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EDUCATING DESIGNERS TO SUSTAINABLE INNOVATION. A REFLECTION ON THE CONTRIBUTION OF DESIGN IN PROJECTS WITH SOCIAL AND ENVIRONMENTAL IMPACT

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Abstract

Design for sustainability is not necessarily a new subject. Research and studies about it rapidly increase, given the current conditions of the planet and the way lifestyles, production and consumption continually move towards unsustainability. The concept, which was initially treated as a design specialty with ecological concerns, has today a broad theoretical and practical scope, recognizing the important role of users, communities, and society in general. Thus, designers are increasingly expected to have more than technical skills. Existing methods and tools taught at universities, and applied to design practice, are currently challenged by the global changes that affect the planet, by transforming the role and responsibility of designers in building a more sustainable and inclusive material reality. With this scenario, universities play an important role on training professionals rather than just researchers, highlighting the need for teaching methods and processes focusing on preparing designers for the complexity of the contemporary world. In order to bring students closer to this new reality, a module was developed within the Master Program in Product and Industrial Design (MDIP) of University of Porto, in which, by applying the Project Based Learning methodology, students were confronted with a real problem and challenged to create innovative solutions on an experimental basis. The We Won't Waste You initiative, presented as a challenge to the students, is a social design project developed in the Design Studio FEUP, in partnership with the City Council of Matosinhos, which aims, through design, define strategies to transform waste into raw materials for objects to be produced by vulnerable social groups. The students, organized into teams, were responsible for all project management, and had the opportunity to share knowledge and learn from each other. The challenge of balancing the social, environmental and technical concerns was supported by the application of methods and tools suggested by the professors, who also played the role of advisors, encouraging discussions and suggesting appropriate tools.
This paper presents a case study of this project, followed by a brief analysis of the applied methods and tools, and the results of a survey with the students. To conclude, the final considerations are presented, aiming to indicate new questions to be addressed, in order to encourage academia to respond to global challenges, rethinking the role of design for sustainable innovation.

Keywords: *Project based learning, design research and education, design for sustainability, sustainable innovation, social design.*

1. Introduction

The planet goes through a time of intense transformation. Economic growth and an increasing production acceleration have faced imminent resource depletion, loss of biodiversity and the deterioration of the life-giving support provided by global ecosystems (Fuad-Luke 2009). According to Manzini (2008), the transition towards sustainability requires a systemic discontinuity, which will represent a process of social learning where human beings should gradually learn to live better by consuming less and regenerating the quality of the environment in which they live. For this reason, it is increasingly important to encourage innovation. It is necessary to find creative solutions with the least possible impact, capable of leading humanity in this transition process. According to Thackara (2005), the challenge of sustainability is a matter of design. Eighty percent of the environmental impact of the products, services or systems around us is determined at the design stage. Thus, the designer can help to reverse this tendency, and to promote that the culture of sustainability in the university turns into a strategic action searching of a perspective change in future designers' mindset.

2. Project based learning

The issues related to the essential skills that designers need to develop to act in contemporary society are increasingly addressed by various authors (Margolin 1998) (Thackara 2005) (Christian Wahl and Baxter 2008), (Krucken 2008). All point to a new design thinking, which implies seeing the product (or tool, or transport device, or building, or city) as a meaningful link between man and the environment (Papanek 2005). In this sense, the importance of a learning environment that offers opportunities for experimentation through this new sustainable approach is emphasized in design education, and is highly interactive, providing relevant feedback to the student.

Considering the importance of the thematic, the Master's program in Product and Industrial Design of the University of Porto (MDIP) is a course based on the methodology of Project Based Learning (PBL). The program is based on integrated curricular units through which the students develop several projects simultaneously, always having real companies as clients. Students, organized in groups and with the teachers' guidance, have the opportunity to face real problems. This creates good learning conditions as it involves both individual and co-operative activities, interactive discussions, theory and practice. During this process the students can develop, besides the professional capabilities, their personal skills, like cooperation and management (Graaff and Kolmos 2003).

Whereas the interaction and partnership processes are considered as great potential for innovation (Krucken, Mol, and Mouchrek 2016), the importance of collaborative approaches in design teaching promoted by the PBL methodology becomes clear. The role of the teacher, in this scenario, is that of guiding, promoting experimentation, strengthening strategic thinking and suggesting appropriate tools, in a innovation driven program (Krucken and Mol 2014).

