INTERNATIONAL DOCTORATE in ARCHITECTURE AND URBAN PLANNING

Cycle XXXV

IDAUP Coordinator Prof. Roberto DI GIULIO

Thesis Title

DEVELOPMENT OF A MODEL FOR THE PROJECTION OF OBJECTS WITH ETHICAL RESPONSABILITIES AND SOCIAL INNOVATION BASEDON THE SOCIAL –CULTURAL AND GEOGRAPHICAL CONTEXT

Curriculum Architecture / 1.2 Inclusive design, design for all, accessibility to spaces, products and services, sustainable design (SDS: ICAR/13 Disegno industriale)

Candidate	**Supervisor DA** / POLIS
Ivonne, ORTIZ SÁNCHEZ	Prof. Giuseppe, Mincolelli
_____	_____

(UniFe Matr. N. 158296)

(Polis Univ. Reg. N. PL581N080020)

Supervisor DA / **POLIS**

Prof. Gjergji, Ikonomi

_____

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To Martha, my mom, who has taught me to follow my dreams and never give up.

In loving memory of my father, Nelson Ramiro, a warrior who fought with immense faith to improve the world.

To Carlos, my partner/husband, who is an example to learn, investigate and explore the world.

To Cristina and Martina, my sister and niece, who believe in me and always support me.

To Claudia, my dear friend, thank you for the support and strength that you have always given me to fight for an ethical and just world.

IV

Abstract (English)

Design is a young discipline that has mainly developed its practical area (project) by incorporating methodologies, methods, and tools in professional work, with the resulting product/object/artefact. On the other hand, the research and teaching areas of the discipline have gradually been constructed, and there is still much ground to cover. The purpose of this research is to delve into the field of design education. However, research and product development are not separate from this, nor is the object.

This doctoral research develops a teaching model for the projection of socially responsible products with social innovation in the Ecuadorian context. This proposal arises because Ecuador is a country with immense possibilities for growth, yet it faces significant political, economic, and productive problems since the last century. To improve this situation, National Development Plans (NDP) have been created, which promote state policies for the transformation of the country's production matrix, with the teaching of Design falling under the umbrella of Higher Education.

It has also been identified that the discipline of Product Design has had little impact in the country due to a lack of connection with the state and the limited existing industry. However, it has the potential to integrate itself into state policies through NDP, with the development of products, services, systems, processes, and experiences. Therefore, it is necessary to consider training designers with a responsible approach in the development of projects that promote innovation and social improvement.

After presenting the context and state policies, the research delivers and in-depth analysis into the development of the profession in the country. Design, according to the country's development, also emerged late, first in the professional field and later in the academic field. Therefore, the Product Design Program of the Faculty of Architecture, Design and Arts (FADA) at the Pontifical Catholic University of Ecuador (PUCE) has been taken as a case study for teaching design. It is one of the first references in the country for the teaching of Design, with the school starting in 1994, and four processes have been constructed during the past 28 years. The first three are based on the principles of modern design, focused on form, function, and production. They are characterised by a projective development of the black box that goes hand in hand with experimental teaching processes.

This doctoral research proposal focuses on the fourth process, which responds to the principles of postmodern and contemporary design, focused on the user, sustainability, and incorporating the projection of the immaterial and intangible through new technologies and forms of communication.

The model's development is structured with: (i) Pedagogy, which incorporates concepts of Cognitivism, Ignatian Pedagogical Paradigm, Kolb's experiential learning, Project-based Learning, challenges, and problems. All these educational processes coincide with the innate design processes, emphasising the importance of learning in context and with experiences in real spaces. (ii) Methodology, based on the cyclical process of knowledge construction and the projective process. (iii) Content, developed by a specific subject, in this case, the User-Centred Design Workshop, delves into the concepts that build this model of thought and brings students closer to reflective and responsible product development. (iv) Reflection and teaching action methods that promote the learning process and knowledge construction, among others.

After developing the proposal, the research collects the application and results obtained during five academic periods to evaluate, reflect, and conclude.

Keywords: product design, project, teaching model, methodology, user-centered design.

Abstract (Italian)

Il Design è una disciplina giovane che ha incentrato lo sviluppo nella sua area prattica (progetto) incorporando metodologie, metodi e strumenti nella professione, e il prodotto/oggetto/artefatto come risultato di quella attività. Dall'altro canto, invece, le aree di ricerca e insegnamento della disciplina sono state costruite piano piano e ancora c'è strada da percorrere. L'obbiettivo della ricerca che si presenta nelle prossime pagine e l'approfondire nel campo dell'insegnamento del Design, ma, senza scollegarlo della ricerca e lo sviluppo del prodotto, e anche dell'oggetto in sé.

La ricerca dottorale che si presenta, sviluppa un modello d'insegnamento per la progettazione di prodotti innovativi con responsabilità sociale nel contesto Ecuadoriano. Questa proposta nasce dal fatto che l'Ecuador è un paese con immense possibilità di crescita, ma allo stesso tempo afflitto da problemi legati all'economia, alla situazione politica e produttiva, i quali vengono portati in avanti dal secolo scorso. Con la finalità di combattere le problematiche anteriormente elencate si sono generati i Piani di Sviluppo Nazionale (Planes de desarrollo Nacionales - NDP) i quali promuovono politiche statali per favorire la trasformazione della matrice produttiva del paese. Questi piani includono il sistema di Educazione Superiore (Università) nel quale s'inquadra l'insegnamento del Design.

Come parte della ricerca condotta, è stato possibile identificare che l'inserzione del Product Design nel paese è stata quasi nulla per mancanza di collegamento con enti statali e la industria, anche se quest'ultima è quasi inesistente ma ha le capacità e potenzialità d'integrarsi alle politiche statali attraverso i NDP. Per raggiungere quest'obbiettivo, si deve pensare alla formazione di designers con approccio responsabile alla costruzione di progetti con responsabilità sociale focalizzati nello sviluppo di prodotti, servizi, sistemi, processi ed esperienze.

Una volta specificato e presentato il contesto e le politiche statali, la ricerca approfondisce nello sviluppo della professione nel paese. Il Design nell'Ecuador compare tardivamente, prima nel campo professionale e poi nell'accademico. In questo contesto, si è preso come caso di studio alla laurea in Product Design della Facoltà di Architettura, Design e Arti (FADA) della Pontificia Università Cattolica dell'Ecuador (PUCE) visto che è uno dei primi referenti in quanto all'insegnamento e funziona ininterrottamente dal 1994 consolidando quattro processi(curricula) di formazione durante questi 28 anni. I primi tre processi si sono basati nei concetti del design moderno incentrati nella forma,

funzione e produzione e si sono caratterizzati per uno sviluppo progettuale di "scatola nera" collegati a processi d'insegnamento esperimentali.

La proposta principale di questa ricerca dottorale si concentra nel quarto processo, il quale risponde ai concetti del design postmoderno e contemporaneo incentrati nell'utente, la sostenibilità e include la proiezione dell'immateriale e non tangibile attraverso l'uso di nuove tecnologie e forme di comunicazione.

Lo sviluppo del modello è strutturato con: Pedagogia (i), la quale include concetti del cognitivismo, il Paradigma Pedagogico Ignaziano, l'apprendimento esperimentale di Kolb, l'apprendistato attraverso progetti, sfide e problemi; questi coincidono nell'importanza d'imparare immersi nel contesto ed esperienze sviluppati in spazi reali e, finalmente, corrispondono ai processi innati del Design. Metodologia (ii) basata nel processo ciclico di costruzione della conoscenza e del processo progettuale. Contenuti (iii) sviluppati per soggetto specifico, in questo caso il Laboratorio di Design incentrato nell'utente, dove si approfondisce nei contenuti che costruiscono il modello di pensiero e con l'obbiettivo di avvicinare lo studente allo sviluppo responsabile di prodotti attraverso l'uso della riflessione. Processi di riflessione e azione che partono dall'insegnate (iv) che promuovono il processo di apprendimento e la costruzione di conoscenze, ecc.

Finalmente, una volta sviluppata la proposta metodologica, la ricerca si centra nell'analisi dei dati raccolti durante l'applicazione della stessa, e per un periodo di cinque periodi academici, con la finalità di valutare riflessivamente i risultati e arrivare a delle conclusioni sulla sua applicazione.

Parole chiave: product design, progetto, modello didattico, metodologia, design centrato sull'utente.

Abstract (Spanish)

El Diseño es una joven disciplina, que ha desarrollado mayoritariamente su área practica (proyecto) incorporando metodologías, métodos y herramientas en el quehacer profesional; y el producto/objeto/artefacto como resultado de esta actividad. Por otro lado, las áreas de investigación y enseñanza de la disciplina se han ido construyendo poco a poco y aún hay mucho camino por recorrer. El propósito de esta investigación es adentrarse en el campo de la enseñanza de diseño, sin embargo, la investigación y el desarrollo del producto no están desligados de esta; así como tampoco el objeto.

Esta investigación doctoral desarrolla un modelo de enseñanza para la proyección de productos responsables con innovación social en el contexto ecuatoriano. Esta propuesta nace de que el Ecuador es un país con inmensas posibilidades de crecimiento, sin embargo, acarrea grandes problemas políticos, económicos y productivos desde el siglo anterior; para mejorar esta problemática se ha generado los Planes de Desarrollo Nacionales (NDP) que promueven políticas estatales para la transformación de la matriz productiva del país, parte de este cambio involucra el sistema de Educación Superior en el cual se enmarca la enseñanza del Diseño.

También, se ha identificado que la inserción de la disciplina de Diseño de Productos en el país ha sido casi nula por la falta de ligación con el estado y la poca industria existente, sin embargo tiene la capacidad de integrarse a las políticas estatales a través de los NDP, con el desarrollo de productos, servicios, sistemas, procesos y experiencias; por lo que es necesario pensar en la formación de diseñadores con un enfoque responsable en el desarrollo de proyectos que impulsen la innovación y la mejora social.

La investigación después de presentar el contexto y las políticas estatales; se adentra en el desarrollo de la profesión en el país. El Diseño de acuerdo al desarrollo del país también aparece tardíamente, primero en el campo profesional para más tarde aparecer en el campo académico por lo que se ha tomado a la Carrera de Diseño de Productos de la Facultad de Arquitectura, Diseño y Artes (FADA) de la Pontificia Universidad Católica del Ecuador (PUCE) como Caso de Estudio ya que es uno de los primeros referentes en el país de la enseñanza en diseño, la escuela inicia en 1994 y durante estos 28 años se han construido cuatro procesos. Los tres primeros basados en los postulados del diseño moderno centrados en la forma, la función y la producción; se caracterizan por un desarrollo proyectual de caja negra que va de la mano con los procesos de enseñanza experimentales.

La propuesta de esta investigación doctoral se centra en el cuarto proceso el cual responde a los postulados del diseño posmoderno y contemporáneo centrados en el usuario, la sostenibilidad e incorpora la proyección de lo inmaterial y lo intangible a través de las nuevas tecnologías y formas de comunicación.

El desarrollo del modelo se estructura con: (i) Pedagogía, la cual incorporan conceptos del Cognoscitivismo, el Paradigma Pedagógico Ignaciano, el aprendizaje experimental de Kolb, El Aprendizaje basado en proyectos, retos y problemas; los que coinciden en la importancia de aprender en el contexto y con experiencias en espacios reales, adicionalmente todos estos procesos educativos coinciden con los procesos innatos del diseño; (ii) metodología que está basada en el proceso cíclico de construcción de conocimiento y el proceso proyectual; (iii) contenidos, desarrollados por asignatura específica, en este caso es el Taller de Diseño centrado en el usuario, se profundiza en los conceptos que construyen este modelo de pensamiento y acercan al estudiante a un desarrollo de productos reflexivo y responsable; (iv) procesos de reflexión y acción docente que promueven el proceso de aprendizaje y la construcción de conocimiento; entre otros.

La investigación después del desarrollo de la propuesta recopila la aplicación y los resultados obtenidos durante cinco periodos académicos para evaluarlos, reflexionar y concluir.

Palabras clave: diseño de producto, proyecto, modelo de enseñanza, metodología, diseño centrado en el usuario.

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"Design is the conscious effort to establish a significant order".

Victor PAPANEK.
Design for the real world.

Introduction

Design is a discipline and an activity of social order, which has been transformed from the beginning, when it was projected to meet the demands of mass production and the requirements of the industry, concerned and focused on user requirements (primarily physical requirements), to later be centred on both the services design and product design, with the interest that projects have to be social, egalitarian and inclusive, and that are consciously oriented towards the environmental factor.

We can identify two broad fields of study in design. Design as an object (result); generator of cultural material, which is the object in the tangible dimension, since as Jules David Prown states in his article *Mind in Matter*, "material culture is the study through artefacts of the beliefs —values, ideas, attitudes, and assumptions— of a particular community or society at a given time"[1], **visual culture** which is the perceptive dimension through the denotation and connotation of the object, the intangible; and communication. The artefact is seen as an objectual result and a representation: material from a culture, visual as a symbol, as an communicative object of a culture, and as a message from the designer. On the other hand, design as an activity of research, education (teaching design) and projective (product development). The purpose of this research is to enter the field of design activity, focusing mainly on design education, however, research and product development are not unrelated to it, nor is the object.

This doctoral research work is a proposal to develop a model/methodology for teaching and development of responsible products in the Ecuadorian context. This proposal arises becuase Ecuador is a country with immense possibilities for development, however, it has significant political, economic and productive problems; and in order to improve this context, the endeavour of National Development Plans (NDP), has been established. Part of this transformation involves the Higher Education system in which the teaching of Design (activity) is framed, and on the other hand the discipline of Product Design in Ecuador is almost null, but has the ability to intervene within these plans to improve the Ecuadorian context with the development of products, services, systems, processes and experiences; so, it is necessary to think about the training of designers with a responsible approach in this context.

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1   PROWN, Jules David. *Mind in Matter*. 2009 . BRODY, David; HAZEL, Clark. Design Studies: a Reader. Oxford: Berg. Pp. 220. (English)

The research has been developed in two parts, the first is framed within an analytical-theoretical phase that includes the development of three chapters: (1) **Methodological Framework**, (2) **Logical or Contextual Framework** and (3) **Case Study**. These chapters contextualise Ecuador, its problems and the proposal for the improvement of Higher Education, the development of Ecuadorian design and design education with the case study, which is the Product Design Career of the Faculty of Architecture, Design and Arts (FADA) of the Pontificia Universidad Católica del Ecuador (PUCE). The second part, in a synthetic-practical way includes the following chapters: (4) **Development of the proposal** and (5) **Final Chapter (Analysis and Conclusions)**, the theoretical and conceptual references for the development of the proposal are presented, then the proposal is generated, tested, data is collected and analysed to finally conclude.

The firs chapter deepens in the methodology developed for this research. The chapter two, **Logical or contextual framework**, focuses on the contextualisation of Ecuador, an account of the main political, economic and productive problems has faced from the twentieth century to the present; then it analyses the National Development Plans (NDP) that were proposed from 2013, Nacional Plan del *Buen Vivir* (PNBV) and 2017, Nacional Plan *Toda una Vida* (PNTUV), through which the plan programme for the improvement of Higher Education in the country is approached. In the third chapter, the development of the case study is evidenced, the Product Design career of FADA-PUCE is presented through a historical journey, and its main subsequent milestones are exposed, until reaching the Redesign of the career, which goes hand in hand with state public policies and the curricula in effect since 2018.

In the second part, chapter four focuses on the development of the proposal of the Teaching Model/Methodology in Design, in which the following structures are developed: theoretical, pedagogical and methodological; its application in the periods 2020_01 to 2022_01, to later show the data collection carried out on the results; these are analysed to present a correction of the proposed and finally definitive Model. Finally, the conclusions of the project are defined.

General Purposes

The purpose of this doctoral work is the analysis and development of a teaching model in design for the development of responsible products with a focus on social innovation in the context of Ecuador. As a case study, the Product Design Career of the FADA-PUCE will be taken.

The focus is the proposal of the Redesign of the Career, a proposal that is linked to the NDP and the new policies developed to improve higher education in Ecuador as mentioned, through which it seeks to narrow the inequality gaps in the population, a transformation towards a sustainable country that takes care of its resources and makes a responsible use of them; reaching the use of renewable energies and moving away from dependence on extracting and using fossil fuels; as well as enhancing the productive matrix and diversifying the supply of products and services of Ecuador.

Specifically, this model has been developed for the third level of the career in the subject of User-Centred Design Project (UCDP), a proposal that has been applied from the first period of 2020 to the first period of 2022. The Redesign began its implementation in 2018 and has an adjustment in 2019, currently has the first court of graduates; with which it is possible to analyse the progress of students and the knowledge they have been acquiring throughout their professional training.

Limitations

The limitations were centred on the adjustments and adaptations that had to be made due to the SARS COVID-19 pandemic. This caused an abrupt transformation in social interactions and in the way things developed, as well as the initial proposal of this project. Initially, work with communities and the process of a model for teaching people outside the area of design, for the development of responsible products with their reality and through this, promoting a dignified life, community development and shortening the inequality gaps in the country; however, the lack of connectivity and accessibility with the different sectors caused a change in the focus of the proposal, and it was directed to students of the Product Design Career of FADA-PUCE, the focus remained on development of responsible products that respond to local reality; because it was observed that the intervention of professionals in the productive field also seeks to achieve these objectives. Also the pandemic involved a change in teaching methods, from face-to-face to virtual modality and vice versa.

The model was applied during five academic periods between 2020 and 2022, three of which were virtual, one in hybrid mode and the last one, which was performed in face-to-face mode. Each period required adapting to the conditions in which they were developed, given the pandemic.

The new context requires an immediate response, and the challenge has been taken as a design problem to be solved; therefore, the teaching of design is developed through a projectual methodology.

Another limitation has been the groups of students, each one with its particularities and the influence in the dynamics given by the number of students in each semester. During this research one of the important factors in the development of each period was the mood, both of professors and students, who faced the changes and challenges brought by the pandemic: death of family members, loss of job of parents or partner, economic problems, COVID infection, among others. Uncertainty, constant change and immediate response are elements left by the pandemic, and which are factors that are taken into account in the development of this project.

Expectation of the results

As an expectation of the present work, there are several results: the first and main one is the development of a teaching model/methodology that through its application, collection and analysis of results, is defined as part of the products that the career has developed, as its own and contextualised element; the second one is the documentation of the evolution of the career. By means of these results, the future and the direction it will take, can be planned.

This introduction shows the work developed during this doctoral research showing the two defined areas of the project, an analytical-theoretical one that corresponds to the first phase of the research, where the Ecuadorian context is understood, its problems and the proposal of transformation of the country, where higher education and design are fundamental, and the case study where the intervention takes place, the Product Design career of the FADA-PUCE. The other is the proposal put forth in the synthetic-practical sense, that corresponds to the second part of the research, where the theoretical framework from which the concepts that will govern the constructed model are obtained , then the model is developed and applied, information is collected and evaluated, so as to define the final model; this being done with the expectation of generating a contextualised product and that is specific to the career.

"Design is not science, and it is not art, or any other discipline. It has its own purposes, values, measures, and procedures."

Charles L. OWEN.
Design research: building the knowledge base.

First Part: Analytical-theoretical

1. Chapter I: Methodological Framework

This chapter develops the methodological proposal, applied in this doctoral research, based on the construction of knowledge, proposed by Charles Owen and the project methodology from Design. In addition, the general purposes of the study are the objectives of the project.

1.1. Methodology

1.1.1. Base line

As we begin this chapter, it is essential, to remember Owen's opinion: "Design (and design education), though young in comparison with many disciplines, has had sufficient time to move from fledgling practice to responsible discipline."[1]

Design is a relatively young discipline, compared to other, such as Architecture or Engineering, and even with Art; all of them developed for centuries and even millennia. Consequently, talking about research on Design, and teaching the discipline, is also new. The most developed is the connection between practice and the realisation of products, services, processes, systems, and experiences. For this reason, Design, unlike other disciplines, has a mostly practical approach with tangible results (products, services, processes, systems and experiences); instead of methods, tools, and theoretical resources.

Research on the discipline of Design is in its initial stages, and although several advances have been developed, the methods, tools and techniques, are not specific to the discipline, rather they have been adapted to its requirements.

