart Tiles project. By integrating technological features into ceramic tiles, students offered Revigrés a set of four multi and pluri-functional concepts that align with market trends and this Ph.D. goals. The four of concepts have potencial to position the company as an innovator, extending its offerings beyond traditional aesthetics and embracing cutting-edge solutions that meet the evolving needs of consumers.
In summary, with these partnerships, the Revigrés' innovative trajectory described in this article is characterized by strategic collaborations, adaptability, and a commitment to education-driven innovation. The study of the CDO's strategic role in guiding a company aligns with these principles, opening new possibilities to ensure that Revigrés stands as a leader in the ceramic industry through continuous innovation and a forward-thinking approach.

4. Discussion

Fostering Design Synergies: Exploring the Teacher's Role and CDO Parallels in Academia-Industry Collaboration for Holistic Innovation

The collaboration between academia and industry within the MEDP program yields significant insights into the pedagogical dynamics and educational outcomes for design students. The relationship between the results and the original hypothesis, focusing on the adaptability of the pedagogical approach and the successful integration of real-world challenges, aligns with the central assumption of the research. The seamless blend of academia and industry, guided by CDOs and teaching teams, supports the hypothesis that such collaborations are essential for a holistic and industry-responsive design education.
Pedagogical adaptability in challenging times, exemplified during the 2020/2021 academic year, demonstrates the resilience of the teaching team. The integration of online and in-person formats, coupled with the use of collaboration tools like Miro, showcases the adaptability required in the contemporary educational landscape. This adaptability aligns with the multifaceted role of CDOs, who, like teaching teams, need to navigate and guide design teams through organizational circumstances in both present and future scenarios.
The collaboration with companies, such as Revigrés, underscores the importance of strategic partnerships in design education. The meticulous distribution of students among collaborating companies, the involvement of company representatives in-class sessions, and the emphasis on soft skills mirror the diplomatic and relationship-building roles of CDOs. The CDO's influence in managing relationships between academia and industry partners is mirrored in the collaborative efforts to foster effective communication, understanding, and a dynamic exchange of ideas.
The insights gained from the Revigrés MEDP briefings and the four projects obtained highlight the practical application of design concepts in real-world scenarios. The emphasis on aligning projects with the development of multi-functional products, creativity, innovation, and value addition to the industry aligns with the CDO's role in fostering innovation and achieving strategic goals. The strategic tool selection for product range extension, as guided by the CDO, resonates with the deep understanding of design tools, technologies, and methodologies showcased in student projects.
Evaluation and feedback on projects echo the importance of continuous improvement and align with the CDO's responsibility to ensure that design results are perfectly aligned with strategic company goals. The emphasis on imbalances in teamwork and communication as areas for improvement aligns with the CDO's leadership in team dynamics and collaboration, where effective communication and collaboration within the design team are paramount.
The outcomes of student projects, not only demonstrate innovation but also highlight the interdisciplinary nature of some projects. While the evaluation poses challenges, it reflects the teachers role in bridging the gap between theoretical insights and practical industrial needs. Similarly, the CDO serves as a bridge between academia and industry, ensuring that educational initiatives are aligned with industry needs and strategic innovation goals.
The discussion integrates these results with previous studies, emphasizing the transformative nature of the educational strategy. The unexpected results, such as the challenges in evaluating interdisciplinary projects, lead to hypotheses for further exploration, possibly through revised evaluation criteria or interdisciplinary collaboration *framework*s. The role of teachers, identified as influential in student projects, aligns with the CDO's influence in guiding design teams, emphasizing the critical role of mentors in shaping the educational and professional journey of design students.

In conclusion, the collaboration between academia and industry, guided by CDOs and teaching teams, significantly contributes to a holistic and industry-responsive design education. The insights gained from this collaboration align with the original hypothesis, showcasing the importance of adaptability, strategic partnerships, and the practical application of design concepts in real-world scenarios. The discussion serves as a foundation for further exploration and refinement of the collaborative educational model, emphasizing the pivotal role of CDOs and teachers in shaping the future of design education.

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