3. Design methodologies

Design methodologies are based on tools to stimulate the creative process in different ways for new products' development. Scholars have organized ways and techniques along the history, aiming to structure the development process in order to achieve efficient results, framing design as an almost accurate tool that requires the use of creative skills as well as organizational and analytical skills in problem solving (Munari 1981), (Baxter 2011), (Löbach 2001), (Bürdek 2010). In recent years, new sustainable approaches have been increasing emphasis in the world context: Participatory Design, Co-Design, Slow Design, Metadesign, Inclusive/Universal Design (Fuad-Luke 2009), User-centered design (IDEO 2011) and others, in attempt to reformulate the theory and practice of design, reinforcing the environmental and social sustainability awareness (Manzini 2008). The proposal is not a complete change in the way design works, but the goal is for designers integrating business needs with society and environment concerns. The selection of methodology and the combination of tools to be used in the project depends on the problem's complexity and nature, and the ability to decide which methodology to use in each situation, in order to obtain the best results, should be part of the designer's training (Bürdek 2010). To deepen these reflections about the design practice and the learning processes of design, focused on training specialists aware of this new role, the following case study describes a project carried out in the academic field, where the students were confronted by a real project.

4. Case study

This challenge describes the product development for "We Won't Waste You" project, a partnership between ADEIMA - Association for the Integrated Development of Matosinhos and Design Studio FEUP. The purpose of this workshop is, through design strategies, to transform wastes from the industry and local commerce in raw material for objects to be produced by vulnerable social groups. The project is based on three pillars of innovation: social, environmental and technological (Figure 1).

Figure 1. The "We Won't Waste You" project innovation pillars.

The achievement of a positive social impact occurs through the involvement of a group of socially vulnerable people from the council, in a training program for development and manufacture of products, thus generating an income that allows a social re-inclusion of those involved. The environmental impact is achieved through the use of waste as raw material that aims to extent the materials' life cycle and reduces waste, and the technological innovation through the university's participation in research and product development by students and teachers, as described in this case study.

This challenge has been applied to the students of the same course, in the past years of 2016, 2017 and 2018. Several products were developed using as main raw material, wastes from the Matosinhos city, such as fishing nets (Monteiro et al. 2016), eggshells, plastic caps, algae (Fernandes et al. 2018), coffee grounds (Canavarro, Rangel, and Alves 2016), among others. The present case study was developed in the context of the Design Project subject with the first-year students of the MDIP. The activities took place from August/2018 to January/2019, amounting to a workload of 32 hours devoted to lectures and tutorials. The actors were two guiding teachers, one researcher as assistant and thirty-eight students with diverse backgrounds and professional experiences. The briefing was the development of products for the WWWY project, having as requirements: 1 - use at least 90% of recycled materials, wasted materials from the municipality itself; 2 - present a concept that values the history, culture and territory to which it belongs, in addition to the social responsibility represented by the initiative, and 3 - being manufactured through simplified processes, to allow the future production in the workshop of the "We Won't Waste You" project. The products were developed during one semester and at the end of this period were presented to all the partners enrolled.

5. Methodology

The activities were organized in three phases: 1 - diagnosis and theoretical foundation, 2 - research and definition of the concept, 3 - development. Throughout the project development, teachers' role was creating a learning environment based on reflections and experimentation, following the guidelines suggested by Hansen and Jensen (Kolmos et al. 2008) for a successful facilitation: focus on optimizing communication among students, encouraging reflections, introducing communication diagrams and participating in project design. The first two classes were adressed to collaborative activities, through presentations about the target groups, context and materials' research made by the teams to the whole group. On the following meetings, individual sessions by team were made, in which the professor, an environmental engineering specialist and an assistant researcher took turns offering references, stimulating discussions and pointing out directions.

5.1. Phase 01 - Diagnosis and theoretical basis

In the first phase, the students focused on analyzing the city's context (historical, environmental, cultural aspects), available materials (wasted from industry and local commerce), and the target public. The main objective of the diagnosis phase was drive students to explore the context and identify opportunities through research. This phase also included lectures, presentation of methodologies and design tools. At this stage, the Empathy Map (Osterwalder and Pigneur 2011), Personas (R. Floyd, Jones, and Twidale 2008) and Moodboards (Bürdek 2010) support the definition of specific target profiles.