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1 OWEN, Charles L. 1998. *Design research: building the knowledge base*. Design Studies (19 N.1), Pp. 9-20, Pp. 5. (English)

Author	Context	Year	Country
John Chris Jones	Black box - transparent box	1970	Gales
Bruno Munari	*Riso verde*, designer and artist	1981	Italy
Bern Löbach	Designer, theorist	1976-1981	Germany
Bernhard Bürdek	Designer, theorist	1994	Germany
TU Delft	DELFT University	1969	Netherlands
Hans Gugelot	HfG Ulm University	1953	Germany
Instituto Nacional de Tecnología Industrial (INTI)	INTI, Argentinian Ministry of Productive Development	2009	Argentina
Design Thinking	IDEO, company	1991	United States

1   Project methodology proposals.[2]

This work uses the design methodology, which has an **analytical-theoretical** section, and another, that is **synthetic-practical**. Although for the design process there are several methodological proposals, such as the following ones:

All of them share some points in common that are summarised in five phases: (i) discovering (Research), (ii) defining (Problem), (iii) developing (Proposal), (iv) applying (Results), and (v) evaluating (Analysis).
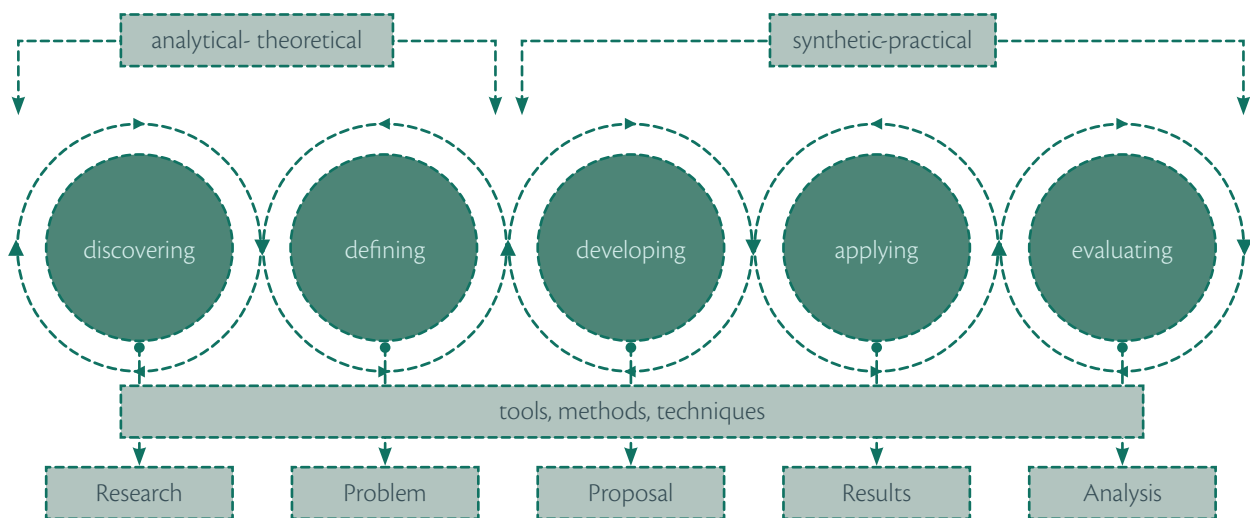
1   Methodological proposal developed.

Discovering and defining belong to the analytical-theoretical area because they allow us to identify: the problem, the tools and the methods used to investigate it, and to define the theoretical concepts that guide to the consequential steps shown in the Figure 1.

On the other hand, developing, applying, and evaluating are included in the synthetic-practical area, to develop the proposal (model). It is applied, and evaluated, to reflect on the proposal to generate a definitive one, and to conclude the project.
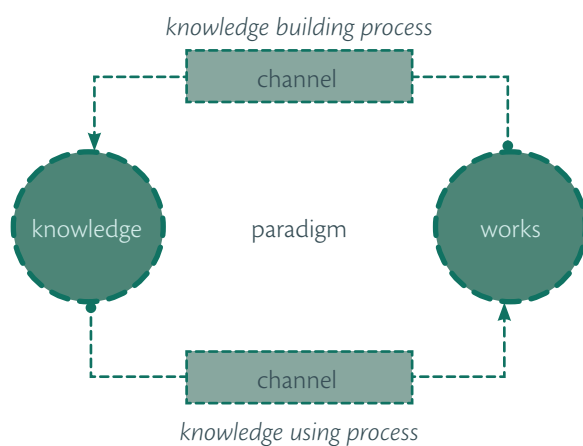
2   General model for generating and accumulating knowledge.[4]

This scheme is compatible with the proposal presented by Owen in his article *Design Research Building the Knowledge Base*[3]. This article proposes that the construction of design knowledge is a cyclical process as shown in the Figure 2.

The previous figure shows the developed process. In this sense, knowledge is the starting point for the generation of a product "*works*", by a channel that are exercises, tools, techniques or methods proposed by the researcher or professor, in the theory are the postulates an in the practice are the proposals, as shown in figure 3 that went through an evaluation process that creates, increases, or confirms the knowledge that resulted from the process, and generates a scientific and non-empirical basis.

3   OWEN, Charles L.1998. *Design research: building the knowledge base.* **Design Studies** (19 N.1), Pp. 9-20. (English)

4   OWEN, Charles L.1998. *Design research: building the knowledge base.* **Design Studies** (19 N.1), Pp. 9-20, Pp. 3. (English)

analytic | synthetic

knowledge building
measures

knowledge building
criteria

knowledge

inquiry paradigm

application paradigm

proposals

theory
knowledge using

principles
knowledge using

works

realm of theory | realm of practice

finding   discovery | invention   making
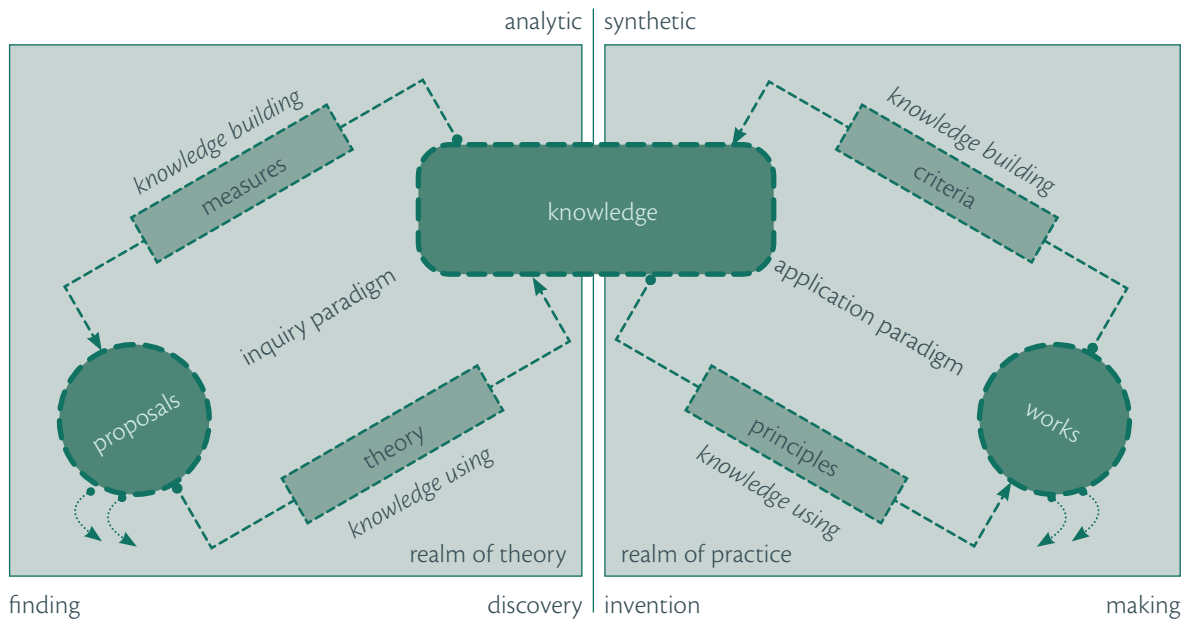
3   General model to generate and to accumulate knowledge in the analytical and synthetic field.[5]

The scheme in design is applied in two moments. First, in the analytical field, occurs through design theory which is the theoretical part. As Owen says: "[…] the realm of theory, the model is a paradigm for inquiry. Existing knowledge, under the direction of theory, is used to generate proposals. Proposals are tested with measures that verify or refute conclusions to build knowledge".[6]

It is the building from the basis of knowledge that creates a process: knowledge - proposals - verification - greater knowledge.

In the synthetic field is the link between practice and process, in other words, the design project through the application of design methods "[…] the realm of practice, the model forms a paradigm for application. Here, knowledge is used through the application of principles to produce works. Works are judged for their worth, as additions to the knowledge base, using the criteria of the discipline"[7]; this is shown in the figure 4.

5   OWEN, Charles L. 1998. *Design research: building the knowledge base.* Design Studies (19 N.1), Pp. 9-20, Pp. 3. (English)

6   OWEN, Charles L. 1998. *Design research: building the knowledge base.* Design Studies (19 N.1), Pp. 9-20, Pp. 3. (English)

7   OWEN, Charles L. 1998. *Design research: building the knowledge base.* Design Studies (19 N.1), Pp. 9-20, Pp. 3. (English)

analytic | synthetic

demonstration
Empirical Test

knowledge

evaluation
Market Utility

inquiry paradigm

application paradigm

Model

Design Theory
formulation

Design Methods
product design

product

realm of theory | realm of practice

finding | discovery | invention | making
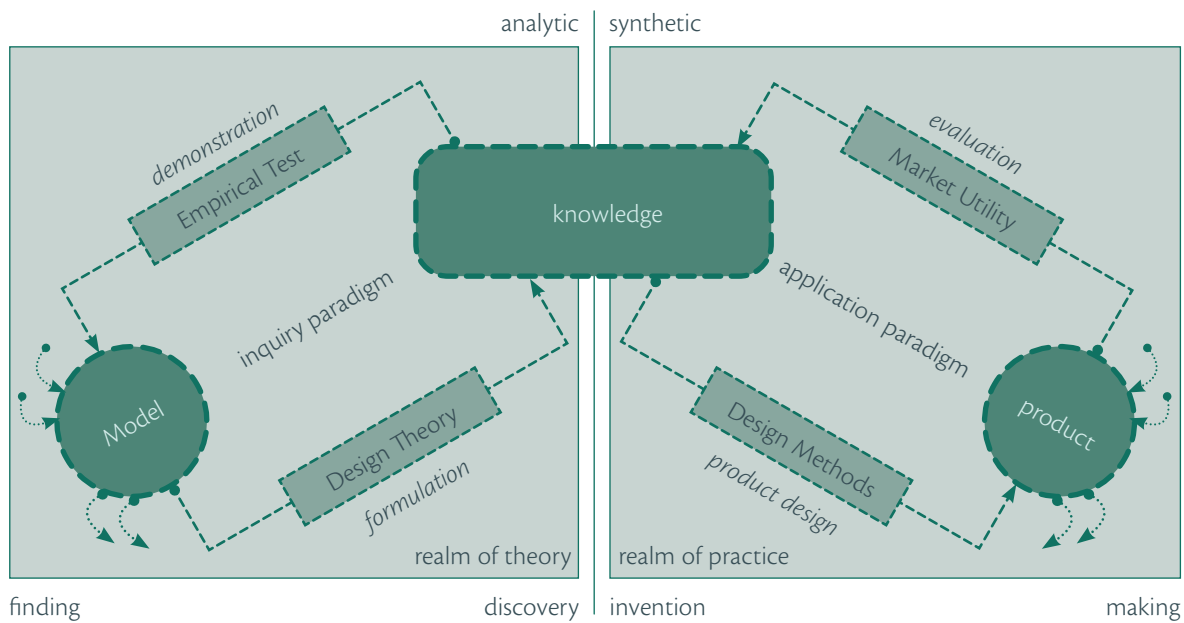
4   Model to generate and accumulate knowledge in the analytical and synthetic field applied to product design.[8]

The work and research methodology of this dissertation combines these two proposals. The construction of knowledge occurs in each phase theoretical and practical of the project, placing the action that is developed as the central paradigm. To begin the process, we start from prior knowledge, through tools, methods and techniques (channels) we arrive at a product, which through reflection, analysis and synthesis (channel) increases knowledge and allows to continue to the next phase, like shown in the figure 5.

8   OWEN, Charles L. 1998. *Design research: building the knowledge base*. Design Studies (19 N.1), Pp. 9-20, Pp. 4. (English)
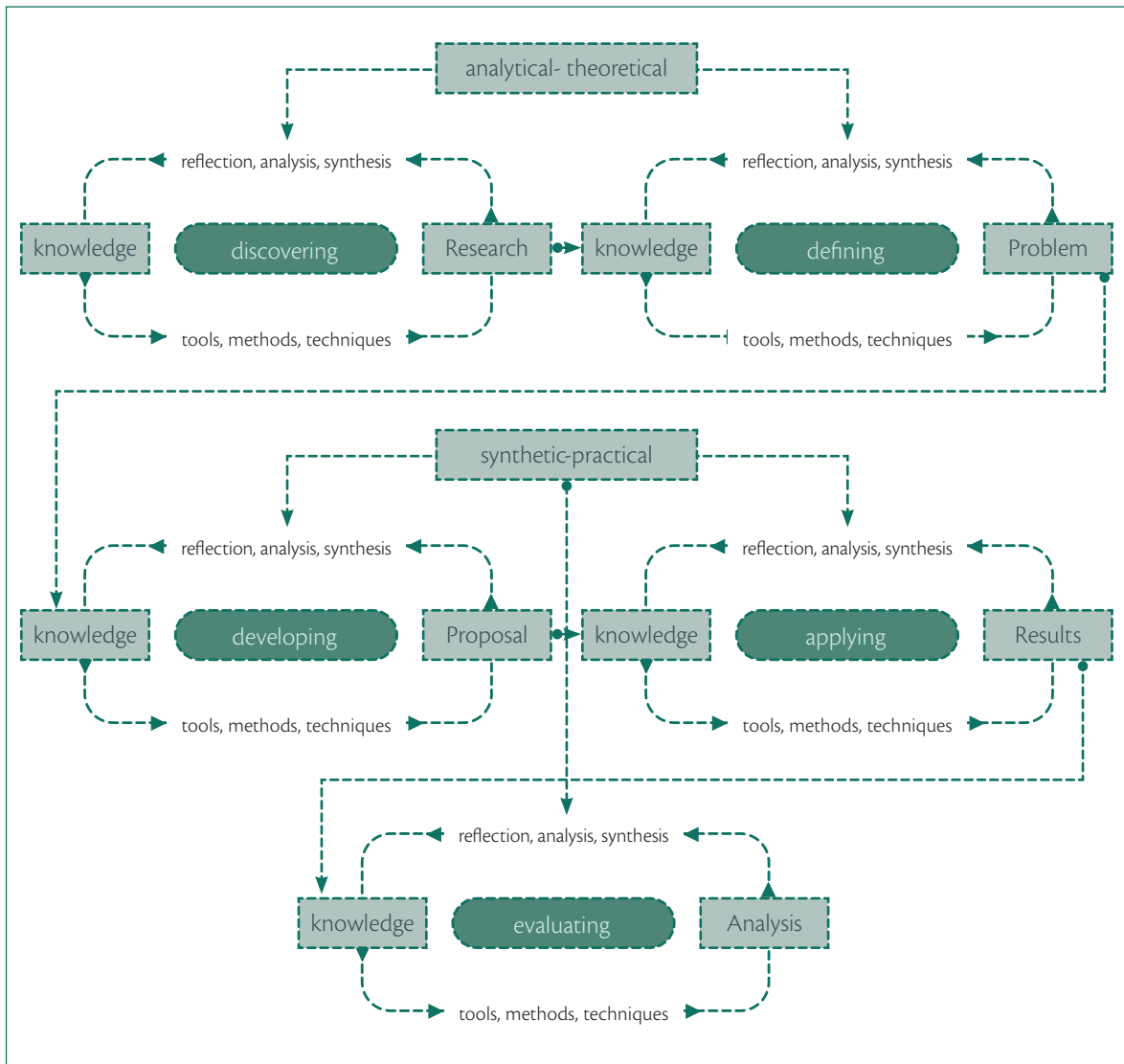
5   Work and research methodology of this dissertation, developed by the author.

This dissertation is divided into two parts. The first part is the analytical-theoretical, that will be subject of the Chapter II: Logical Framework, and contextualisation, through the **deductive method**. General information on Ecuador will be presented, including political, economic, and productive problems and the governmental transformation proposal. This public policy argues that, through the specificity of design and improvement in higher education in the country, a transformation of reality can be generated. The Chapter III: Case Study in will be analysed with the **historical-comparative method**. It will present the development of the career and demonstrates the proposal that is currently being applied. This proposal redesigns the model of teaching and develops the creation of responsible products. Subsequently, the theoretical framework examines the relevant concepts for the evolution of the proposal. The second synthetic-practical part examines the proposal; this section develops, applies, collects the results, and evaluates them, to generate a definitive model.

1.2.   Research Objectives

1.2.1.   Main Objective

The main objective of this dissertation is the development of a teaching model/ methodology in designing, for project responsible products with social innovation, in the Ecuadorian context.

1.2.2.   Secondary Objectives

The secondary objectives are:

• To analyse the development of the career, from its inception to the present moment, and identify the historical milestones and teaching proposals.

• To study the proposal of the redesigned career of Product Design, proposal that changes the teaching process at the Faculty of Architecture, Design and Arts, of the Pontificia Universidad Católica del Ecuador (FADA-PUCE).

• To develop a teaching model for the Subject User-Centred Design Project (UCDP).

• To analyse the model applied in the different semesters, to find opportunities for improvement, and to propose a definitive model.

1.3.   Chapter conclusions

This chapter shows the methodological process carried out, working in both areas of the project. The first part is analytical-theoretical, and corresponds to the research phase, concentrating on the Ecuadorian context, its problems, and the proposal for the national transformation; in this proposal, higher education, and design, are fundamental elements. The Product Design career of the FADA-PUCE is used as the case study. The second part shows the synthetic-practical nature of the model; that starts with the theoretical framework that presents the concepts that will govern the constructed model, then it will be developed, used, applied, and will collect the information to evaluate and to define the adjusted/final model.

"Ecuadorians are rare and unique beings: they sleep peacefully between creaking volcanoes, they live poor in the midst of incomparable riches and rejoice in sad music."

Alexander von HUMBOLDT (1769 - 1859).
Travels to the Equinoctial Regions of the New Continent (1802).

2. Chapter II: Logical Framework

The logical framework of the research contextualises, and frames the research; therefore, it presents the historical, economic, and productive landscape of Ecuador until the proposal and application of the recommendations of the last 2 National Development Plans: (i) *Buen Vivir*[1] 2013-2017 (PNBV) and (ii) *Toda una Vida*[2] (PNTUV) 2017-2021.

Both plans propose objectives that involve higher education as one of the mechanisms of transformation of the country. Product design as a profession is directly involved in the change of the productive matrix, sustainability, technological development, and innovation of the country; all of these areas and policies are proposed in the development plans.

2.1. Context of the investigation

2.1.1. Ecuador

Named after the equator line, Ecuador has been an independent country since 1830 after a provisional regional union with Venezuela, Panama and Colombia, which was named Gran Colombia[3]. Since its dissolution the country has been a republic.

Autor	General Information on Ecuador[4]
Official name	Republic of Ecuador
Surface	256.370 km2
Limits	Ecuador is in South America, to the northwest, latitude 0º 00'. It borders Colombia to the north; with Perú to the south and east; and with the Pacific Ocean to the west.

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1   *Buen vivir* can be translated into English as good living. Author's note.

2   *Toda una vida* can be translated into English as a lifetime. Author's note.

3   *Gran Colombia* can be translated into English as Greater Colombia. Author's note.

4   This information has been summarised from:
     - Ecuadorian Ministry of Foreign Relationships and Human Mobility and Ministry of Foreign Relationship (July 2021).
     - Ecuador Ministry of Foreign Relationships. https://bit.ly/3TY0Ehg.
     - Spain Government (2020). *Ecuador Country Information* (PDF file). https://bit.ly/3DRPlv1
     - Ecuadorian Constitution 2008 also known as Montecristi Constitution after the city where it was drafted and adopted.

Population	17.7 million inhabitants (estimated 2021 - National Institute of Statistics and Censuses, INEC)[5]
Capital city	Quito
Important cities	Guayaquil, Cuenca, Loja, Santo Domingo, Ambato, Machala, and Portoviejo
Language	The official languages are Spanish, Quechua and Shuar; these last 2 are languages of intercultural origin.
	Other ancestral languages are in official use by indigenous peoples in the areas where they live and under the terms established by law.
Currency	Since September 9, 2000, the legal currency in Ecuador is the United States dollar.
Government	Ecuador is a unitary republic that is governed in a decentralised manner. It is organised as a constitutional state of rights and justice, social, democratic, sovereign, independent, unitary, intercultural, and pluri-national.
	The constitutional reform of 2011 created two new powers of the state in addition to the classic ones (executive, legislative and judicial), the electoral power and that of citizen participation and control.
Administrative Organisation	Ecuador is divided into 24 provinces presided over by a Governor (appointed by the president) and a Prefect (elected by popular vote), except in the case of Pichincha, seat of the capital (Quito) that lacks a governor.
	The provinces are divided into cantons presided over by a mayor (221).

2   General Information on Ecuador.

6   Politic map from Ecuador.

https://www.geoportaligm.gob.ec/portal/index.php/descargas/geoinformacion/

2.1.1.1. Historic, economic and productive contexts

This small South American country, is a megadiverse country and has many valuable renewable and non-renewable natural resources, such as fossil fuels (oil). The history of Ecuador has been turbulent, since the middle of the last century, thanks to the application of various economic measures, that have caused political crises. The late infusion of modernity, and the political instability affecting the country, produced a modest development, and a lack of definition of economic policies. This has prevented the industrial sector from developing further, because the aforementioned crises reduced the stability of the system, and each government has modified the data and standards.

The domestic economy is mainly driven by primary exports. By the analysis of the yield or extraction of star and central products, we can identify clear historical trends: (i) in the thirties and forties: cocoa, coffee, and sugar; (ii) in the fifties: the banana boom; (iii) in the seventies: the oil boom and (iv)currently: flowers and shrimp.

7   Ecuadorian export products.

Currently the economy promotes raw material processing, the inclusion of added value, and the development of other products based on these raw materials.

The Ecuadorian economy has hardly progressed due to the permanent dependence on international markets and trends for its agricultural products, the lack of public policies, the mismanagement of public revenues, and the privatisation of most public companies during the nineties.

Now, the country has a small industrial sector, this promotes the development and increase of the domestic market, as well as the improvement of quality, and the optimisation of its competitiveness. An attempt is also made to open the way for industry and design as a method of differentiation and stimulation of the market.

The cause-and-effect relationship between economic and political crises, is not new to Ecuador.

Between 1925 and 1948, that is in less than 25 years, 27 presidents have served[6]. These years were characterised by instability and struggles for political power between the social classes. Examples include the appointment and overthrow of several governments, sometimes by social movements, others for the convenience of economic groups. At times, scenarios of regional dispute (coast vs Andes) emerged with clear divisions of ideology, between social classes, and political sectors.

The creation of the Central Bank in 1927 limited the power, and curbed the abuse, of private banking. It also consolidated the monetary system around the unified national currency (sucre)[7] and imposed a national policy to replace prior measures that were regional in character.

In the forties, specifically in 1942 after the Peruvian invasion to the south of the country, a boundary treaty was signed (known as the Treaty of Rio de Janeiro), in which Ecuador lost much of its Amazonian territory. Despite the treaty, the border situation with Perú would be a cause of conflict in the 1950s and 1960s, and even in the nineties.

It is worth mentioning that a period of modernisation began in the fifties. There was a push for industrialisation through the action of substitution of imports and a focus on investment in strategic public works.[8]

Attempts were made to encourage industry and support the manufacturing sector, and although several cities expanded and the increase in population, the enterprises were developed only for the provision of services, not to produce consumer goods. After a decade of political stability, in which presidents were democratically elected and completed their terms, a new era of instability began in 1960. In addition, Ecuador was not exempt from the wave of military governments in the region: between 1961 and 1972 there were seven successive governments, but only two of them were not military.

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6   AYALA Mora E. & FERNÁNDEZ Rueda Sonia. 1995-1999. *Ecuador: The Roots of Present.* Andean University Simon Bolivar. (Spanish)

7   ALMEIDA Rebeca. (1994). *Kemmerer in Ecuador.* Latin American Faculty of Social Science, FLACSO. Quito. (Spanish)

8   Public investments were mainly directed to the sectors of road works, infrastructure, communication, transport, electrification, health and education. Source: MONARD Arciniegas, A.S. 2020. *Modern Architech in Quito, 1954-1960.* Doctoral thesis, UPC, Departament of Teoria i Història de l'Arquitectura i Tècniques de Comunicació. Available on: http://hdl.handle.net/2117/328184. (Spanish)

In the sixties, for fear of the extension of the Cuban Revolution, left-wing groups were repressed and persecuted, and diplomatic relations with the island were broken for fear of its influence. In this decade there was ideological tension, between the marginal social classes and the power of minority groups. Non-conformism, the vision of social change, and the growing criticism of the North American economic model, (partly due to the rise to power of the Cuban Revolution), were characteristic signs, not only in the debate in Ecuador but throughout Latin America and worldwide. This was the breeding ground of the Revolution of '68.

A few years earlier, in 1964, Ecuador had initiated national processes of agrarian reform and industrial impulse. The oil boom in the late sixties and early seventies allowed the fiscal coffers to become independent from the agricultural productor and export sector.[9]

The decade of the eighties re-inaugurated democracy at the hand of the election of the binomial Roldós-Hurtado. New economic policies were implemented and the opening to neoliberalism and privatisation was promoted; in this scenario, the limited role of the state contrasted with the power of private companies, to the point that part of the oil production process created unprofitable contracts for the treasury.[10]

In the mid-nineties a new stage of political instability began. The vice president (Alberto Dahik) left office in 1995 due to corruption problems. The following year, Abdalá Bucaram won the election and became the president, he was dismissed 6 months later because he was accused of mental incapacity. His vice president Rosalía Arteaga governed for a few days; then, the Congress appointed Fabián Alarcón as interim president. In 1998, Jamil Mahuad was elected, whose government reached the last milestone in the southern border dispute with Perú and ended the historic conflict. Despite this success, his tenure was victim to deep economic instability, inflation, and currency devaluation; the exchange rate increased from 5,000 to 25,000 sucres to 1 dollar.[11] As a result of this, there was a massive migratory wave of almost three million Ecuadorians whose destinations were mainly to the United States, Spain, and Italy.[12]

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9   AYALA Mora E. 2018. *Summary of History of Ecuador* (6th edition actualised). Andean University Simon Bolivar. National Publishing Corporation. (Spanish)

10   AYALA Mora E. 2018. *Summary of History of Ecuador* (6th edition actualised). Andean University Simon Bolivar. National Publishing Corporation. (Spanish)

11   AYALA Mora E. 2018. *Summary of History of Ecuador* (6th edition actualised). Andean University Simon Bolivar. National Publishing Corporation. (Spanish)

12   RAMÍREZ Gallegos Franklin & RAMÍREZ Jacques Paul. 2005. *The Ecuadorian Migration Stampede: Crisis Transnational Networks and Repertoires of Migratory.* (2nd Edition). Ciudad Research Centre UNESCO-ABYA YALA-ALISEI. (Spanish)

With this as a prelude, the crisis that followed was unprecedented: the government, in 1999 incapacitated people from withdrawing their money.[13] This time, holders lost their cash and investments. The national currency changed from the sucre to the US dollar. Several financial institutions were closed, and the Deposit Guarantee Agency (AGD) intervened to save some banks. In 2000 an indigenous uprising, backed by the army and the National Congress, ousted President Mahuad, and his vice president, Gustavo Noboa, assumed power.

After a new electoral process, in 2003, Lucio Gutiérrez became president, and was later dismissed in April 2005 after a social uprising called the *Movement of the Outlaws*. He was succeeded by vice president Alfredo Palacio.

In the following elections (2006) Rafael Correa Delgado won, and in an unheard-of sequence of events, he would remain in power for a decade.

The government of the *Citizens' Revolution*, his party, renewed economic and social policies and promoted constitutional reform. At the time, the price of oil was high, and this generated returns that were invested in administration and the public sector.

During the 10 years of Rafael Correa's government, they considered several plans linked to the development of production and the promotion of domestic consumption. Higher education was also reformed.

> "Between 2007 and 2014, the Ecuadorian economy experienced a period of growth, above the average for Latin America and the Caribbean, with an increase in public investment and a reduction in the indices of poverty and inequality. The fall in oil prices from 2014 coincided with a period of slowdown, resulting in and registering negative growth in 2016."[14]

Since 2007, several sectors of the industry were boosted, including the production and development of local products such as in the food industry, beverages and alcoholic beverages, footwear, textile products, transport and storage, the manufacturing industry and construction.

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13   In order to avoid all clients withdrawn their money from the banks, the government decided nobody was allowed to manage their banks deposits; therefore, locally this time was named *"bank holiday"* or *"frozen money"*. Author's note.

14   Spain Government. 2020. *Country information: Ecuador* (PDF file). https://bit.ly/3DRPIv1. Pp. 2.

"In 2012, 44% of national production is comprised of primary goods, industrialised goods, and services with reduced added value, while the other 56% is composed of high value-added services. On the other hand, 72% of exports are comprised of primary goods, followed by 21% for industrialised goods and only 7% for services."[15]

Between 2017-2021, Lenin Moreno, Rafael Correa's first vice president, held the presidency. Criticism of his mandate bottomed out in October 2019 after there was an indigenous uprising that pushed for a change in social policies, especially in fuel subsidies, and other improvements in the quality of life.

In March 2020, during a period of economic crisis, a health emergency was unleashed, due to the SARS COVID-19 pandemic.[16] This pandemic produced high mortality and high unemployment rates, as well as a new wave of migration. It also highlighted the shortcomings of the public health and social welfare systems.

In 2021, the current president, Guillermo Lasso, was elected, whose government is applying economic policies characterised by the promotion of private investment and little in public investment. It has made some social mistakes especially for not being able to stop the increase in unemployment and the delay in economic reactivation post-SARS COVID-19. In the present it faces several security problems such as the prison crisis, the increase in crime and the growing sense of insecurity.[17]

Ecuador has entered into an economic recession since 2014 because of low oil prices; a factor that visibly affects industry and society.

Ecuador's dependence on oil is undeniable. "The item that Ecuador exports mainly are oil products (crude oil and derivatives) and, consequently, it depends a lot on international oil prices. … The next most important items are bananas and shrimp, each are about 18% of the share of the total exports".[18] To this dependence is added the prevalence of agricultural exports and especially the production of bananas, shrimp, and cocoa; this shows that the economic matrix has not been modernised, and that, in terms of boosting domestic industry, there is still a long way to go.

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15 National Secretary on Planning and Development, SENPLADES. 2014. *National Development Plan Buen Vivir 2013-2017*. Ecuador government. Pp. 41. (Spanish)

16 Vistazo Magazine. May 18 2021. *The Good and the bad: Lenín Moreno government ¿is the food ready?*. Vistazo Magazzine. https://bit.ly/3DZzL7f. (Spanish)

17 CHIRIBOGA Andrés. May 24 2022. *Ecuador: Politic Analysis on Lasso's First Government Year*. CE-LAG. Available on: https://bit.ly/3zANpLp. (Spanish)

18 Spain Government. 2020. *Country Information: Ecuador* (PDF file). Available: https://bit.ly/3DR-PIv1. Pp. 3. (Spanish)

Recently, the government faced in June 2022 a strong wave of protests, impulsed by indigenous and social groups, that requested a change in social policies, the protection of small agro producers, the social targeting of subsidies and the improvement in the quality of life of Ecuadorians.

2.2. National Development Plans

Since the election of President Rafael Correa in 2007 the role of the State, in the public and institutional agenda, has been reinforced, and public planning has been given greater importance. The National Development Plans (NDP) ceased exercising plans, that only generated periodic reports and, that were nourished by strategic institutional instruments for decision-making and development proposals.

A new constitution was promulgated the following year.

The Constitution of *Montecristi* defines Ecuador as a constitutional state, of rights and justice, social, democratic, sovereign, independent, unitary, intercultural and multinational.[19] This instrument obliges the government to comply with the NDP.[20] On this basis, a transformation was created in higher education policies and productive development; both are relevant topics for this research.

In 2009 the first NDP of Correa's era was introduced, in force for the period from 2009 to 2013. This instrument proposed alternatives to development that surpassed the hegemonic visions of economic growth and neoliberalism, which had such an impact on Ecuadorian society in the eighties and nineties.[21] The constitutional redefinition of Ecuador as a state of rights and justice, multinational and intercultural, resulted in comprehensive planning. Based on this plan, the information was updated, and several appropriate policies were generated; this disclosure of new information also resulted in the incorporation of the Millennium Development Goals 2000-2015 (MDG). Currently, subsequent plans have implemented the use of Sustainable Development Goals 2015-2030 (SDG).

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19   Ecuador Constitution, 2008.

20   Ecuador Constitution, Articles 280 and 293.

21   National Secretary on Planning and Development, SENPLADES. 2017. *National Development Plan Toda una vida 2017-2021*. Ecuador government (Spanish)

Coinciding with the second term of President Correa, the National Plan *Buen Vivir* 2013-2017 (PNBV) was put into effect.[22] This plan served to: (i) reduce social gaps, (ii) consolidate the democratic State, (iii) enhance human talent through comprehensive education processes, and (iv) generate production capabilities through large investments in areas of infrastructure and strategic sectors. Later, the presidency of Lenin Moreno defined the National Plan *Toda una Vida* 2017-2021 (PNTUV) that sought to deepen, innovate, and improve the conditions previously achieved.[23] The National Plan *Creación de Oportunidades* (Creation of Opportunities) 2021-2025 (PNCDO) is currently in force.

This research analyses the PNBV and PNTUV plans, because in this period the Product Design Course was redesigned (2015-2018), and its first modification occurred 2019, on which this doctoral project is based.

The PNCDO is not included in the analysis because it is difficult to show concrete results that allow an objective analysis since it is in its second year of implementation. Also this plan has no focus on higher education nor improvement of industry and production.

2.2.1.   National Development Plan *Buen Vivir* 2013-2017

In the governments of Rafael Correa, science and education always received political and budgetary attention.

> "The Knowledge Revolution, which proposes that innovation, science and technology are the foundations for the change of the productive matrix, must be conceived as a different way of producing and consuming. This transition will take the country from a phase of dependence on limited resources, to one on unlimited resources, such as science, technology, and knowledge."[24]

To analyse the PNBV, its twelve objectives will be studied and the most relevant ones for the area of this study will be deepened: (i) education, (ii) industry and (iii) society. Below in the table 3 the public policies relevant for design and teaching are listed.

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22   National Secretary on Planning and Development, SENPLADES. 2017. *National Development Plan Toda una vida 2017-2021.* Ecuador government. (Spanish)

23   National Secretary on Planning and Development, SENPLADES. 2017. *National Development Plan Toda una vida 2017-2021.* Ecuador government. (Spanish)

24   National Secretary on Planning and Development, SENPLADES. 2014. *National Development Plan Buen Vivir 2013-2017.* Ecuador government. Pp. 27. (Spanish)

Objective		Public Policies
1. Consolidate the democratic state and the construction of popular power		
2. Promote equality, cohesion, inclusion, social and territorial equity in diversity.	2.1.	Generate conditions and capacities for economic inclusion, social promotion, and the progressive eradication of poverty.
	2.4.	Democratising the means of production, creating a level playing field and opportunities and promoting territorial cohesion.
	2.11.	Guarantee rural Good Living and the overcoming of social and territorial inequalities, with harmony between rural and urban spaces
3. Improve the quality of life of the population	3.1.	Promote the improvement of the quality of the provision of public attention services that make up the National System of Inclusion and Social Equity.
	3.8.	Promote adequate conditions for access to a safe and inclusive habitat.
	3.9.	Ensure access to adequate, safe, and dignified housing.
	3.10.	Guarantee universal, permanent, sustainable, and quality access to safe water and basic sanitation services, with territorial, environmental, social, and cultural relevance.
4. Strengthen the capacities and potentialities of citizens	4.4.	Improve the quality of education at all levels and modalities, for the generation of knowledge and the integral formation of creative, supportive, responsible, critical, participatory, and productive people, under the principles of equality, social equity and territoriality.
	4.5.	Enhance the role of professors and other education professionals as key actors in the construction of *Buen Vivir*.
	4.6.	Promote reciprocal interaction between education, the productive sector and scientific and technological research, for the transformation of the productive matrix and the satisfaction of needs.
	4.9.	Promote training in non-traditional areas of knowledge that contribute to the construction of *Buen Vivir*.
	4.10.	Strengthen the professional training of artists and athletes of highly competitive level.
5. Build common meeting spaces and strengthen national identity, diverse identities, multinational and intercultural identities	5.1.	Promote the democratisation of the enjoyment of time and public space for the construction of solidary social relations between diverse people.
	5.2.	Preserve, value, promote and represent the various collective and individual customs and democratise the access and dissemination.
	5.4.	Promote cultural and creative industries and enterprises, as well as their contribution to the transformation of the productive matrix.
6. Consolidate the transformation of justice and comprehensively strengthen security, with strict respect for human rights		

Objective	Public Policies
7. Guarantee the rights of nature and promote territorial and global environmental sustainability	7.4. Promote the generation of bio knowledge as an alternative to primary-export production.
	7.7. Promote the efficiency and greater participation of sustainable renewable energies as a measure to prevent environmental pollution.
	7.9. Promote patterns of consumption which are environmentally conscious, sustainable, and efficient under criteria of sufficiency within the limits of the planet.
	7.10. Implement climate change mitigation and adaptive measures to reduce economic and environmental vulnerability with emphasis on groups with priority attention.
8. Consolidate the economic, social and solidarity system, in a sustainable way	
9. Guarantee decent work in all its forms	9.2. Promote youth work in dignified and emancipatory conditions that enhance their skills and knowledge.
	9.4. Establish and guarantee the sustainability of self-consumption and self-sustenance activities, as well as human care activities with a rights- and gender-sensitive approach.
10. Promote the transformation of the productive matrix	10.1. Diversify and generate greater added value in domestic production.
	10.2. Promote technological intensity in the primary production of intermediate and final goods.
	10.4. Promote production and productivity in a sustainable and sustainable manner, promote inclusion and redistribute the agents and resources of production in the agricultural, aquaculture and fisheries sectors.
	10.5. Strengthen the economy of the people and solidarity -EPS-, and micro, small and medium-sized enterprises -MSMEs- in the productive structure.
	10.6. Promote diversified and sustainable commercial processes within the framework of productive transformation.
	10.9. Promote the conditions of competitiveness and systemic productivity necessary to enable the transformation of the productive matrix and the consolidation of more equitable structures for the generation and distribution of wealth
11. Ensure the sovereignty and efficiency of strategic sectors for industrial and technological transformation	11.1. Restructure the energy matrix under criteria of transformation of the productive matrix, inclusion, quality, energy sovereignty and sustainability, with an increase in the participation of renewable energy.
12. Guarantee sovereignty and peace, deepen strategic insertion in the world and Latin American integration	

3 Objectives y Public Policies del National Development Plan *Buen Vivir* 2013-2017.[25]

25 National Secretary on Planning and Development, SENPLADES. 2014. *National Development Plan Buen Vivir 2013-2017*. Ecuador government. (Spanish)

The policies of goals 2, 3, 4 and 5 focus on reducing social gaps and achieving a better quality of life for the population, through the provision of means and tools, as well as methods to reduce poverty. Increased access to adequate, formal or non-formal, education is expected to generate better livelihoods and development for the population. In addition, the respect and incorporation of culture is recognised as an identity element of society.

Goals 7, 9, 10 and 11 focus on the promotion of sustainable development through the responsible use of natural resources, which Ecuador has in abundance. Diversification of energy sources and incentives for productive development are also mentioned. In this framework, teaching in design, and design as a project activity, are intimately and directly combined; both have the capacity to generate products, to promote the economic inclusion of vulnerable groups; as well as to support the democratisation and accessibility to resources and means of production to multiply the development of products, services, systems, processes, and experiences that improve the lives of Ecuadorians.

The teaching of design plays a fundamental role because it links academia, industry and society, and allows the improvement in quality of life. Developing teaching models of the profession, initially transcends within the academic field (the university) and later expands to reach groups and communities, that have difficult access to formal education, and that require design to raise their quality of life.

On the other hand, through design, solutions can be generated for the sustainable use of resources and environmentally responsible production systems that influence the future of the country.

2.2.2.   National Development Plan *Toda una Vida* 2017-2021

In analysing the PNTUV, the nine objectives set out in the three proposed axes are studied. Specifically, the most relevant for this research are analysed: (i) education, (ii) industry and (iii) society, in these topics the policies related to design are identified.

Axes 1: Rights for all throughout life

	Objective		Public Policies
1.	Ensure a dignified life with equal opportunities for all people	1.2.	Build capacity and promote opportunities in conditions of equality, for all people throughout the life cycle.
		1.7.	Ensure access to decent work and social security for all.
		1.8.	Ensure access to adequate and dignified housing, with cultural relevance and a safe environment, including the provision and quality of public goods and services linked to habitat: soil, energy, mobility, transport, water and sanitation, environmental quality, safe public space, and recreation.
		1.15.	Promote the use and enjoyment of a safe habitat, which allows equal access to public spaces with an inclusive approach.
		1.16.	Promote the protection of the rights of users and consumers of goods and services.
2.	Affirm intercultural and multinational identities, and revalue all diverse identities	2.3.	Promote the rescue, recognition and protection of tangible and intangible cultural heritage, ancestral knowledge, cosmovision and cultural dynamics.
		2.4.	Promote the full exercise of cultural rights along with the opening and strengthening of common meeting spaces that promote the recognition, valuation and development of diverse identities, creativity, freedom, aesthetics, and individual and collective expressions.
		2.7.	Promote the valuation and inclusion of ancestral knowledge in relation to the management of the educational system, health services, environmental management, habitat management and production and consumption systems.
3.	Guarantee the rights of nature for current and future generations	3.1.	Conserve, recover and regulate the use of natural and social, rural, and urban, continental, insular and marine-coastal heritage, which ensures and protects the rights of present and future generations.
		3.4.	Promote good practices that contribute to pollution reduction, conservation, mitigation, and adaptation to the effects of climate change, and promote them at the global level.
		3.5.	Promote the urban and rural economy, based on the sustainable use and value aggregator of renewable resources, promoting social co-responsibility and the development of the bioeconomy.
		3.7.	Encourage environmentally responsible production and consumption, based on the principles of the circular economy and bio-economy, promoting recycling and combating planned obsolescence

Axes 2: Economy at the service of society

	Objective		Public Policies
4.	Consolidate the sustainability of the economic, social and solidarity system, and strengthen dollarisation	4.2.	Channel economic resources to the productive sector, promoting alternative sources of financing and long-term investment, with articulation between public banks, the private financial sector and the popular and solidarity financial sector.
		4.8.	Increase the added value and the level of national component in public procurement, ensuring greater participation of MSMEs and actors of the popular and solidarity economy.
		4.10.	Promote competition in markets through efficient regulation and control of monopolistic practices, concentration of power, and market failures. This will generate adequate conditions for the development of economic activity, the inclusion of new productive actors, and fair trade, which contribute to improving the quality of goods and services for the benefit of their consumers

	5.1.	Generate decent work and employment by promoting the use of built infrastructures and installed capacities
	5.2.	Promote the productivity, competitiveness, and quality of national products, as well as the availability of related services and other inputs, to generate added value, and industrialisation processes in the productive sectors, with a focus on satisfying domestic and export demand.
	5.3.	Promote national industrial development, by improving productive chains, with the participation of all actors in the economy.
	5.4.	Increase productivity and generate added value, by creating differentiated incentives to the productive sector, to satisfy domestic demand, and diversify the exportable supply in a strategic manner.
5. Boost productivity and competitiveness for sustainable economic growth in a redistributive and supportive manner	5.5.	Diversify national production with territorial relevance, benefiting from the competitive and comparative advantages and opportunities identified in the domestic and foreign market, to achieve sustainability and sustainable economic growth.
	5.6.	Promote research, training, development and technology transfer, innovation and entrepreneurship, protection of intellectual property, to promote the change of the productive matrix through the link between the public, productive sector, and universities.
	5.8.	Promote national production with social and environmental responsibility, promoting the efficient management of natural resources and the use of durable and environmentally clean technologies, to guarantee the supply of quality goods and services.
	5.9.	Strengthen and promote associativity, alternative marketing circuits, production chains, inclusive businesses, and fair trade, prioritising the Popular and Solidarity Economy, to consolidate in a redistributive and solidary manner the productive structure of the country.
	5.10.	Strengthen and increase the efficiency of public enterprises for the provision of quality goods and services, the responsible use of natural resources, the revitalisation of the economy, and strategic intervention in markets, maximising their economic and social profitability.
	6.1.	Promote decent work and employment with emphasis on rural areas, enhancing productive capacities, combating precariousness, and strengthening the targeted support of the State and promoting entrepreneurship.
6. Develop productive and environmental capacities to achieve food sovereignty and rural Good Living	6.2.	Promote land redistribution and equitable access to the means of production, with emphasis on water and seeds, as well as the development of infrastructure necessary to increase productivity, trade, competitiveness, and quality of rural production, considering the competitive and comparative territorial advantages.
	6.5.	Promote fair trade of products, with emphasis on the peasant family economy and the popular and solidarity economy, reducing intermediation at the urban and rural levels, and encouraging the care of the environment and the recovery of soils.
	6.6.	Promote access to health, education, safe water, basic sanitation, citizen security, rural social protection and housing with territorial relevance and quality in rural areas, as well as the promotion of connectivity and national roads.
	6.7.	Guarantee plural participation, with a gender focus and emphasis on organisations of peoples, nationalities, communes, communities, and collectives, in the sustainable management of natural resources and environmental services.