5.2. Phase 02 - Research and concept definition

Some teams, focusing on user needs, have choose to deepen analyzes about needs and habits through observation surveys and interviews (Carmo and Ferreira 2011). Other teams, focusing on the reuse of materials, intensified their research about it. In this phase, the Material Driven Design methodology (MDD) (Karana et al. 2015) was presented to the students, suggesting intense experimentation, not only considering material's technical properties, but also aiming to understand how it is perceived by the people, how people react to it, as well as the 'MET Matrix', an environmental impact analysis tool for an overview of environmental priorities and that does not require a high degree of accuracy (AEP 2013).

5.3. Phase 03 - Development

The third phase concerned the materialization of the concept, product development, prototyping and communication, as well as the validation of results, ensuring that all the briefing requests were considered. At this stage the students applied the "Value star" tool (Krucken 2009), which provide dimensions for evaluating the quality of products and services, assisting the designer in the construction of the product experience.

6. Results and challenges

The PBL approach organizes learning around a problem and is accomplished through the development of a project. This is a central principle to increase student motivation (Kolmos et al. 2008).

The challenge is a starting point, and students work on a single task, performing complex problem analyzes and outlining their own problem-solving strategies. The theory-practice relation happens as the theory is used in the analysis of real-life problems and empirical methods are applied in solving these problems.

In this case study, it was possible to realize how the accomplishment of the methodological exercises made possible different project approaches. The exercises Empathy Map, Persona and Moodchart were important drivers for the Luza (Figure 8), Cinzé (Figure 1), Traineira (Figure 4), and Quibom (Figure 7) projects, which have in common a concept built around a single user profile, resulting in products that try to meet a specific need, focusing on usability. The phase of materials' experimentation, guided by the MDD methodology was fundamental for the Escama (Figure 5) and Poisson (Figure 3) projects. In these cases, the product concept was structured from the materials' tests and experimentations. Both are good examples of material driven design projects.

Figures 2 to 10. Products developed by students (Source: courtesy of the authors).

7. Survey with students

After completing this process, a survey was held with the group of students of this course, in order to evaluate the level of enrolment and interest provided by the proposed activity. The questionnaire was applied digitally through online form. Twenty eight students (out of 38) participated on the survey (74%). Of this sample, 68% are female and 32% are male, 93% are between 21 and 30 years and 7% above 31 years. Most of students (70%) are graduated in design and its different areas, 10% in architecture and 7% in engineering. Regarding professional experience, 37% never had professional experience with design. Regarding specific design skills, empirical academic knowledge predominates in the group.

The results show that to be involved with a real problem helps the student to get involved and to be motivated. All the interviewees considered the possibility of seeing the final product manufactured as "very interesting". Being in contact with a real customer and the contact with suppliers and real experts was highlighted by 93%. The greatest difficulties listed were time management (64%), prototyping (54%) and team management (43%). Regarding the learning perception, students pointed some project phases that brought them knowledge and skills they did not have previously: to develop a project with social/environmental approach (68%) and material tests in laboratories (68%). 71% of students cited as main motivation the possibility of cooperating with an environmental action. Regarding theoretical and practical learning levels, 38% did not know and 29% had only theoretical knowledge about the used design methodologies (Empathy Map, Moodboard, MDD, Values Star, MET Matrix). On this experience, they had the opportunity to apply them in a real case for the first time. Among them, the MDD, the Empathy Map and the MET Matrix were the least known.

8. Final considerations

Considering the importance and urgency of the transition towards sustainability, and the need to rethink design to cooperate with the construction of this new way of life, it is fundamental to educate new aware and engaged professionals to this new reality. To do so, this research looks for methodologies to sensitizing and raising awareness among students, who may act in the future as connectors and facilitators, quality producers, and designers as catalysts for change (Fuad-Luke 2009). According to Papanek, no environment can strongly affect a person unless it is strongly interactive. To be interactive, the environment must be responsive, that is, must provide relevant feedback to the learner (Papanek 2005). In this activity, the use of the PBL methodology was fundamental to provide great involvement and extra motivation, as it allows the students themselves to establish project objectives and means to reach them. The tutors offered tools and a safe orientation, but the self-management of the teams was crucial for the fundamental personal skills development to a future good performance. The positive experience evaluation as well as the indicators of knowledge improvement and increasing environmental and social components valorization in design practice point to the necessity of new studies in the same line of research, thus seeking to contribute to the academy in training designers for sustainable innovation.

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