4   Objectives and Policies of the National Development Plan *Toda una Vida 2017-2021*.[26]

26   National Secretary on Planning and Development, SENPLADES. 2017. *National Development Plan Toda una vida 2017-2021*. Ecuador government. (Spanish)

In the first 6 objectives, policies focus on: reducing social gaps and raising the quality of life of the population, encouraging productive development to diversify Ecuador's economy and its energy sources, the responsible use of resources, and the access to the means of production. It is encouraged that domestic developed products have added value, satisfy the domestic market, and can reach the foreign market to boost exports.

Design education and design as an activity are involved and contribute to the development and production of: products, services, systems, processes and, experiences. All of them contribute to the social and productive development of the country and make design a transversal and strategic tool for the performance, competitiveness, and innovation of these products.

Design and its teaching serve to project and develop research-based products that meet the needs and expectations of Ecuadorians and ensure environmental well-being, cultural diversity, and good use of natural resources.

2.3.   University Education

As mentioned above, the country has suffered several economic and political crises over the years, and they have influenced higher education.

In 1938 the first Law of Higher Education was issued in Ecuador. It granted universities autonomy, as well as technical and administrative independence with the aim of supporting: development, modernisation, and the search for solutions to national problems. This law declared free public education.

In 1990, the special regulations for non-university higher education were issued. This instrument regulates technical and technological training centres, relevant in the field of production and for the improvement of industry. During the nineties, due to national privatisation policies, investment in public universities was stopped, in addition the free nature of this education was eliminated.[27] That is why private universities, as well as technical and technological institutes, began to gain space and increase in number. This expanded the offerings of courses but a crisis occurred when accessibility to third-level training was linked to available economic resources and not to quality.

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27   At this moment, the public education in universities was not free, it had a paying differentiated system which was cheaper than the private universities. Author's note.

Some analysts documented this situation. "Until 2012 Ecuador had 71 universities, 45 of these were founded during the years 1992 to 2006 [which] shows an increase of 273% in 14 years. Of these 45 universities created, 35 were private".[28] Between the nineties and 2000s education became a business in which the quality of the offer did not matter, and this produced several problems such as:

1. offer of degrees that could not be registered with State institutions to practice the profession;

2. curricula whose minimum contents and learning outcomes did not correspond;

3. employment of professors without teaching skills and without a professional degree nor a work experience;

4. institutions without infrastructure or human capital; and,

5. a wave of scams for students who aspired to hold a professional degree.

All this happened because the regulatory body that was supposed to supervise higher education was under the control of the institutions that it had to supervise.

In 2008, in the Constitution and in the NDP 2009, principles were proposed that transformed higher education in the country. The Constitution established that public higher education must respond to the public interest and not be for profit. It also granted the state exclusivity in the control and regulation of higher education, as a key piece of national development.

2.3.1. Legal and Institutional Frameworks on Educative Policies

2.3.1.1. Legal Regimen: Superior Education Organic Law

Based on the Constitution of 2008 and the NDP of 2009, the new Superior Education Organic Law (LOES) was enacted in 2010 under the following principles:

1. Co-governance, through which the functions and responsibilities are distributed among the sectors of the university community.

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28 PACHECO Olea, Leónidas; PACHECO Mendoza, Rosa. 2015. *Superior Education Evolution in Ecuador. The Ecuadorian University Educative Revolution*. Pacarina del Sur [On line]. Year 6, # 23, April-June 2015. ISSN: 2007-2309. Source: Pacarina del Sur. Available on: bit.ly/3ULDb2M

2. Responsible autonomy, in other words, higher education institutions are free to structure their responsible academic work, although they are subject to accountability and compliance within the law.

3. Equality of opportunities, that includes free public education, scholarships and the differentiated pension system applied according to the performance of the students, under the scheme, that study in private universities.

4. Quality that is verified through external evaluation and self-evaluation that allow constant improvement.

5. Relevance, that is, that the academic offer responds to national needs and requirements and in support of compliance with the NDP.

6. Integrality between the different levels of training. And,

7. Self-determination to produce thought and knowledge.

Since the entry into force of the LOES, these principles govern all higher education institutions (IESs) and promote their excellence.

2.3.2. Institutional Regime

There are three institutions that make up the higher education system (SES): (i) the Council of Higher Education (CES), (ii) the Council for Quality Assurance of Higher Education (CACES), and (iii) the National Secretariat of Higher Education (SENESCYT), all of them are analysed below.

2.3.2.1 Council of Higher Education (CES)

This council is the body that is responsible for planning, regulating, and coordinating the SES. It also regulates the relationship between academic actors, the state, and society. Its objective is to guarantee a quality higher education that contributes to the development of the country.

The CES encourages universities, polytechnics, institutes and higher conservatories to work using efficient professional processes, relevant to national development. It also advocates the exercise of responsible autonomy; it verifies that the offerings of courses and programs is relevant, of quality, and by design stimulates and adapts to the needs of the social and economic development of the country.

Its first strategic objective, with the participation of the different actors in the education sector, is to consolidate the SES. It will achieve this through academic diversification that responds to national demands in the social, political, economic and technological fields. Other strategic objectives are: to strengthen efficiency in the issuance and reform of regulations, for the exercise of responsible autonomy of higher education institutions, and to strengthen their institutional capacities.[29]

2.3.2.2.   Council for Quality Assurance of Higher Education (CACES)

This is the technical public body that is responsible for the regulation, planning and coordination of the quality assurance system of higher education. It enjoys regulatory and managerial powers.

CACES leads the following participatory processes: internal and external evaluation, accreditation and academic qualification, and the guarantee of quality in higher education institutions. This council is focused on the balance of teaching, research, innovation, and social bonding.

It is expected that the CACES will be recognised by the actors of the SES and Ecuadorian society, as an innovative, transparent, and accountable body, capable of promoting and ensuring the culture of quality in higher education.

2.3.2.3.   National Secretariat of Superior Education (SENESCYT)

The LOES of 2010 establishes that SENESCYT is the body responsible for the processes applicable to higher education, specifically:

> "The National Secretariat of Higher Education Science Technology and Innovation - is the body that aims to exercise the direction of public policy of higher education and coordinate actions between the Executive Branch and the Institutions of the SES. It will be directed by the National Secretary of Higher Education, Science, Technology, and Innovation, appointed by the President of the Republic."[30]

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29   Council of Higher Education (CES). 2022. *Mission, Vision, and Objectives*. Available on: www.ces.gob.ec

30   LOES, Article 182.

2.3.3.   Evaluation Process of Superior Education

From the issuance of the LOES in 2010 and the creation of the three institutions mentioned, a process of regularisation and evaluation of the IESs started, which lasted 5 years.

In this process, the relevance and quality of all IESs and their academic proposals were evaluated and analysed in accordance with the country's development policies.

> "In terms of quality, the issue of the purification of the system has been well executed, with the definitive closure of 15 universities and the purging of venues or extensions. Today a process of evaluation and accreditation ensures that not only the institutions but also their courses and programs must have this certification and accreditation."[31]

The regularisation of the academic offerings compelled the closure of some institutions and some programs that did not meet quality standards. It was determined that each IES should benefit from evaluation processes (external), self-evaluation (internal) and the redesign of their academic offerings. They also had to define new courses. The latter was necessary because the programs offered were heterogeneous, to the point that, for example, the content for the same course or profession was different in each IES.

This produced different competencies among professionals, reduced coherence in education and aptitude of the graduates. On the other hand, many programs lacked basic tools such as curriculum meshes, syllables, adequate spaces for learning; all of which lacked consistency in content and produced poor learning outcomes.

On their side, professors also had to transform themselves to improve the level of higher education; not everyone had fourth-level degrees or develop research.

During this process, the CES together with the CACES were constantly monitoring.

Between 2015 and 2018, academic programs were defined that responded to the PNBV and PNTUV plans; these programs came into force from 2017 and are currently being implemented. The CACES established an accreditation system applicable not only to the IESs but to each program offered, that since then is obliged to accredit its quality. This process is in place to this day.

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31   Council of Higher Education (CES). 2016. Department of Communication of the Council of Higher Education. *Press bulletins*. Available on: www.ces.gob.ec

Specifically, in this framework of reforms, the Product Design Course of the Faculty of Architecture Design and Arts (FADA) at the Pontificia Universidad Católica del Ecuador (PUCE) was redesigned. This is the proposal that will be analysed in the next chapter and on which this research is developed.

2.4.　　Chapter conclusions

Ecuador's economy is based on the production of primary goods, including bananas, shrimp, flowers, cocoa, and oil extraction. The country's political problems have not allowed to maintain stability in economic policies, which has generated social problems and little productive development.

The policies of the last two NDP, PNBV 2013-2017 (government of Rafael Correa) and PNTUV 2017-2021 (government of Lenin Moreno) focus on reducing social gaps to achieve a better quality of life, provide it with means and tools for its development and to reduce poverty. These plans propose to improve accessibility to formal and non-formal education to generate livelihoods and development. In addition, respect for culture was incorporated as an element of construction of society's identity. The aforementioned public policies focus on the promotion of sustainable development, the responsible use of resources, and on the diversification of energy sources, as well as on encouraging productive development.

This approach directly influences the teaching of design and design as an activity, because design can enhance resources by adding value, encouraging, and diversifying the market.

Teaching in design is fundamental since it is the point of convergence and link between academia, industry, and society; It also supports the processes of democratisation and social equality. Developing a model of teaching in design transcends the academy and reaches society that seeks to improve their quality of life.

It is undeniable that the design of products, services, systems, processes, and experiences contributes to the social and productive development of the country. Design is a transversal and strategic tool for product performance, competitiveness, and innovation.

Based on the Constitution of 2008, the LOES and the 2 NDPs studied (PNBV and PNTUV) there were generated public policies that improved higher education in Ecuador. Also noteworthy is the institutional regime formed by the CES, the CACES and the SENESCYT.

Between 2010-2015, an unprecedented process of evaluation of the IESs was carried out that solved the existing shortcomings and launched the redesign of the programs; these programs have been in execution since 2017.

This is the policies framework of the redesigned of the Product Design Course, that will be reviewed in the next chapter.

"However, in my opinion, all design education must be based on ecological methods and ideas. This will include studies in the scientific method, as well as in biology, anthropology, cultural geography and related fields. Social and human ecology and philosophy and ethics will form an integral part of this training."

Victor PAPANEK.
The green imperative - ecology and ethics in design and Architecture.

3.   Chapter III: Case study

This chapter will be dedicated to the case study of this research. It starts by framing the development of design in Ecuador; it describes its informal appearance in the professional field about 40 years ago. Additionally, it explains the reasons why the integration between industry and design is deficient.

The author considers that as of 2007 with the validation of new policies and the National Development Plans (NDP) it was possible to introduce strategies to promote the industry and the insertion of design.

The case study that is presented is the Product Design Career of the Faculty of Architecture, Design and Arts (FADA) of the Pontificia Universidad Católica del Ecuador (PUCE), one of the first spaces that promotes discipline in the country. It includes the four curricula that have been implemented from 1994 to the present, as well as the latest plan, the redesign the career developed from the LOES 2010; which is developed from the evaluation of universities, careers and programs carried out by the CES, CACES and SENESCYT between 2010 and 2015, reviewed in the previous chapter.

3.1.   Development of Ecuadorian Design

As explained in the previous chapter, in Ecuador´s economy, based on primary products for export, design has strongly lagged behind as an industry. Starting in the sixties, with the attempt to modernise Ecuador in a late manner, and with the oil boom, the first companies focused on complementary products were created. An example of this is Pycca[1], dedicated to the production of plastic household items. On the other hand, the main industries focused on the provision of services (electricity, telephony and tourism) and the development of materials, mostly focused on construction like Cementos Chimborazo[2] (currently Unión Cementera Nacional, UCEM - National Cement Union).

At that time, the government's priorities were centred on the social, economic and technological progress of the country: for this reason, investments were made in development and the implementation of infrastructure,

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1   https://www.pycca.com/

2   https://www.ucem.com.ec/

for public companies as well as for private ones. For example, after the creation of social security, its headquarters were constructed, in that moment called Caja de Seguro (Security Fund), now called the Ecuadorian Institute of Social Security (IESS); other relevant buildings that were constructed in Quito in this period are: (i) the Hotel Quito, (ii), the Red Cross, (iii) different ministries, such as the Ministry of Finance, (iv) the Inmaculada Concepción School, and (v) the San Francisco de Sales School, among others.[3] In the initial proposal, it was thought that all of the furniture, household items and objects should be built or manufactured within the country; nevertheless, the industry of that time was not ready to respond to the demand, and most of the products were imported. This failure exemplifies the limitations of the national industry. As discussed in the previous chapter, the deep political and economic crises have slowed down technological and industrial development in the country, to the point that the intervention of design in industry has been almost nil.

To understand and to dive deeper into the subject matter, this research will revise the development in Design in Ecuador in the professional and academic fields.

The history of design in Ecuador is of late blooming, in comparison with other countries in the region.

Latin America history in general has been marked with political instability, military dictatorships, governments of left and right (with very strong differences) and significant corruption. These factors and the characteristics of the different countries have been the reason why there are different moments for the beginning and consolidation of professions related to design.

In Mexico, Brazil and Argentina the profession was introduced in the thirties and forties of the 20th century and was consolidated mid-century thanks to the European diaspora that arrived to Latin America after the World War II. In countries like Colombia, Perú and Chile the profession developed from mid-century onwards due to population growth and the requirements of industrial and economic development. On the other hand, in Ecuador, Bolivia, Guatemala and some Central American countries, the emergence of the profession happened between the seventies and eighties in an informal manner within the professional environment; the surfacing of design was linked to industrial and technological development, as well as public policies of the state.

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3   MONARD Arciniegas, A.S. 2020. *Modern Architech in Quito, 1954-1960*. Doctoral thesis, UPC, Departament of Teoria i Història de l'Arquitectura i Tècniques de Comunicació. Available on: http://hdl.handle.net/2117/328184. (Spanish)

In Ecuador, design began in the professional field rather than in the academic one, because the first professionals were born instinctively, out of restlessness, individual motivation and desire. Seeing that there were no Ecuadorian design schools, most of those interested, opted for the most similar disciplines: Architecture or Art. Hence, one of the pioneers in this discipline is renowned Architect Guido Díaz, whose works include graphic areas, furniture and fashion design, art and others.

In Design, the career at the FADA or the PUCE began in 1994, more than 28 years ago with the idea of focusing on integral design. The first professionals were characterised for having comprehensive design knowledge, without specification and without limitation "because it is increasingly difficult to specify what each branch does, if a graphic designer makes signage, he is an urban designer and also an industrial designer."[4]

Schools such as the Metropolitan Institute of Design *La Metro*, was created in 1985 with a technical and technological focus. The Cuenca School of Craft Design dates back to 1984 and proposed to link craftsmanship to design and production.

As mentioned in the last chapter, in the decades of the nineties and 2000s there was a boom of the privatisation of higher education. Nowadays, there are a variety of institutes and universities that promote the profession of Product Design in the country, for example: Universidad de las Américas (UDLA) and the Escuela Superior Politécnica del Litoral (ESPOL).

In Ecuador, the first concern of designers at this time was to develop objects of quotidian nature like household and office items, or furniture. That is why furniture companies emerged like: ATU[5] or Tempo Design[6], which mostly opted for the redesign and copying products, and who bet very little on design as a differentiating factor. An example of this is Guido Diaz's Art Tempo factory, whose furniture production was destined for export.

One of the problems the profession faces in the country is that an association of designers has not been consolidated, in which parameters can be defined and will link designers in the public and private, nationally and internationally.

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4   Personal interview with Guido Diaz, by ORTIZ, I., in May 2009. (Spanish)

5   ATU, after 70 years in the Ecuadorian market, it closed its doors in 2018. Author's note.

6   https://www.tempodesign.com.ec/

Even though it is true that the Chamber of Design of Ecuador (CADE) was created in 2015, but is not well known or recognised by most professionals in the field, since there is no evidence of work in best interest of the union. This situation is very different from what happened in Argentina, México and Brazil, where schools and associations of designers have existed for decades.

In 1980, a regional meeting of designers was convened in Colombia. Guido Díaz, attended and reported that there was no academics in Design in the country and that some architects performed functions as designers. "At that time, we were not many, if there were about three or four it was enough".[7] Some of the attendees shared similar stories: there was no design advocacy in the professional and academic arenas.

At this meeting, the Latin American Association of Industrial Design (ALADI)[8] was formed. It brings together design professionals in different countries, each with different characteristics.

Since its creation, ALADI has organised several congresses and important agreements have been reached between countries. For example, in 1984, five scholarships were obtained for the Master's Degree in Industrial Design at the National Autonomous University of Mexico (UNAM) for architects graduated from the Central University of Ecuador (UCE). These scholars were Ángel Jácome Gallardo, Diego Hurtado Gomezjurado, Luis Bosano, Jorge Izurieta and Julia Tamayo; the first professionals specialised in design, the Ecuadorian pioneers.

The youth of design in Ecuador is evident because the first records of its activities date from the late seventies and earlier eighties.

Ecuadorian design, as well as in most Latin American countries, fails to have a link with the State in its projects; this would be a great tool for the development of the profession in the country and of the country through design, and would enable the insertion of design in other fields.

During the government of Rafael Correa, an attempt was made to create this alliance and one of the first approaches was the development of the *Much better if it is done in Ecuador* (Mucho mejor si es hecho en Ecuador) program,

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7   Personal interview with Guido Diaz, by ORTIZ, I., in May 2009. (Spanish)

8   In 1980, the ALADI (Latin American Association of Industrial Design) was created in Latin America and was recognised by the UN in 1989 as a representative entity of the region's designers. Among its objectives, it declared as a priority the need to promote industrial design as a technological discipline for the social, economic and cultural development of the region, and as a way to promote the rupture of external dependence, an entity that is still in force. Source: https://www.disenioaladi.org/ (Spanish)

which strongly supported the national industry. This program was designed to accompany safeguard policies, protect national products and their marketing, as well as promote fairer competition.

Currently, local design has been promoted through small associations of designers, fairs and specialised stores that promote local consumption, fair trade, cleaner production processes and the use of sustainable materials. Some examples are *La Imaginativa*,[9] *Casa Kiki*,[10] *Olga Fisch*,[11] among others.

https://www.laimaginativa.com/info

https://lifestylekiki.com/ https://www.instagram.com/casa__kiki/

https://olgafisch.com/ https://www.instagram.com/olgafischfolklore/

8   Spaces and shops for equadorian Designers.

Taking advantage of the growth of design in recent years, information has been collected on the insertion fields of design and the work-spaces of designers. In the Product Design Career of FADA-PUCE, this information has been analysed based on the requirements of pre-professional practices and internships, as well as the following-up of graduates; designers have also been interviewed. Based on these sources, it is concluded that the fields that are currently being developed in Ecuador are:

9   https://www.laimaginativa.com/info https://www.instagram.com/laimaginativa/

10   https://lifestylekiki.com/ https://www.instagram.com/casa__kiki/

11   https://olgafisch.com/ https://www.instagram.com/olgafischfolklore/

	Designers in industries	Designers in companies	Independent Designers

https://objekt1.com/

Ortiz, Ivonne.

https://www.instagram.com/dennisecalero/

9   Designers and working spaces.

	Designers	Area	Examples
1	Designers in industries	Massive production / Standardised industrial processes	Edessa (ceramic - sanitary), Artesa (ceramic - crockery), Indurama (appliances)
2		Intermediate and limited production / Standardised industrial processes or digital production	Objeckt, Los Andes, Loft Noa, Studio Noa, Orígenes
3	Designers in companies	Public or private companies	Museum of the City, Contemporary Art Centre (CAC), Metropolitan Cultural Centre (CCM), YAKU Water Museum, Interactive Science Museum (MIC), Colineal, Adriana Hoyos, Uribe & Schwarzkopf
4	Independent designers dedicated to	Manufacturing and product development	Imabu, Urku, Olivez
5		Service design	Ziette, Diseño Probeta, Hola Sapiens, Ficto, Estudio Turé
6		Own products:	Dennise Calero (signature jewellery) Uve jewelry, Cuica laboratorio de inventos, Inti eyewear, Fernando Echeverria, Materia

5   Areas of work of Designers in Ecuador.

Designers in mass production industries and who are involved in standardised industrial processes: Heads of production areas and team leaders for product development in companies such as: Edesa[12] (ceramics - sanitary ware), Artesa[13] (ceramics - crockery) and Indurama[14] (home appliances). Although these companies have design departments, the number of involved designers is small.

Designers in intermediate and limited production industries, involved in standardised industrial processes or digital production, with products such as furniture or household goods. These are, in general, companies and ventures of designers or architects; they are small, family or one-person companies dedicated to the generation and production of authorship objects or customisation of products such as: Objeckt,[15] Los Andes Home Design,[16] Loft Noa,[17] Studio Noa[18] and Orígenes[19].

Designers in public or private companies that insert design into the identity and projects of them. An example is the museography in the City Museums Foundation of the Mayor's Office of the Metropolitan District of Quito, of which five museums are part: (i) The City Museum, (ii) The Contemporary Art Centre (CAC), (iii) The Metropolitan Cultural Centre (CCM), (iv) YAKU Water Museum, and (v) The Interactive Science Museum (MIC). In this case, the designer is part of the company and his work has focused on the management, museology and museographyof the spaces and proposals. Another example is the insertion of designers in private companies such as Adriana Hoyos Design Studio,[20] Uribe & Schwarzkopf[21] or Colineal[22] as consultants for the construction and decoration of the interior spaces of office, warehouses and sales rooms.

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12   https://edesa.com.ec/

13   https://www.artesa.com.ec/

14   https://www.indurama.com/indurama/es/USD/

15   https://objekt1.com/

16   https://www.instagram.com/los_andes_hd/

17   https://loftnoa.com/

18   https://studionoa.com.ec/

19   https://www.instagram.com/origenes.ec/

20   https://www.adrianahoyosdesignstudio.com/

21   https://www.uribeschwarzkopf.com/

22   https://colineal.com/

Independent designers dedicated to the manufacture and development of products have their ateliers such as Imabu, Urku Design Studio[23] and Olivez,[24] among others. Its metal, wood and ceramic workshops provide object development and production services, they mainly support windows dressing and interior decoration, among other activities.

There is a group of independent designers dedicated to the design of services in ateliers such as Ziette,[25] Diseño Probeta,[26] Hola Sapiens,[27] Ficto[28] and Hot brands,[29] among others. They provide consultancy, advisory and strategic development services to different companies, both public and private; they are focused on the 360 approaches for companies and cover a wide range of activities focused on development of graphic design and communication, branding, packaging, decoration, interior and product design, among others.

Independent designers who are dedicated to the development of their own products such as Dennise Calero jewellery creator,[30] Uve jewellery,[31] Cuica laboratory of inventions,[32] Inti eyewear,[33] Fernando Echeverria[34] and Materia,[35] among others, are dedicated to different fields such as jewellery, leather goods, fashion accessories and household items, mainly.

At present, the fields of design have diversified and the work of designers in Ecuador has expanded. This shows that academic development is essential to provide professionals with the skills, aptitudes and attitudes of the discipline to face the challenges that the country proposes.

23   https://www.instagram.com/urku.designstudio/

24   http://www.olivez.ec/

25   https://ziette.com/

26   https://zonadegestacion.com/

27   https://www.holasapiens.com/

28   http://ficto.com.ec/ficto/

29   https://hotbrands.global/

30   https://www.instagram.com/dennisecalero/

31   https://www.instagram.com/uvejewelry/

32   https://www.instagram.com/cuicalab/

33   https://www.intieyewear.com/

34   https://ferech.com/

35   https://www.instagram.com/materiaec/

3.2.   Case Study

3.2.1.   Faculty of Architecture and Design of the Pontificia Universidad Católica del Ecuador

Originally, the experimental Faculty of Architecture and Design was born in 1994. Initially, it offered two majors: (i) Architecture, and (ii) Design. In 1998 a third career was incorporated: Plastic Arts, later renamed Visual Arts. From then on, the name of the faculty was changed to the current Faculty of Architecture, Design and Arts (FADA).

In 2003, the specialisation of the Design Career was generated and divided into two: (i) Product Design and (ii) Graphic Design and Visual Communication. In 2022, the creation of the fifth career was approved: Engineering in Urban and Territorial Planning.

When it was created in 1994, as mentioned FADA was an experimental faculty. That year, between February and June, its creation was approved by the Superior Council and Rectorate of the PUCE, the responsible administrative instances. The academic offer was opened in the second semester of 1994.

10   Careers in FADA-PUCE.
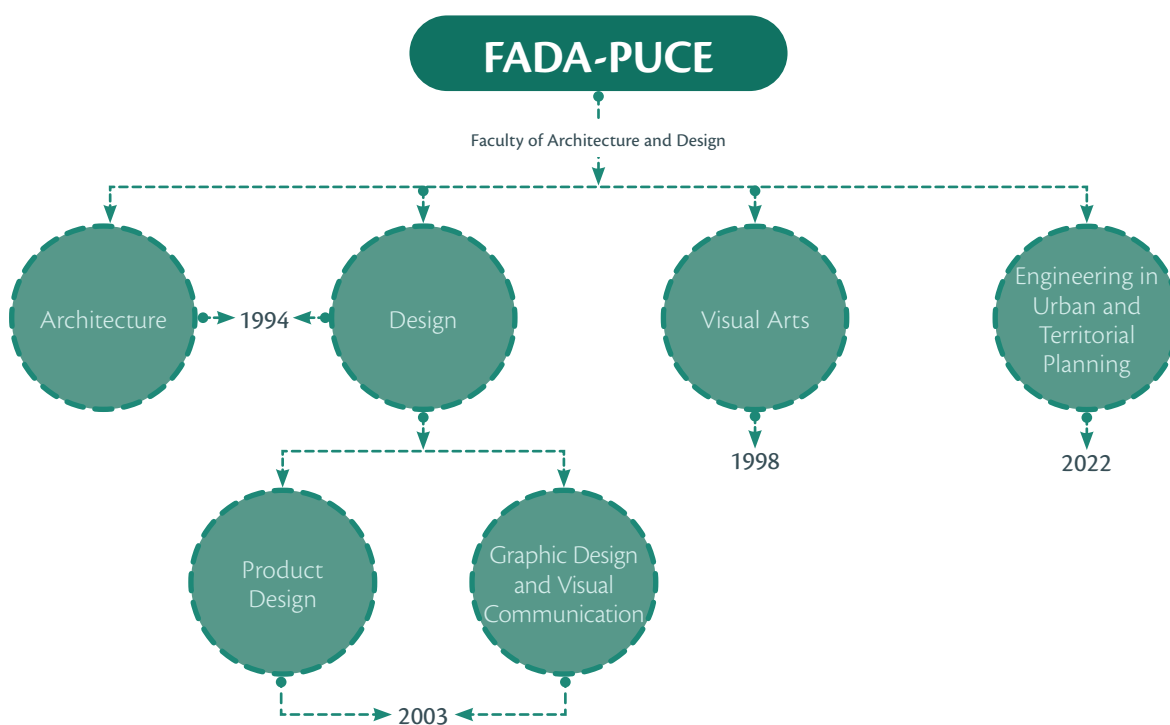
Since then, at FADA the main engine has been by the *learning by doing* formula. Among its innovative proposals was the *common first year*, quite similar to the Vorkus of the Bauhaus,[36] which focused on total and holistic learning. The professors belonged to different fields: (i) urban, (ii) architectural, (iii) product design, (iv) graphic design and (vi) arts. They introduced students to the generic disciplinary field that all these professions share in common and encouraged extensive experimentation; this was in force in the Architecture and Design careers until 2007 when the change to a specific teaching of the disciplines was proposed. As Diego Carrión Mena said: "From the pedagogical point of view, this implied establishing a common starting course: two semesters of liberal arts that would allow students to decide and choose their path".[37]

On the other hand, the structure of the career also had its evolution.

> "Since its creation (1994), FADA began the Architecture and Design careers with a common year, the Basic Year, which included the first and second level. The two careers had a duration of 10 semesters. This first year was the first stage of learning. It mainly sought to develop reflective thinking and had a vision of vocational guidance. At the end of the second level, the students opted for one of the two careers."[38]

Between 2000 and 2001, hand in hand with the financial crisis in Ecuador, the dollarisation process and the massive migration to Spain, Italy and the United States, the FADA entered into crisis. The resignation of the majority of the founders implied a change of authorities and the entry of foreign professors, as well as a change of vision and a proposal for transformation, the result of which is perceived in the implementation of the 2003 plan which will be explored on a deeper level later on.

The history of the FADA Product Design Career is not recorded or documented; many of the elements described in this research are known through the oral transmission of authorities, professors and students.

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36 The Staatliche Bauhaus ('State Building House'), or simply Bauhaus, was the school of Architecture, design, crafts and art founded in 1919 by Walter Gropius in Weimar, Germany. Author's note.

37 Faculty of Architecture, Design and Arts (FADA). 2014. *Twenty FADA, 1994-2014: Vol. I* (1 Edición). Publication Centre PUCE. (Spanish)

38 Product Design Career. 2010. *Career in Professional Design with mention in Product Design*. Pontificia Universidad Católica del Ecuador. Pp. 2 (Spanish)

"There was also evidence of the scarcity of written reflections that would allow the community to socialise the Integral Design thought, and keep a record of how the career developed and was developing. Finally, the lack of reflections on Design pedagogy and the lack of development of research in this field became evident."[39]

There is no official fixed query base about the first years. The documents identified, analysed and systematised in this research have been compiled through the collaboration of different actors who have kept them privately. The lack of formal memory is the result of: (i) constant administrative changes, (ii) lack of management of activities, (iii) minimisation of the culture of registration and documentation, and, (iv) lack of management and confidentiality of information.

Between 1994 and 2010 the little information available is brief and incomplete; as of 2010 there is a better quantity and quality of information.

It is clear that between 2015 and 2018 the records improve hand in hand with the redesign of the career; at this stage, the document base is better. At the moment, the information is collected in a better way and this allows analysing the development of the career, its successes and errors in favour of proposing a better future.

As it will be seen in the following sections, the product design career has been modified since its original conception in a chronological process that can be summarised as follows:

Product Design Career

1994 - nowadays

Design Career	Academic Action Plan PAC	Plan Q041	Redesign Product Design Career
1994-1997	2003	2007-2010	2018-2019

11   Chronological process of the Product Design Career FADA-PUCE.

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39   Faculty of Architecture, Design and Arts (FADA). 2014. *Twenty FADA, 1994-2014: Vol. I* (1 Edición). Publication Centre PUCE. Pp. 80. (Spanish)

3.2.2. Product Design Career 1994 - nowadays

Jorge García and Fernando Calle, two of the founders of FADA, explain the teaching-learning process that the faculty had. "Learning to learn, learning to relearn, learning to unlearn, learning to undertake and to be."[40]

As previously mentioned, design was initially taught as an *integral whole*, that is, students learned and developed projects in different fields, mainly dedicated to product, graphic, interior, and fashion design.

In 2002, from the implementation of the recommendations of the technical consultancy carried out in 2001 by Jaime Franky,[41] it was defined that it was necessary to specify the fields of learning and development of the Design Career and it was determined that it should be divided into two broad fields: Product Design and Graphic Design and Visual Communication, this was implemented from the second period of 2003. This proposal gains strength due to the administrative change that FADA underwent between 2000 and 2001, from the shuffling of professors and introduction of new ones, which caused an ideological transformation in the construction of the Design Careers.

3.2.2.1. Initial period 1994-1997

As Monard says: Diego Carrión Mena in his inaugural speech, in June 1994, synthesised the objective of creating the two initial careers when he said:

> "[…]the faculty (Architecture and Design Careers) arises under the conception and desire to contribute to the formation of human resources that are socially sensitive, who are technically capable of comprehensively addressing the various aspects of Architecture and design, in the indissoluble articulation between society and its environment […]"[42]

The initial proposal of the career offered two types of training, a professional one with 10 semesters (five years) of studies with the titles of: Product Design,

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40 Faculty of Architecture, Design and Arts (FADA). 2014. *Twenty FADA, 1994-2014: Vol. I* (1 Edición). Publication Centre PUCE. Pp. 15.(Spanish)

41 Architect from the National University of Colombia (1981), Master in History and Theory of Art and Architecture from the National University of Colombia (2004), Diploma in Intensification in design of industrial elements from the National University of Colombia (1983). Full-time associate professor of the Industrial Design Career at the National University of Colombia. Author's note.

42 Faculty of Architecture, Design and Arts (FADA). 2014. *Twenty FADA, 1994-2014: Vol. I* (1 Edición). Publication Centre PUCE. Pp. 32. (Spanish)

and Graphic Design and Visual Communication; and another technical and te-chnological one with two intermediate careers of six semesters (three years) and with the titles of: Technology in Products Design and process control, and Technology of Graphic Design and process control.

Later, in 1997, the program was merged into a single degree with the title of In-tegral Design, although the offer of technical training was maintained.

Duration	Approach	Title
10 semesters (5 years)	Professional	Product Design and;
		Graphic Design and Visual Communication
6 semesters (3 years)	Technical - technological	Technology in Product Design and process control
		Technology in Graphic Design and process control.

6   Original Design Careers of FADA-PUCE.

This first change in the degree responded to a necessity to recover generality instead of specialty, in which a designer possesses different capacities to res-pond to the environment.

The first updated plan sought to train professionals capable of building a more humane, just, supportive, creative and profoundly democratic future. Peralta in the article *El Taller de Diseño* (The Project Design), summarised the three types of design that were taught[43]: (i) grounded design to be able to do it here and now, meaning, contextualised; (ii) flying or creative design that encompasses everything from the game, fantasy or from a possibility of utopia; and, (iii) de-sign in the infinite redesign with constant processes of evolution, in which the design of an object can be modified or optimised. Through these three types, the aim was to humanise professionals with their environment.

In addition, the program sought to broaden the training of designers to improve their comprehensive professional profile, based on a holistic approach that was synthesised in the following four aspects: (i) Broad ceiling, meaning the possi-bility of a career that grows in an interdisciplinary territory; (ii) Movement and constant change of the career to maintain an openness to change and to truly transform its teaching; (iii) Design with its own personality with a holistic vision as input to understand in a better way the participation of design in the context;

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43   Peralta Ebelia. 1997. *Designinga Design Career*. Diseños Magazine 1. (Spanish)

(iv) Training based in objective knowledge through the link to other media and disciplines to support and explain the practice of design.[44]

It can be observed in this first stage, even if the objective of the career was clear, the first plan had to be updated to provide more tools to its students. Two stages in the educational process can be identified, (i) the basic cycle shared with Architecture with the liberal arts, as mentioned by Carrión, and (ii) the formative cycle in which different types of projects where developed, which were linked to the main areas: product, graphic, interiors and fashion design; the title was developed once students graduated.

In this first plan, a lack in the use of project methodology was observed, we can asume the use of the *black box*[45] method, the processes that were addressed were more experimental in the development of projects; in terms of theoretical support, clear trends of thought were not identified in subjects or contents that were addressed by this plan; likewise, the teaching methodology was experimental.

Plan	# S	Formation cycles			Theory	Teaching Methodology	Design Methodology
		Cycle	S	Shared with			
1994-1997	10	Basic cycle	1s	Architecture	None	Experimental	Experimentation
			2s				
		Training cycle	3-10s	None			Black box

7   Summary of the plan 1994-1997.

3.2.2.2.   Academic Action Plan - 2003 (PAC)

As of the 2000 and 2001 crisis, the new authorities of the FADA-PUCE hired an external consultancy to analyse the state of design careers.

Although it is true, an analysis of the situation was necessary due to the departure of the majority of the conceptual authors of the career, it was undeniable that it had been a mistake to have designated the gathering of information and the analysis of the proposal to a single person, and that was implemented and executed from the second semester of 2003 under the supervision of the Career Department.

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44   Product Design Career. 2010. *Professional Design Career with mention in Product Design*. Pontificia Universidad Católica del Ecuador. (Spanish)

45   The black box and the transparent box are terms coined by John Christopher Jones in his book Design Methods, to explain the design processes. Author's note.

The diagnosis concluded that the specialisation of the careers was necessary because the designers did not have enough tools to respond to each specific area and the acquired knowledge was generic. This observation was also supported by feedback from career graduates, many of whom had found it difficult to establish themselves in their professional fields.

The situation has been documented as follows:

> "In the Second Semester of the 2003-2004 School Year, the Design Career changed the duration of its career from 10 to 8 semesters, but kept the subjects of the Basic Year, common to the Architecture and Design careers. This reform in its academic part, opted for a disciplinary approach to design in its specific fields. Graphic Design and Visual Communication together with the design of Products and configuration of objects, that take place in the educational model of the career."[46]

For this reason, the academic action plan (PAC) adopted some measures: (i) to reduce the training to 8 semesters (4 years), (ii) eliminate intermediate careers, technical-technological titles, and (iii) identify that the technological titles were not recognised in the work field. Three aspects were raised at the methodological level: (i) community participation, (ii) relevance to the needs of the context, and (iii) recognition of the road to be taken and obtained achievements so far.[47]

However, the plan has shortcomings because it did not have a tactical, operational and regulatory approach, which would facilitate its execution, because the training of designers was improvised. In addition, it did not take into account the resources it had, including infrastructure, faculty, and administrative staff. There was also an inadequate number of professors to cover the needs of the careers, which resulted in training which was biased by few visions; for example, the career had three full-time professors who taught most of the subjects.

At that time, the basic cycle shared with the Architecture degree was maintained (1-2 semester), as well as a shared semester with the Graphic Design degree (3 semester); from the fourth semester, vertical training was applied up until the seventh semester, the eighth semester was dedicated to the graduation process.

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46   Product Design Career. 2010. *Professional Design Career with mention in Product Design*. Pontificia Universidad Católica del Ecuador. Pp. 3. (Spanish)
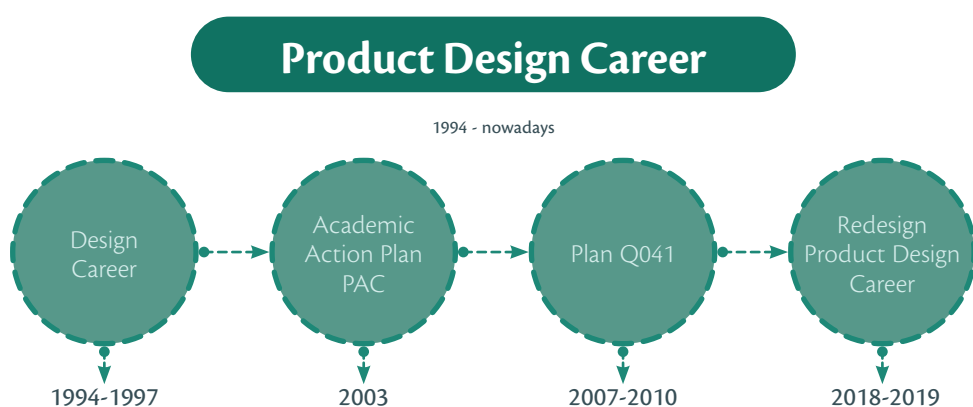
47   Faculty of Architecture, Design and Arts (FADA). 2014. *Twenty FADA, 1994-2014: Vol. I* (1 Edición). Publication Centre PUCE. (Spanish)

Vertical training was planned to encourage collaborative work in students; the model opted that, through shared experiences and the knowledge of others, learning could take place as well. The proposed projects were organised according to their complexity and the type of objects, for example: tableware, furniture, transport, jewellery, handicrafts and lighting, among others, as well as learning about different types of materials, their techniques and technologies.

This method was based on the proposal of Sánchez 2005, to reference objects with a haptic scale:

> "[…] it includes gestures as a way of communication (with emphasis on the scale of the hands), and the form in terms of the mediator of acts and gestures is a haptic structure. The objects of digital technology should come from this study (a Rubik's cube, a cup or a piece of jewellery are haptic structures)."[48]

In this scale where developed projects pertaining to jewellery, crafts, tableware, luminaire, among others.

To reference objects with proxemics scale:

> "[…] comprises the relationships between individuals and space; or how individuals understand space (enter, exit, pass, move, inside, outside, flow, etc.) and the form as a stable space or configuration of a space is a proxemics structure. It is widely used in workstations, cabins and all objects of inclusion, macro-objects and semi-mobile objects that tend to contain or semi-contain the human body and that are of a spatial order."[49]

The projects developed in this area were: home, office and urban furniture, workstations, scenography, museography, window dressing, among others.

To reference objects with kinetic characteristics: "includes everything related to movement, where the shape conditions movement from its morphology (perceptive, formal tensions) or functional as a means of generating movement (a skateboard)",[50] the projects that were developed around mobility and transport.

48 Sánchez Mauricio. 2005. *Morphogenesis of the Object of Use* (Second edition). Jorge Tadeo Lozano University of Bogota Foundation. Pp. 32. (Spanish)

49 Sánchez Mauricio. 2005. *Morphogenesis of the Object of Use* (Second edition). Jorge Tadeo Lozano University of Bogota Foundation. Pp. 32. (Spanish)

50 Sánchez Mauricio. 2005. *Morphogenesis of the Object of Use* (Second edition). Jorge Tadeo Lozano University of Bogota Foundation. Pp. 32. (Spanish)

FADA defined the Product Designer profile as: "Product configurator, who develops them based on the constant search for creativity and innovation. The designer assumes a serious commitment to the configuration of his products and their impact on the environment and ecology".[51]

This plan also lacked project methodologies, they maintained experimentation (*black box*) for product development, however, the line of theoretical thinking was linked to Morin's complex thought; theories such as the semiotics of communication and ergonomics were introduced. In the same way, as in the previous plan, there was no clear definition of subjects and content, as a result of poor planning within the plan.

By way of conclusion, in this second plan it can be affirmed, that the specialisation of the careers and the difference between Product Design, and Graphic Design and Visual Communication were opted for. The execution was disastrous due to a lack of planning, the future of the careers was handed over to an external consultant who issued a criterion under which a reform was proposed without considering the evolution of the career and the objective with which it had been created. Three levels of training were identified: (i) the basic one that maintained the common year with Architecture, and the third semester that was shared with the Graphic Design career; (ii) a formative level from the fourth to the seventh semester with a vertical teaching in which different skills and complexities came together; the projects were focused on typologies of objects and lacked project methodologies, it was maintained experimentation (*black box*); (iii) in the eighth semester, which was the professional level, the final project began. Also, the teaching was experimental as the plan before.

This plan was rejected by the students who felt the improvisation of its application and felt that they were deceived since it did not comply with what was offered and promoted in relation to the degree.[52]

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51   Faculty of Architecture, Design and Arts (FADA). 2014. *Twenty FADA, 1994-2014: Vol. I* (1 Edición). Publication Centre PUCE. Pp. 83. (Spanish)

52   This is the conclusion of the Graduate Follow-up process in which the students of this period participated, between 2007 and 2013. Author's note.

Plan	# S	Formation cycles			Theory	Teaching Methodology	Design Methodology	Type of products developed
		Cycle	S	Shared with				
Plan 2003 (PAC)	8	Basic cycle	1s	Architecture	Morin's complex thought	Experimental	Experimentation Black box	Based on typology and scale
			2s					
			3s	Graphic Design				
		Training cycle	4-7s vertical	None	Semiotics			
		Professional cycle	8s		Ergonomics			

8   Summary of the plan PAC 2003.

3.2.2.3.   Plan Q041 2007-2010

Given the lack of planning and the rejection by the students of the PAC, in 2007 a new adjustment was proposed in the career, one of the main changes was to end the joint basic cycle with the Architecture career and move to a shared basic cycle only with the Graphic Design career in which the knowledge was addressed in common.

The change was clearly documented.

> "In the second semester of the 2006-2007 school year, the design career presented another modification to its curriculum: it proposed changes in first and second level subjects, with more specific programs for the design program and reduced it to a 190-credit plan.
>
> In the First Semester of the 2007-2008 School Year, the design career began its independent curriculum from the Architecture career, except for the second level that continued with Architecture and design students, thus being the last common semester of the basic year."[53]

Three levels of training were defined: (i) the basic cycle, (ii) the training cycle, divided into two: Training 1, lasting one year and Training 2, lasting another year and (iii) the professional cycle. In the latter, a project was worked on together with the seventh level, with a transversal project with the two disciplines and with an emphasis on strategic design, seeking to work with companies and an approach to the reality of the national context; the eighth semester was devoted to degree work.

The training cycle 1 consisted of one year in which the projects were developed under thematic axes whose objective was to develop functional and formal objects.

53 Product Design Career. 2010. *Professional Design Career with mention in Product Design.* Pontificia Universidad Católica del Ecuador. Pp. 4 (Spanish)

"[…] Formative cycle 1 (one year), in which the proposal defines a division by thematic axes, which are traced according to the sectors of the socio-economic structure of the country, each semester two themes are assumed to be developed in the product Design Projects, themes that are worked related to the vertical disciplinary axes."[54]

In this first formative cycle, the development of haptic scale objects was maintained; in the second formative cycle, instead, the focus was on the development of projects of a proxemics and kinetic scale.

"The emphasis of the appreciation is focused on the conceptualisation of the elaboration of the design…Formative cycle 2 develops project proposals intervening in the configuration of systems that deal with complexity and multiplicity of design applications. In this period of four semesters, the activities are developed interactively with the student, the set of knowledge, techniques, instruments, skills and professional values, enough to achieve a commitment with themselves, in terms of the need of learning to learn. It mainly seeks to develop critical thinking."[55]

In this plan, from the third semester onwards, thematic workshops were undertaken. Project III was dedicated to objects of use with emphasis on their function. Project IV targets objects with an emphasis on their language. Project V deals objects of immediate surroundings, while VI is destined to the objects of industrial production; however, the emphasis on the object and its typologies was maintained as in the previous plan.

Another characteristic was working on problem-based learning (PBL)[56] as a teaching-learning methodology so that students develop their reflective and divergent thinking; it was undoubtedly the first plan that integrated *concept* and *process* in design teaching. The adjustment of the plan presented in 2010 does not register substantial changes, although there were adjustments in form of the descriptors of some subjects to update their contents. This plan was in force until the first semester of 2021, when the last group of students finished the last academic period.

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54 Product Design Career. 2010. *Professional Design Career with mention in Product Design*. Pontificia Universidad Católica del Ecuador. Pp. 4. (Spanish)

55 Product Design Career. 2010. *Professional Design Career with mention in Product Design*. Pontificia Universidad Católica del Ecuador. Pp. 4. (Spanish)

56 Problem-Based Learning is an innovative teaching method that uses complex, real-world problems as a vehicle to promote student learning of concepts and principles, as opposed to the direct presentation of facts and concepts. Source: PUCE 2022 training.

Plan	# S	Formation cycles				Theory	Teaching Methodology	Design Methodology	Type of products developed
		Cycle	S	emphasis	Shared with				
Plan 2007-2010 (Q041)	8	Basic cycle	1s	-	Graphic Design	- Morin's complex thought - Semiotics - Ergonomics	PBL	• Bruno Munari • INTI • Design Thinking	Based on typology, context and scale
			2s						
		Training cycle	Formative Cycle 1	3s	emphasis on function	None			
				4s	emphasis on language				
			Formative Cycle 2	5s	objects immediate surrondings				
				6s	industrial production				
		Professional cycle	7s	emphasis on strategic design					
			8s	-					

9   Summary of the plan Q041 2007-2010.

Figure 12 shows the organisation of this plan by levels and training cycles. One of the shortcomings observed in this plan is that subjects have generic names, therefore there was no structure or clear definition of the contents of each one; repetition and change of topics was also generated, as well as an approach to random topics, depending on the knowledge of the professor.

MALLA CURRICULAR DE LA CARRERA DE DISEÑO DE PRODUCTOS   SEGUNDO SEMESTRE 2011-2012

PLAN DE ESTUDIO Q041

TRABAJO DE FIN DE CARRERA

FECHA: 12/FEB/2012

NIVEL 1 — CICLO BÁSICO

- TALLER DE DISEÑO I — COD.: 11870 — CRED.:8
- TEORÍA DEL DISEÑO I — COD.: 14317 — CRED.:2
- PENSAMIENTO CONTEMPORÁNEO — COD.:14263 — CRED.:3
- TECNOLÓGICO I — COD.:11876 — CRED.:2
- LABORATORIO HERRAMENTAL I — COD.:14293 — CRED.:2
- DIBUJO I — COD.:12030 — CRED.:2
- REPRESENTACIÓN GRÁFICA I — COD.:14315 — CRED.:2
- FOTOGRAFÍA I — COD.:12029 — CRED.:2
- MATEMÁTICAS I — COD.:11875 — CRED.:2
- SEGUNDA LENGUA I — CRED.:5
- OPTATIVA — CRED.:2

32

NIVEL 2

- TALLER DE DISEÑO II — COD.: 14764 — CRED.:8
- TEORÍA DEL DISEÑO II — COD.:14770 — CRED.:2
- INTERDISCIPLINARIO I — COD.: 14766 — CRED.:2
- TECNOLÓGICO II — COD.:11882 — CRED.:2
- LABORATORIO HERRAMENTAL II — COD.:14772 — CRED.:2
- DIBUJO II — COD.: 14773 — CRED.:3
- REPRESENTACIÓN GRÁFICA II — COD.: 14774 — CRED.:2
- FOTOGRAFÍA II — COD.: 14769 — CRED.:2
- MATEMÁTICAS II — COD.: 11880 — CRED.:2
- TALLER DE COLOR I — COD.: 14765 — CRED.:1
- SEGUNDA LENGUA II — CRED.:5
- OPTATIVA — CRED.:3

34

NIVEL 3 — CICLO FORMATIVO I

- TALLER DE DISEÑO III PRODUCTOS III — COD.: 14406 — CRED.: 8
- TEORÍA DEL DISEÑO III PRODUCTOS III — COD.: 14419 — CRED.: 2
- INTERDISCIPLINARIO PRODUCTOS II — COD.: 14413 — CRED.: 2
- TECNOLÓGICO PRODUCTOS III — COD.: 14391 — CRED.: 2
- LAB. HERRAMENTAL PRODUCTO III — COD.: 14431 — CRED.: 3
- LAB. DE MODELOS PRODUCTOS I — COD.:14394 — CRED.: 2
- REPRESENT. GRÁFICA PRODUCTOS III — COD.: 14422 — CRED.: 2
- FACTORES HUMANOS PRODUCTOS I — COD.: 14418 — CRED.: 2
- TALLER DE COLOR II — COD.: 14423 — CRED.: 1
- SEGUNDA LENGUA III — CRED.: 5
- OPTATIVA — CRED.: 3

32

NIVEL 4 — CICLO FORMATIVO I

- TALLER DE DISEÑO IV PRODUCTOS IV — COD.: 16180 — CRED.: 8
- TEORÍA DEL DISEÑO IV PRODUCTOS IV — COD.: 16178 — CRED.: 2
- INTERDISCIPLINARIO PRODUCTOS III — COD.:16179 — CRED.: 2
- TECNOLÓGICO PRODUCTOS IV — COD.: 16181 — CRED.: 3
- LAB. HERRAMENTAL PRODUCTOS IV — COD.: 16175 — CRED.: 3
- LAB. DE MODELOS PRODUCTOS II — COD.: 11931 — CRED.: 2
- REPRESENT. GRÁFICA PRODUCTOS IV — COD.: 16176 — CRED.: 2
- FACTORES HUMANOS PRODUCTOS II — COD.: 16177 — CRED.: 2
- SEGUNDA LENGUA IV — CRED.: 5
- OPTATIVA — CRED.: 3

32

NIVEL 5 — CICLO FORMATIVO II

- TALLER DE DISEÑO V PRODUCTOS V — COD.: 16185 — CRED.: 8
- TEORÍA DEL DISEÑO V PRODUCTOS V — COD.: 16184 — CRED.: 2
- INTERDISCIPLINARIO PRODUCTOS IV — COD.: 16365 — CRED.: 2
- TECNOLÓGICO PRODUCTOS V — COD.: 16366 — CRED.: 3
- LAB. HERRAMENTAL PRODUCTOS V — COD.: 16182 — CRED.: 2
- LAB. DE MODELOS PRODUCTOS III — COD.: 16364 — CRED.: 2
- FACTORES HUMANOS PRODUCTOS III — COD.: 16183 — CRED.: 2
- PRÁCTICAS I — COD.: 16367 — CRED.: 2
- SEGUNDA LENGUA V — CRED.: 5
- OPTATIVA — CRED.: 3

30

NIVEL 6 — CICLO FORMATIVO II

- TALLER DE DISEÑO VI PRODUCTOS VI — COD.: 16188 — CRED.: 8
- TEORÍA DEL DISEÑO VI PRODUCTOS VI — COD.: 16187 — CRED.: 2
- INTERDISCIPLINARIO PRODUCTOS V — COD.: 16666 — CRED.: 2
- TECNOLÓGICO PRODUCTOS VI — COD.: 16189 — CRED.: 3
- LAB. HERRAMENTAL PRODUCTOS VI — COD.: 16186 — CRED.: 2
- LAB. DE MODELOS PRODUCTOS IV — COD.: 16368 — CRED.: 2
- JESUCRISTO Y LA PERSONA DE HOY — COD.: 16667 — CRED.: 3
- PRÁCTICAS II — COD.: 16668 — CRED.: 2
- SEGUNDA LENGUA VI — CRED.: 5
- OPTATIVA — CRED.: 3

32

NIVEL 7 — CICLO PROFESIONAL

- TALLER DE DISEÑO PRODUCTOS VII — COD.: 16191 — CRED.: 8
- TEORÍA DEL DISEÑO PRODUCTOS VII — COD.: 16190 — CRED.: 2
- INTERDISCIPLINARIO PRODUCTOS VI — COD.: 16670 — CRED.: 2
- TECNOLÓGICO PRODUCTOS VII — COD.: 16671 — CRED.: 2
- LAB. DE MODELOS PRODUCTOS V — COD.: 16669 — CRED.: 2
- SEMINARIO PRODUCTOS TFC — COD.: 16192 — CRED.: 3
- PRÁCTICAS III — COD.: 16672 — CRED.: 2
- OPTATIVA — CRED.: 3

24

NIVEL 8 — CICLO PROFESIONAL

- TALLER PROFESIONAL PRODUCTOS TFC — COD.: 16194 — CRED.: 8
- INTERDISCIPLINARIO PRODUCTOS TFC — COD.: 16193 — CRED.: 2
- ASESORÍAS PRODUCTOS TFC — COD.: 16674 — CRED.: 4
- ÉTICA PERSONAL SOCIAL Y PROFES. — COD.: 16673 — CRED.: 3
- PRÁCTICAS IV — COD.: 16675 — CRED.: 5

20

Leyenda:
- ÁREA DE TALLER
- ÁREA INTERDISCIPLINARIA
- ÁREA DE TEORÍA
- ÁREA HERRAMENTAL

Totales: 22 — 32 — 30 — 32

12   Organisation chart of Plan 1003 of the FADA-PUCE Product Design Career, by levels and cycles, levels and subjects. PUCE, 2013.
Source: Product Design Career.

As a summary, this plan maintained the 8 semesters, it ended the common year with the Architecture career and it begins to have a common year with the Graphic Design career. It was better structured than the previous plans, as it defined a certain type of project per semester. The emphasis on the object was maintained and the vertical formation was eliminated to return to a transversal formation.

3.2.2.4.   Graduation Process

In Ecuador, the process of graduation and obtaining the professional title have particular characteristics, through the years and the different plans, graduation has been transformed to improve and increase the number of professionals; also responding to state processes. During the first plan 1994-1997, the students studied for 10 semesters and once this period ended, the student had 3 semesters to develop a final project independently; this figure in Ecuador its known as *egresamiento/egresados*;[57] once completed, it was presented to a panel of professors that evaluated it; at the end of this process the title of Designer was obtained. In the 2003 PAC and 2007-2010 Q041 plans, the final project began in the eighth semester, but continued with a process similar to the previous one, 3 semesters to develop it independently, once completed, it was presented to a panel of professors that evaluated. In the 2018-2019 plan, the final project is carried out during the last semester as part of a subject and at the end of the semester a panel evaluates it and the title of Product Designer is obtained, the students no longer have to do it in an extended period.

The problem of the process prior to the redesign is that the students did not complete the projects in the stipulated time, which meant that they did not obtain professional titles. When carrying out an evaluation of the Career, there were many *egresados* and few graduates.

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57   Egresamiento (action) or egresados (students) are people who have satisfactorily completed and passed the entire regulated study plan for a program or career, but who have not yet received the academic degree, due to the lack of development of the final project. Graduates are those who have received the academic degree. Egresamiento/egresados has no translation into English. Author's note.

Table 10 shows the different plans and their structure by semester, training and graduation process.

Plan	# S	Formation cycles								Graduation process
		Cycle	S	Shared with	Cycle		S	Cycle	S	
Plan 1994-1997	10	Basic cycle	1s	Architecture	Training cycle		3-10s			Once the last courses were finished
			2s							
Plan 2003 (PAC)	8	Basic cycle	1s	Architecture	Training cycle		4-7s	Professional cycle	8s	Once the last courses were finished
			2s							
			3s	Graphic Design						
Plan 2007-2010 (Q041)	8	Basic cycle	1s	Graphic Design	Training cycle	F1	3-4s	Professional cycle	7-8s	Once the last courses were finished
			2s			F2	5-6s			
Plan 2018-2019	8	Basic unit	1s	None	Professional unit		4-7s	Curricular Integration Unit	8s	8s
			2s							
			3s							

10 Comparison of the Semester Structure of the 1994-1997, 2003, 2007-2010 and 2018-2019 Plans.

Below, the curricular evolution and the main characteristics of each plan is shown:

DESIGN

Architecture

PRODUCT DESIGN PAC

PRODUCT DESIGN

FADA-PUCE
Faculty of Architecture and Design
1994

PRODUCT DESIGN

curricular stages

1. 1994-1997

2. 2003

3. 2007-2010

4. 2018-2019

PRODUCT DESIGN

holistic approach

- Design with possibility to grow from other disciplines
- Design in motion and constant change
- Design with its own personality
- Base trainingto objective knowledge

- Do-learn-do
- Based on the principles of the new education
- Build schemes-break schemes
- Based on the principles of complexity
- Learn-unlearn-relearn
- Based on the principles of complexity (the other education)

5 years - 10 semesters

3 years - 6 semesters - technicians/technologists

1 common year

- reflective thinking
- divergent thinking
- vocation

design methodology

black box

specific fields

- PRODUCT DESIGN
- Graphic Design

1 semester common

- common projects
- shared subjects
- generic knowledge

- Vertical formation, 4-7 semester together

shared learning

4 years - 8 semesters

GRAPHIC DESIGN

1 common year

- reflective thinking
- divergent thinking
- vocation
- generic knowledge

- Do-learn-do
- Based on the principles of the new education
- Build schemes-break schemes
- Based on the principles of complexity
- Learn-unlearn-relearn
- Based on the principles of complexity (the other education)

PBL problem based learning

- multi-methodological
- multididactic
- self-learning
- self-training

design methodology

- Bruno Munari
- INTI
- Design Thinking

4 years - 8 semesters

- PBL problem based learning
- CBL Challenge based learning
- PbL Project based learning
- Case-study based earning

- multi-methodological
- multididactic
- self-learning
- self-training

design methodology

- **discovering** (Research)
- **defining** (Problem)
- **developing** (Proposal)
- **applying** (Results)
- **evaluating** (Analysis)

4 years - 8 semesters

13   Curricular Processes of the FADA-PUCE Product Design Career.

3.2.2.5. Redesign of the Product Design Career 2018-2022, Plan Q177

For the last plan known as the redesign of the career, it was established that it should respond to the real context of the country and be consistent with the PNBV - PNTUV. Prior to the analysis of the redesign that is currently in force, it should be remembered that the direct insertion of design in the development of the country is part of the following problems that the profession addresses:

Problem	Description
1	Despite its evolution and the diversification of areas, there is a low insertion of design in the national productive apparatus in its different forms: 1. public, 2. private, 3. mixed, 4. communitarian, 5. associative or cooperative. It seeks to democratise the means of production to achieve greater social equity.
2	The quality of the products designed in Ecuador does not satisfy physical needs or national or international emotional expectations, so there is little export, and consumer goods are mostly imported.
3	National design suffers from: 1. Little information, dissemination and technical training, 2. Lack of incorporation of design aspects such as innovation and control of the environmental impact of products, services, systems, processes and experiences. In addition, at present high pollution (natural and cultural) exists or provokes deterioration of the environment and waste of resources.
4	- There is minimal inclusion of design policies in cultural and environmental aspects that guarantee the protection of both heritages. - Global trends increase the risk for the conservation of symbolic aspects and natural and ancestral knowledge, which are very rich in Ecuador.
5	There is a deficient culture of innovation in the design and development of products, services, systems, processes and experiences; both in their development and production, as well as in their benefits.
6	- There is low linkage of product design in the solution of the country's social problems. - There is little supply of national products and services to improve the quality of life of Ecuadorians and attention to minorities and vulnerable groups such as: disabled people, the elderly, rural populations or various genders are excluded, to a greater extent. - Limitations are caused by the adaptability of these groups to their social environment to have a dignified life, efforts are made to work on universal design policies, design for all or inclusive design to reduce the high levels of inequality.

11 Problems addressed by the profession. Source: Product Design Career.[58]

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58 Product Design Career. 2019. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. (Spanish)

As it was analysed in the previous chapter, considering the PNBV and PNTUV plans, their objectives, policies and problem nuclei, the fields of action of the profession and what to do in the Product Design Career of FADA-PUCE were defined. Under these parameters, the redesign of the career was proposed, which, as presented in the previous section, was worked on between 2015-2018 and updated in 2019. This result is the current offer and on which this research is developed.

This proposal has several innovative elements for design teaching, the most relevant are presented below.

First, the change in the teaching paradigm and structure that, as seen in previous proposals (1994-2010), were focused on the product, its complexity, and the context. The Design Project subjects included: "Product Design Project, where students must develop a project of low, medium or high complexity and high innovative value, which takes into account the natural, social, economic and technological environment".[59] **From there, it moves on thougnt or thesis-based proposals, as Rodríguez mentions:**

> "[…] theses are proposals that offer solid positions, but that alone do not manage to form a complete theory, so they are complemented with elements of the profession (theoretical foundations and methodological processes) and interdisciplinary theory, that are approaches in which the community of designers can agree on."[60]

The chosen thought/thesis models respond to the development they have gone through, their theoretical progress and development of their own methods processes and tools. The projection is proposed not only of products, but of services, systems, processes and experiences with a specific focus and based on chosen thought models.

In addition, work is being done to move away from discourses, since, as Rodríguez mentions, a discourse is understood as "[…] an argument or reflection that seeks to establish project approaches that reflect certain positions that have arisen from changes in the market or that have emerged in the social context […] they have an implicit short-term vision […] the future of discourses is uncertain."[61]

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59   Product Design Career. 2010. *Professional Design Career with mention in Product Design*. Pontificia Universidad Católica del Ecuador. Pp. 36-37. (Spanish)

60   RODRÍGUEZ Morales, L., BEDOYA Pereda, D., MORALES Zaragoza, N., & PEÑALOSA Castro, E. 2014. *User-centred design. Methods and interactions* (AM Losada & O. Salinas Flores, Eds.; First Edition). Editorial Designio. Pp. 10. (Spanish)

61   RODRÍGUEZ Morales, L., BEDOYA Pereda, D., MORALES Zaragoza, N., & PEÑALOSA Castro, E. 2014. *User-centred design. Methods and interactions* (AM Losada & O. Salinas Flores, Eds.; First Edition). Editorial Designio. Pp. 9. (Spanish)

It is understood that the academic space is one for debate, meeting and agreements in which discourses are not imposed.

This is how these thought models have been defined as follows:

	Name	Definition / Characteristics
1	User Centred Design (UCD) Design Centred on People (DCP) Emotional Design User Experience (UX)	Understood from the point of view of usability and experience, the recognition of the user from their physical and psychological sphere as the axes for the development of products, services, systems, processes and experiences.
2	Eco-design Sustainable design Green Design Circular Economy	Design deals with the conservation and respect for the environment (natural and cultural) through improving production processes, reducing and making better use of resources and taking care of the product's life cycles, among others.
3	Strategic Design IMDI model Design management	It uses models to promote the commercialisation and insertion of the product in the market. It uses strategies for planning, validation and innovation of products, services, systems, processes and experiences.
4	Participatory design Co-Design Social design Design for Everyone Co-Creation	As a model, it seeks insertion into social spaces often forgotten, it promotes the participation of all the agents or actors of the project to achieve designs adapted to the needs and expectations of the community.
5	Service Design	This model is a comprehensive proposal that develops material and immaterial products to improve systems and experiences. It is a comprehensive solution aimed at public and private space.

12   Models of thought or design theses. Source: Product Design Career.[62]

This proposal also focuses on the design paradigm shift from the eighties, the criticism of modernity and the entry into postmodernity. As analysed, in Ecuador the design process is late, so the plans developed for the university career between 1994 and 2010 responded to the postulates of modern design more than to postmodern ones, that is, they were focused on form and function primarily.

Rodríguez summarises three elements that define modern design: (i) morally, modern design determines lifestyles and marks what is appropriate or good for society; (ii) the rational that is manifested in the use of design methods, originally inspired by the scientific method; and (iii) the formal, the final objective of the design process defines design as an activity whose objective is the configuration of forms.[63]

62   Product Design Career. 2019. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. (Spanish)

63   RODRÍGUEZ Morales, L., BEDOYA Pereda, D., MORALES Zaragoza, N., & PEÑALOSA Castro, E. 2014. *User-centred design. Methods and interactions* (AM Losada & O. Salinas Flores, Eds.; First Edition). Editorial Designio. (Spanish)

The same author points out that "[…] as the central axes, there was the function —the '*must be*', which is a manifestation of moral—; propped up in the rational aspect of the paradigm: the methods and as an expected result of the process, the form."[64]

Based on the criticisms of modernity, different problems were identified in design, such as: (i) the focus on aesthetics that leads to the problem of styling and make-up of products focused on production, business, profits, and capital and not in the human being; (ii) technological change and the introduction of the digital age; and (iii) the low social focus given by a mass production approach and not focused on the needs of specific minorities.

For this reason, at present, three main approaches can be identified in how design is defined according to Rodríguez: (i) by its process, its methodological aspects and interdisciplinary interaction; (ii) for what it does, the action it performs; (iii) by its effects, it is defined by the results or effects it has with respect to society.[65]

In accordance with this change of approach to design in postmodernity, the approach of Ortiz (2014) in which design is treated as a cultural construction (Culture of Design) was adopted. The author of this thesis proposes a division of design based on Julier[66] (2010) and Frayling[67] (1994): knowledge (context), object (artefact as result) and project process (activity).

> "**Design culture in the universe of design**. The analytical-theoretical field of knowledge of design employed through research and theory defines concepts, historical-evolutionary process, designers and design icons, critique, and aesthetic. In this approach, design helps to base and consolidate the profession; however, it is necessary to know the past to project into the future and apply the culture of design within/in as a practice informed by the context."[68]

64   RODRÍGUEZ Morales, L., BEDOYA Pereda, D., MORALES Zaragoza, N., & PEÑALOSA Castro, E. 2014. *User-centred design. Methods and interactions* (AM Losada & O. Salinas Flores, Eds.; First Edition). Editorial Designio. Pp. 6. (Spanish)

65   RODRÍGUEZ Morales, L., BEDOYA Pereda, D., MORALES Zaragoza, N., & PEÑALOSA Castro, E. 2014. *User-centred design. Methods and interactions* (AM Losada & O. Salinas Flores, Eds.; First Edition). Editorial Designio. (Spanish)

66   JULIER G. 2010. *The culture of design*. Gustavo Gili. (Spanish)

67   FRAYLING, C. 1993. *Research in Art and Design*. Royal College of Art Research Papers, Volume 1 Number 1. Pp. 1-5. (English)

68   ORTIZ, I. 2014. *Ethics and Design: Ethical Responsibilities of the Design Project*. University of Lisbon. Pp. 13. (Spanish)

In this area, Design Culture is a process of building knowledge through itself, focusing on theoretical subjects that are the basis for practice.

"**Design culture through the artefact**. This is the area of ethics and society; in this field, the interaction, connotation and denotation of the design with the context in which it is developed and with the user for whom it is intended is investigated. Design culture through design (object/result) as an omnipresent but differentiated value. The artefact as a cultural element is a generator of material culture, which is the objectual dimension, and visual culture, which is the perceptive dimension through the denotation and connotation of the object, and communication of the formal, functional and symbolic designer's message. The artefact is an objectual result, a material representation of a visual culture, it is a symbolic and communicative object of a culture, and a message from the designer."[69]

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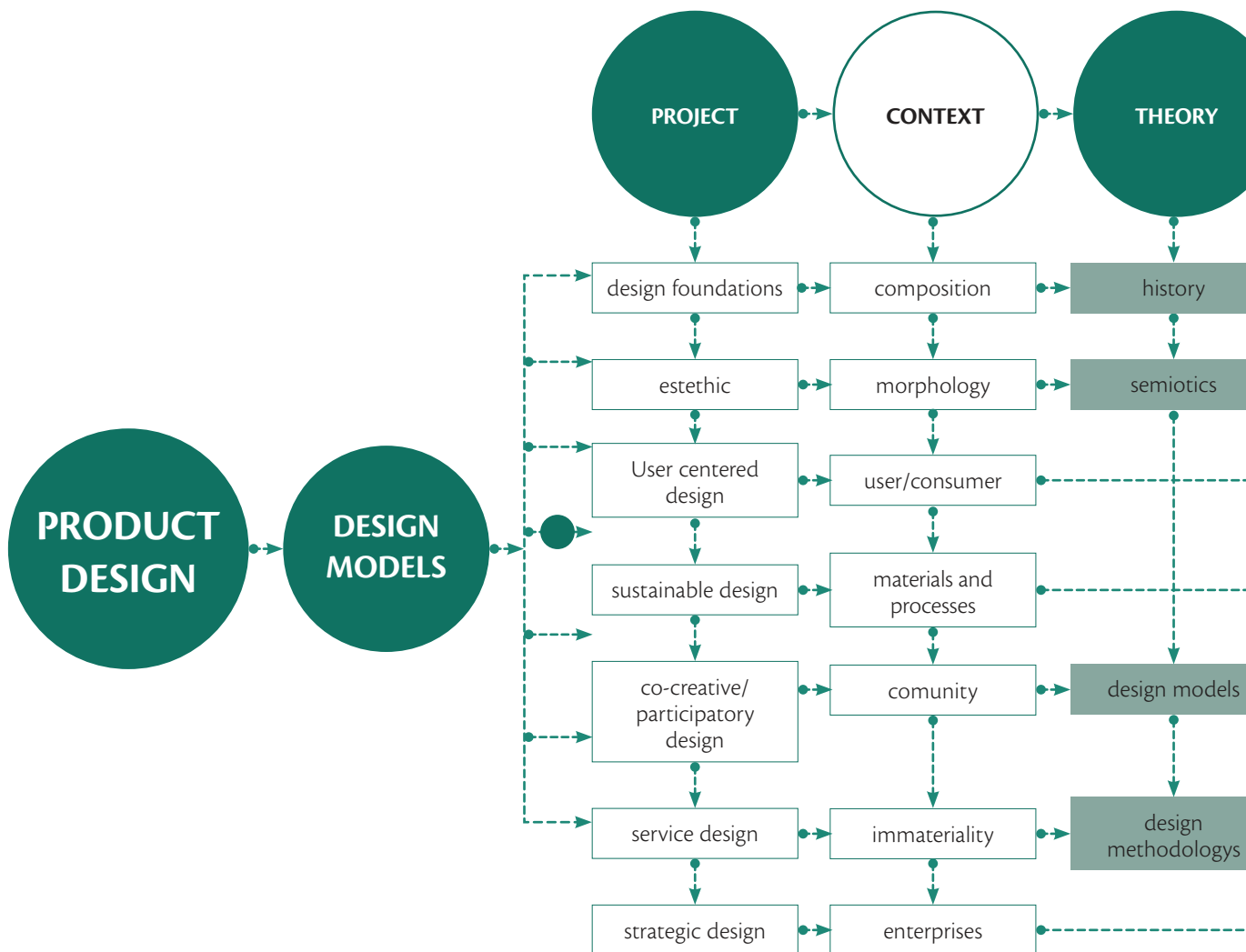
69   ORTIZ, I. 2014. *Ethics and Design: Ethical Responsibilities of the Design Project*. University of Lisbon. Pp. 14. (Spanish)

At this point, Design Culture is synthesised in the artefact as a result of what the discipline does.

Design culture in the design project. "It is the field that is developed in the project, operation and processes, through the investigation of: materials, processes, trends, methods. Design culture for design as a process".[70] The practical subjects that contribute to the design process are linked to this area of Design Culture. The following graph shows this proposed division.
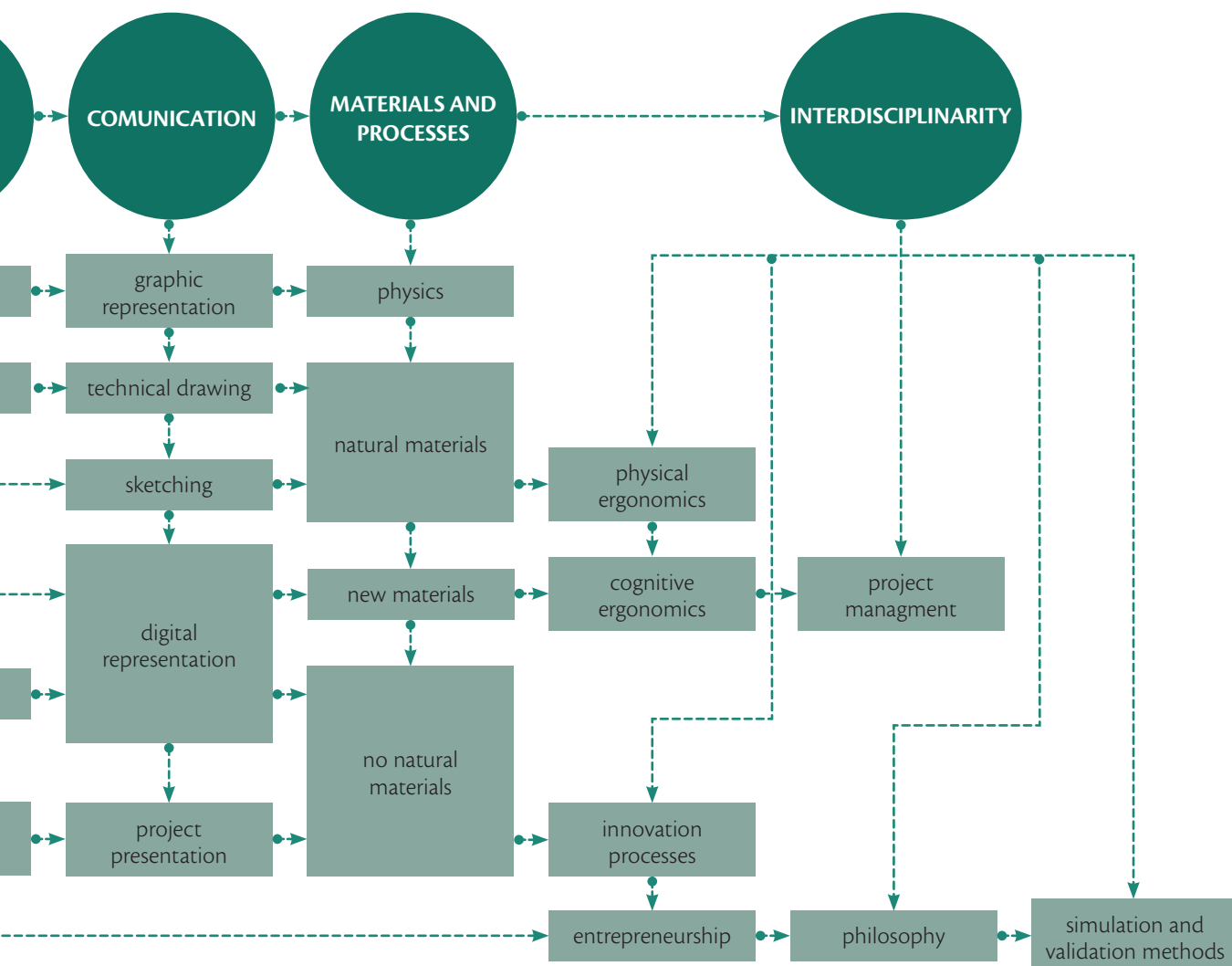
14   Axes of the construction of the redesign under the models of thought or thesis.

70   ORTIZ, I. 2014. *Ethics and Design: Ethical Responsibilities of the Design Project.* University of Lisbon. Pp. 14. (Spanish)

Under this vision, four axes of action are defined for the construction of the re-design: (i) professional praxis, where the design projects, materials and process (object and project process) are located; (ii) theoretical foundations (context), (iii) communication and graphic representation (object and project process), and (iv) interdisciplinary (context).

The projects are organised with the aim of building cumulative and sequential knowledge, in addition to different emphases: aesthetics, user, materials and production processes, social design (for and with people), service design (systems and intangible products) and strategic design (company), already mentioned. This proposal is based on the fact that the design project can be developed from various visions or thought models or thesis; it also includes that each of these visions follow its methodological process and its own tools, methods or emphasis on the application of the tools. The purpose is for the students to develop the ability to discern about the projects they will pursue and how they will approach them.

After the approval of the aforementioned redesign in 2018, a vertical vision was proposed through the design projects subjects. The objective was for knowledge to be cumulative, sequential and seek to apply, combine and sustain itself with what was learned in the modules or projects of the previous semesters; additionally, and in a transversal way, exercises were applied, which received the contribution of one or several subjects and an integrating project.

The first level focuses on the principles and fundamentals of Product Design. "At the end of this network, the student will be able to understand the basic theoretical-practical foundations of product design, to build objects of low complexity".[71] The subjects are: (i) Fundamentals of Product Design, where basic design and two and three dimensional composition are learned; (ii) Expression and Graphic Representation, basic drawing techniques are taught so that students can express their ideas; (iii) Design History, where a historical tour of design since the industrial revolution is carried out, it is built from authors such as John Heskett,[72] Aquiles Gay, Lidia Samar[73] and Penny Sparke[74] who proposed the appearance of Industrial or Product Design from the Industrial Revolution.

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71   Product Design Career. 2018. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. Pp. 22. (Spanish)

72   1937-2014, British. John Heskett was a British writer and lecturer on the economic, political, cultural and human value of industrial design. Author's note.

73   GAY A. & SAMAR L. 2004. *Industrial design in history* (2nd ed. aum). tech. (Spanish)

74   74 years old, British. Penelope Anne "*Penny*" Sparke is a British writer and academic specialising in the history of design. Author's note.

They relied on the concept that designing is the action of projecting, that is, conceiving an object to be produced; and (iv) Design Logic, where students learn the essential tools in Mathematics and Physics for the designer, and the configuration of objects.

The second level focuses on the configuration of the object; after learning the configuration principles, these are applied in the conception of the artefact, the construction of the parts and the whole with coherence, so that the user understands the final product. "At the end of this network, the student will be able to build low complexity objects, understanding their configuration through the application of the basic fundamentals of Product Design, also using different languages such as graphic representation and technical drawing, and the knowledge of natural materials and ways of craft production".[75] The transversal subjects are: (i) Product Design Project that applies the principles of object configuration to a low complexity product. The purpose is to introduce the student to aesthetics through cultural sensitivity; (ii) Materials and Processes I introduces the knowledge of ceramics, glass and natural materials, techniques and technologies with the objective that the student understands the principles of the materials and how they help to shape their ideas; (iii) Technical drawing and descriptive geometry, which are introduced into representation regulations for the creation of technical sheets that are applied in production; and (iv) Semiotics of the product, a subject that is based on the theory of how the object is configured, its legibility, its formal and functional denotation and its cultural connotation.

The third level focuses on the user. Once the students master the composition and configuration of the object, the specific user factor is introduced, designing for a specific person or group (different from the self). "At the end of this network, the student will be able to build low complexity objects, centring their development and configuration around the user, also using different languages such as graphic representation and knowledge of materials for the user experience".[76] The subjects of this level are: (i) User-Centred Design Project, which will be explored in depth in the next chapter when dealing with the proposal of the teaching model; (ii) Materials and Processes II that introduces the knowledge of natural materials and their derivatives, techniques and technologies, introducing the student into the material field; (iii) Physical ergonomics,

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75   Product Design Career. 2019. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. Pp. 22. (Spanish)

76   Product Design Career. 2019. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. Pp. 23. (Spanish)

which teaches students about the relationship of the product, systems and processes with the human body through deepening anthropometry and biomechanics; and (iv) Product Sketching, that teaches manual and digital sketching techniques for project presentations and provides students with tools to materialise and communicate their projects.

The fourth level focuses on production and resources. Once the configuration of the object and its relationship with a defined user have been learned, knowledge of production processes and optimisation of resources is passed on. "At the end of this semester, the student will be able to build design proposals that generate the least possible environmental impact, based on responsibility and awareness of the ecosystem".[77] First, the subject of (i) Sustainable Design and Eco-Design Project are integrated in which these two visions of the product are learned and how the object, systems and processes should be thought based on local, regional and international forms of production considering the principles of sustainability and optimisation of resources; (ii) Materials and Processes III (new materials and biomaterials) introduces the student to new materials, especially biomaterials as an alternative for product development; experimentation and new trends are promoted; (iii) Cognitive and Organisational Ergonomics, which delves into the user's mental processes and their relationship with complex, digital and electronic objects, as well as with different environments; (iv) Design Management introduces the student to organisational processes in which design generates problem-solving strategies in business environments; and finally, (v) Digital Representation I that introduces the student to the digital tools for the technical representation of products under the different regulations.

The fifth level focuses on the community, which is why co-creation and participatory design work in order to involve the student with the surrounding communities and contextual problems. "At the end of this network, the student will be able to: manage and participate in projects that involve all the actors around community strengthening design proposals".[78] At this level, the subjects of: (i) Participatory Design Project explores projects with communities and associations. Shared and horizontal learning is sought; students not only learn in university but also with the community and the community learns from them; (ii) Materials and processes IV that focuses on materials such as metals and plastics,

77 Product Design Career. 2019. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. Pp. 23. (Spanish)

78 Product Design Career. 2019. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. Pp. 23. (Spanish)

their techniques and technologies, which allows students to diversify their solutions and learn about different production processes; (iii) Digital Representation II, that delves into digital tools and introduces parametric design; while providing competitive elements for professional work; (iv) Theoretical models works on the conceptual elements and the authors that broaden the knowledge of different theoretical design processes; this review addresses different Latin American, international and regional visions, mainly Eurocentric.

The sixth level focuses on services, the development of immaterial products, systems and experiences. It is about design as a process of global solutions to the problems of institutions, that is to say, the focus is on the development of different elements that together complement each other. "At the end of this network, the student will be able to creatively and sustainably project significant experiences through proposals that are useful, desirable, and memorable for people, as well as efficient and effective for organisations. All this through the operational and strategic development of the service".[79] The following subjects converge: (i) Service Design Project that allows learning the methodology for configuring services, systems, and experiences for the development of the different elements that will make up the service; (ii) Materials and Processes V focuses on new technologies such as digital printing, CNC, laser cutting, among others, to introduce students to the new technological context, low-scale production processes and product customisation. This subject concludes the axes of materials and process praxis in which all types of materials and all types of production processes converge; (iii) Project Culture focuses on understanding different methodological processes developed in the discipline over time and its different emphases, it addresses the differences between methodology, methods and tools that aid the project process; (iv) Presentation and Communication of Projects, provides communication tools for the adequate presentation of projects. This subject converges and concludes the axes of communication and graphic representation.

The seventh semester focuses on the company, and how design is the tool that helps the business sector generate a differentiating value. "At the end of this network, the student will be able to build, develop and execute highly complex design projects around business and competitive problems of micro, small and medium-sized companies".[80] The subjects at this level are:

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79 Product Design Career. 2019. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. Pp. 23. (Spanish)

80 Product Design Career. 2019. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. Pp. 23. (Spanish)

(i) Strategic Design Project that deals with tools focused on the company and the different types of users and the new market requirements; (ii) Methods for Simulation and Validation of Products, which provides the student with different manual and digital tools for the simulation of products that allow the application of validation and evaluation methods of the product, system, processes, services and experiences; (iii) Work Environments and Entrepreneurship focuses on the different spaces of the designer's professional activity and provides them with the necessary tools for entrepreneurship; (iv) Design Philosophy introduces the student to critical and reflective thinking about the profession and the designer's work; the subject presents the different responsibilities of the designer when projecting an element within a culture. This subject concludes the theoretical axes that provides the necessary tools to support the development of project processes.

The eighth level focuses on the development of the final project; unlike the previous plans, this one proposes that the students complete the level with their degree, as mentioned.

Three units were defined: (i) the basic one that corresponds to the first three semesters in which the principles of composition, configuration and knowing the essential user for the projection of products, systems, services, processes and experiences are learned; (ii) the professional unit that deals with thought models that involve the environment and different actors, such as communities and companies and also delves into production processes and optimisation of materials; it also includes a deeper reflection on the scope of design and the designer's work. The last one is (iii) the curricular integration unit where the final degree project is developed.

In this plan, teaching-learning methodologies have also been proposed, maintaining the PBL that was applied from the previous plan; and they have introduced: (i) Project-based learning (PbL),[82] (ii) Challenge-based learning (CBL),[83] and (iii) Case study-based learning;[84] all of them as processes of the discipline and to introduce more clarity in the teaching processes in the career.

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82 Project-based learning is a methodology that allows students to acquire key knowledge and skills in the 21st century through the development of projects that respond to real-life problems. Source: PUCE 2022 training.

83 CBL is a pedagogical approach that focuses on solving a real problem (it is not a problem designed for the classroom) of the student's environment and optimising the conditions of the community or part of it; all this through concrete action. Source: PUCE 2022 training.

84 The case method is a teaching mode in which students build their learning from the analysis and discussion of real life experiences and situations. Source: PUCE 2022 training.

Table 13 shows the summary the characteristics of the Plan Q177.

Plan	#S	Formation cycles			Theory	Teaching Methodology	Design Methodology	Type of products developed
		Cycle	S	emphasis				
Plan 2018-2019 (Q177)	8	Basic cycle	1s	Fundamentals of Product Design	• Ucer-centerd Design • Sustainable Design and Eco-Design • Participatory/ Social Design • Service Design • Strategic Design	• PBL problem based learning • CBL Challenge based learning • PbL Project based learning • Case-study based earning	• discovering (Research) • defining (Problem) • developing (Proposal) • applying (Results) • evaluating (Analysis)	Based on thesis
			2s	Product Design				
			3s	Ucer-centerd Design				
		Professional cycle	4s	Sustainable Design and Eco-Design				
			5s	Participatory Design				
			6s	Service Design				
			7s	Strategic Design				
		Curriculum integration	8s	Final project				

13   Summary of the plan Q177 2018-2019.

The figure 81 shows the mesh of subjects per level and cycle.

FACULTAD DE ARQUITECTURA
CARRERA DE DISEÑO DE

Resolución aprobación CES: RPC-...............................
Título que otorga: LICENCIADO EN DISEÑO DE PRODUCTOS
Duración: 8 semestres
Modalidad: PRESENCIAL
Sede: QUITO

UNIDAD BÁSICA													
PRIMER NIVEL			**SEGUNDO NIVEL**			**TERCER NIVEL**				**CUARTO NIVEL**			
FUNDAMENTOS DEL DISEÑO DE PRODUCTOS			TALLER DE DISEÑO CENTRADO EN EL PRODUCTO			TALLER DE DISEÑO CENTRADO EN EL USUARIO				TALLER DE DISEÑO SOSTENIBLE Y ECODISEÑO			TALLE
A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.		A.C.D.	A.P.E.	A.A.	A.C.D
64	32	64	80	40	80	80	40	80	0	80	40	80	80
Horas totales asignatura			Horas totales asignatura			Horas totales asignatura				Horas totales asignatura			H
160			200			200				200			
HISTORIA DEL DISEÑO DE PRODUCTOS			SEMIÓTICA DEL PRODUCTO			ERGONOMÍA FISICA				ERGONOMÍA COGNITIVA Y ORGANIZACIONAL			MODEL
A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.		A.C.D.	A.P.E.	A.A.	A.C.D
48	0	72	48	0	72	48	24	48	0	48	24	48	32
Horas totales asignatura			Horas totales asignatura			Horas totales asignatura				Horas totales asignatura			H
120			120			120				120			
LÓGICA DEL DISEÑO DE PRODUCTOS			MATERIALES Y PROCESOS I (MATERIALES NATURALES, CERÁMICOS Y VIDRIOS)			MATERIALES Y PROCESOS II (DERIVADOS NATURALES Y DERIVADOS)				MATERIALES Y PROCESOS III (NUEVOS MATERIALES, MATERIALES COMPUESTOS)			MA
A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.		A.C.D.	A.P.E.	A.A.	A.C.D
48	24	48	48	24	48	48	24	48	0	48	24	48	48
Horas totales asignatura			Horas totales asignatura			Horas totales asignatura				Horas totales asignatura			H
120			120			120				120			
EXPRESIÓN Y REPRESENTACIÓN GRÁFICA DE DISEÑO DE PRODUCTOS			DIBUJO TÉCNICO Y GEOMETRÍA DESCRIPTIVA			BOCETACIÓN DE PRODUCTO				REPRESENTACIÓN DIGITAL I			RE
A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.		A.C.D.	A.P.E.	A.A.	A.C.D
64	32	64	48	24	48	64	32	64	0	64	32	64	48
Horas totales asignatura			Horas totales asignatura			Horas totales asignatura				Horas totales asignatura			H
160			120			160				160			
COMUNICACIÓN ORAL Y ESCRITA			FUNDAMENTOS DE LA INVESTIGACIÓN			JESUCRITO Y LA PERSONA DE HOY				GESTIÓN, DISEÑO y DESARROLLO DE PRODUCTOS			ÉTICA P
A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.		A.C.D.	A.P.E.	A.A.	A.C.D
32	0	48	32	0	48	48	0	72	0	32	0	48	48
Horas totales asignatura			Horas totales asignatura			Horas totales asignatura				Horas totales asignatura			H
80			80			120				80			
TECNOLOGÍAS DE LA INFORMACIÓN Y DE LA COMUNICACIÓN			CONTEXTOS E INTERCULTURALIDAD							Prácticas de Servicio Comunitario I			P
A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.								
32	0	48	32	0	48				0				
Horas totales asignatura			Horas totales asignatura							Horas totales asignatura			H
80			80							40			
										HORAS TOTALES POR S			
720			720			720				720			

Requisitos de ingreso a la UNIDAD DE INTEGRACIÓN CURRICULAR: Cumplir con la aprobación de una segunda lengua del nivel B1, con las horas de

15   Organisation of the Redesign of the FADA-PUCE Product Design Career by units, levels and subjects. Source: Product Design Career.[81]

ANI

A, DISEÑO Y ARTES
E PRODUCTOS

UNIDAD PROFESIONAL												Horas totales carrera
QUINTO NIVEL			SEXTO NIVEL			SÉPTIMO NIVEL			OCTAVO NIVEL			
...R DE DISEÑO PARTICIPATIVO			TALLER DE DISEÑO DE SERVICIOS			TALLER DE DISEÑO ESTRATÉGICO			DEONTOLOGÍA PROFESIONAL Y LEGISLACIÓN			
.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	
	40	80	80	40	80	80	40	80	48	0	72	
...oras totales asignatura			Horas totales asignatura			Horas totales asignatura			Horas totales asignatura			
	200			200			200			120		
...OS TEÓRICOS Y PENSAMIENTO DE DISEÑO			CULTURA PROYECTUAL DE DISEÑO			DEL PROBLEMA AL PROYECTO DE DISEÑO DE PRODUCTOS			REDACCIÓN ACADÉMICA DE DISEÑO DE PRODUCTOS			
.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	
	0	48	32	0	48	32	16	32	48	24	48	
...oras totales asignatura			Horas totales asignatura			Horas totales asignatura			Horas totales asignatura			
	80			80			80			120		
...ATERIALES Y PROCESOS IV			MATERIALES Y PROCESOS V			SIMULACIÓN Y MÉTODOS DE VALIDACIÓN DE PRODUCTOS			GERENCIA DE PROYECTOS			
.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	
	24	48	48	24	48	48	24	48	48	0	72	
...oras totales asignatura			Horas totales asignatura			Horas totales asignatura			Horas totales asignatura			
	120			120			120			120		
...PRESENTACIÓN DIGITAL II			PRESENTACIÓN Y COMUNICACIÓN DE PROYECTOS			ENTORNOS LABORALES Y EMPRENDIMIENTOS			GERENCIA DE MERCADO Y GESTIÓN DE CALIDAD			
.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	
	24	48	48	24	48	48	24	48	48	0	72	
...oras totales asignatura			Horas totales asignatura			Horas totales asignatura			Horas totales asignatura			
	120			120			120			120		
...PERSONAL Y SOCIOAMBIENTAL			Procesos de Innovación Soacial, Productiva y Comercial			FILOSOFÍA DEL DISEÑO			**UNIDAD DE INTEGRACIÓN CURRICULAR**			
.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.	A.C.D.	A.P.E.	A.A.				
	0	72	32	0	48	32	0	48				
...oras totales asignatura			Horas totales asignatura			Horas totales asignatura						
	120			80			80					
...rácticas de Servicio Comunitario II			Prácticas Preprofesionales I			Prácticas Preprofesionales II			INTEGRACIÓN CURRICULAR DE DISEÑO DE PRODUCTOS			
...Horas totales asignatura			Horas totales asignatura			Horas totales asignatura			Horas totales asignatura			
	80			120			120			240		
...EMESTRE												
	720			720			720			720		5760

...e prácticas pre profesionales y de servicio comunitario.

81   Product Design Career. 2019. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. (Spanish)

3.2.3. SARS COVID-19 at FADA-PUCE

One of the factors analysed in this research project is the pandemic caused by SARS COVID-19, which as of March 2020 changed reality.

The world changed when the pandemic arrived, the biggest health problem that the world population has faced in recent times. In Ecuador, on March 16th, 2020 the government decreed the confinement of the population and the total closure of activities; the population then turned to the development of an online life. Initially it was thought that the lockdown and quarantine would be for a short time; however, from the initial restrictions to the gradual return to activities as of January 2022, almost two years have passed.

Different types of work and different levels of education had to take place online. This caused an abrupt transformation in social interactions and in the way, things developed, as well as the initial proposal of this project. As mentioned, the focus of the proposal change, and it was directed to students of the Product Design Career of FADA-PUCE, the focus remained on development of responsible products that respond to local reality. It was observed that the intervention of professionals in the productive field also promotes a dignified life and community development, narrows inequality gaps, promotes the democratisation of the means of production and the responsible use of resources in the country.

On the other hand, PUCE, FADA and the Product Design Career adopted different strategies and policies for the development of online education.

The PUCE promoted the use of the EVA-MOODLE platform to teach classes. Although this resource was available and its use was encouraged in pre-pandemic times, only 7% of all professors used it. Its use was mainly as a digital repository, that is, there was no interaction with the students. Despite the fact that different training programs had been designed to make use of the platform and its different digital tools, it was concluded that the majority of professors were digitally illiterate and did not use these types of tools due to their lack of knowledge.[85] On the other hand, a change in pedagogy and methodology was promoted to face this challenge; in the first semester of 2020, it was identified that the majority of professors in their online classes used the same resources and methodology as in their face-to-face master classes.[86]

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85 This is the conclusion of the analysis process carried out with the participation of various university authorities in August 2019. Author's note.

86 This is the conclusion of the analysis process carried out with the participation of various university authorities and the Virtual Education Centre (CEV) in June 2020. Author's note.

At this time, institutional support systems were also promoted that were mainly focused on students, such as: (i) equipment loans, (ii) internet plans, (iii) psychological support, through the Centre for Applied Psychology (CPA), (iv) legal support, through the Legal Offices, and (v) emotional support through the Identity and Mission Directorate (IMD), among others. With this support, better learning environments were promoted in the new online modality.

The FADA promoted support among the four careers that make up the faculty. Initially, it focused on the teaching staff and their requirements, trying to support the staff in the hourly and monetary reduction that this institutional adjustment represented.[87]

The course focused on establishing its own strategies to improve the development of virtual classes, and it also promoted: (i) collaborative work, (ii) the construction of community support content, (iii) accessibility to information, and (iv) the generation of resources and support for practical classes that were the most affected. The authorities sought alternatives for contact with companies and communities as of 2021. The resourcefulness of both students and professors was promoted to adapt to the new reality, by appealing to the innate spirit of the designer.

3.3.   Chapter conclusions

As a conclusion, it is known that the design in Ecuador, began in the late seventies and early eighties in the professional field rather than in the academic one; the first schools of design in the country formed between 1984 (*La Metro*) and 1994 (Product design career of FADA-PUCE)

Ecuadorian design, as well as in most Latin American countries, has failed to have a link with the State in its projects; this, because of the economic and political problems that the country has had, as indicated in the previous chapter. this link with the State/government would be a great tool for the development of the profession in the country and of the country through design.

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87   On May 15 and 16, the National Assembly approved the Humanitarian Law, which will make it possible to face the impact of COVID-19, facilitating economic reactivation and the generation of agreements to care for the most vulnerable, sustain employment and sources of work.

Humanitarian Support Law: It establishes that workers and employers may reach agreements to modify the economic conditions of the employment relationship, in order to preserve jobs, avoid company bankruptcy and guarantee stability. In the case of PUCE a new workday was stablished of 7 hours and a salary reduction of 12.5%. Author's note.

Today we can see that the field of design has grown and diversified. This shows that academic development is relevant to provide professionals with the skills, aptitudes and attitudes of the discipline to face the challenges that the country proposes.

The four stages of the evolution of the Product Design Career through these 28 years are well defined. The first began with a comprehensive design approach focused on experimentation and the search to train professional for the needs of the context from a humanistic vision. The second consisted of a career specialisation with a specific focus on products; this phase was not planned, which showed a lack of vision of the career; however, the experimentation and development of projects based on object typologies and their complexity continued. The third stage focused on project and methodological processes; it maintains the development of products based on object typologies; its structure is clearer, and it introduced the PBL teaching-learning methodology.

The last ongoing proposal contains clearer definitions in its construction and approach; it clearly defines levels of learning, vertical cumulative, sequential and complementary knowledge processes. This proposal changes the focus of product typologies and starts to develop projects based on design thinking models: it also introduces teaching methodologies such as PbL, CBL, case studies and maintains PBL. With this contextualisation of the career and the exploration of the redesign, in the following chapter, the model proposed in this research is developed for the third semester of the redesign in the subject of User-Centred Design Project.

"Industrial Design is a strategic problem-solving process that drives innovation, builds business success, and leads to a better quality of life through innovative products, systems, services, and experiences. Industrial Design bridges the gap between what is and what's possible. It is a transdisciplinary profession that harnesses creativity to solve problems and co-create solutions with the intent of making a product, system, service, experience or a business, better. At its heart, Industrial Design provides a more optimistic way of looking at the future by reframing problems as opportunities. It links innovation, technology, research, business, and customers to provide new value and competitive advantage across economic, social, and environmental spheres."

World Design Organization (WDO).

Second part: Synthetic-practical

4. Chapter IV: Development of the proposal

This chapter begins with the deepening of the third level of the career to understand transversal work and it explains how each subject supports the level to achieve complementary learning. Subsequently, the development of the User-Centred Design Project (UCDP) is analysed. The proposal of this doctoral research will review the following: (i) the considered pedagogical bases, (ii) the methodological proposal for the application of the developed model, (iii) UCDP structure, (iv) the theoretical construction proposal under which the contents were proposed, (v) the application, exercises and results by academic period, its scope, difficulties and results, which have been corrected in each period and (vi) the final model.

4.1. Third level of the career

As previously mentioned, the learning proposed by the current FADA-PUCE program is transversal, that is, the knowledge of the subjects complements each other. This is particularly relevant in the case of the third level of the career with emphasis on the user and its four subjects: (i) User-Centred Design Project (UCDP), (ii) Physical Ergonomics, (iii) Product Sketching and (iv) Materials and Processes II. This learning is carried out by an integrating project in which the acquired knowledge in each subject is applied. This project is led by the UCDP.

It has been determined through analysis and discussion that it is not possible for the subjects to be integrated throughout the entire process since each one has its own concepts and specific skills that students must delve into. For this reason, through the integrating project, the acquired knowledge is incorporated; likewise, professors are essential to support the development of the project and the fulfilment of this objective. The integration project is developed from the second half of the academic period and lasts approximately 8 weeks.

At the beginning of each academic period, in work meetings, the topics of the projects are determined and there are discussions on how the methodology will be developed. In the first stage, each subject focuses on addressing theoretical concepts, which will gradually be incorporated and complemented. At the end of each period, the work that is carried out is evaluated, taking note of the successes and challenges faced, in order to improve in the following semester.

It should be noted that this is the established work process; however, administrative problems that limit and harm are faced with, in which professors cannot interfere. The lack of professors, the excessive turnover in the semester hiring of professors, the saturation of administrative activities and the lack of hours for academic work are the main problems.

In the next section, the research delves into the subjects by level, learning outcomes and minimum content. It explains how each subject contributes to the integration project led by the UCDP, as mentioned.

4.1.1.   Physical ergonomics

This subject contributes to the UCDP from the analytical phase of the investigation and provides complementary information from the users such as anthropometric tables.

On the other hand, it contributes to the generation of the list of requirements and in the synthetic phase of detailed design, it contributes with the implementation of anthropometric and biomechanical criteria for the development of the proposals, to adopt it to the user and no vice versa. In the validation and verification stage, this subject supports the development of quantitative validation tests that complement the qualitative ones developed in the UCDP.

The following table presents the information for this course.[1]

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1   Product Design Career. 2019. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. (Spanish)

Subject	Learning outcomes	Minimum contents
Physical ergonomics	1. Recognise which are the parts of the human being that interact with the physical interfaces of the object. 2. Identify the dimensions of the human body and their application to product development. 3. Know the anatomical and physiological functions of the parts of the human body necessary for the development of the object. 4. Define the mechanical processes of the human body and their interaction with the use of the object.	The subject of physical ergonomics is centred on the human being, focusing on the knowledge of the anatomical, anthropometric, physiological and biomechanical characteristics of the person, and its relationship with the physical interfaces of the object for its manipulation.

14   Information of Physical Ergonomics.

4.1.2.   Product Sketching

The Product Sketching subject supports the UCDP from the synthetic phase of proposal development and detailed design.

This subject helps the project through the expression of the object and the details that must be evaluated to develop the project iteratively, also sketching allows a process of reflection on the project. It contributes with its tools to communicate the characteristics of the project, bring the student closer to usability processes through tools such as storyboards, interaction and user experience, as well as a first approach to the materiality of the object.

This subject provides students with a space for experimentation through manual and digital techniques for the development of the project; below, you can see its characteristics.[2]

Subject	Learning outcomes	Minimum contents
Product Sketching	1. Know the characteristics of particular materials and supports for the correct application of each of the drawing techniques to be developed. 2. Apply wet, dry and mixed techniques in drawing based on manual development and the use of digital technologies. 3. Sharpen the capacity for observation and creativity to represent objects with high fidelity. 4. Communicate through drawing and with the application of techniques, physical and sensory characteristics of the design object.	The subject includes wet and dry representation techniques for Product Design based on both manual and digital. Materials, textures are simulated, colour mixtures, lighting and shadows are applied to communicate physical and sensory characteristics of the objects to be drawn.

15   Information of Sketching of Products.

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2   Product Design Career. 2019. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. (Spanish)

4.1.3.   Materials and Processes II

The contribution of this subject to the UCDP is from the analytical research phase because it provides complementary information on possible materials to be used for the materialisation of the proposal, as well as the relevant local, regional or international processes for production. The approach to materiality allows a process of reflection on the project.

On the other hand, it contributes to the generation of the list of requirements, sustainability and optimisation criteria are taken into account from the materials and processes. In fact, in the synthetic phase of proposal development and detailed design, this subject contributes with the development of study models.

In this subject, students approach the formal and material characteristics of the proposals and can also validate, verify and support the development of the prototype to carry out the validation tests developed at the UCDP.[3]

Subject	Learning outcomes	Minimum contents
Materials and Processes II (natural derivatives and metals)	1. Distinguish, based on direct practice with the analysed material, its characteristics and its modification and modelling properties. 2. Distinguish the formats, presentations, distributors and components in which they are marketed and materials addressed. 3. Train in the use of tools that allow the modification and modelling of materials. 4. Develop the ability to unite, assemble the materials worked in the subject. 5. Apply finishing techniques and aesthetic treatment from the addressed materials.	The subject works on the configuration, assembly and finishing of materials of natural derivatives and metals.

16   Information of Materials and Processes II.

4.1.4.   User-Centred Design Project

As mentioned, the proposal of the career is to work transversal cumulative learning at each level, through the integrative project and vertical cumulative through the axes. In the axes of Praxis with the Design Project subjects is the UCDP that accumulates knowledge of the subjects that precede it: (i) Fundamentals of Design Project and (ii) Product Design Project, to which it has been made previously referenced and that constitute the starting knowledge base.

3   Product Design Career. 2019. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. (Spanish)

In the Fundamentals of Design Project, theoretical-practical tools are acquired to understand and apply the fundamentals of design: (i) form, (ii) volume, (iii) space, (iv) colour and (v) sign. The purpose is to understand the process of conception, configuration and tangibility of two-dimensional and three-dimensional objects through systemic processes and fundamental design principles, which respond to real problems or needs around an object.

The Product Design Project, on the other hand, has a formal-aesthetic focus and is oriented towards the introduction and management of tools for the development of products for daily use, linked to a technical and technological analysis of their components and applications. During these two modules, projects of medium complexity and innovative value are developed, oriented to the use, form, function and expression of the object within a local cultural, economic and technological environment.[4]

In relation to its structure, it is noteworthy that the UCDP focuses on understanding the needs and behaviour of the human being. In this project, the decisions, desires and limitations of the users are analysed as fundamental criteria for the configuration of a product. It delves into the principles, theories and instruments of User-Centred Design and an approach to Emotional Design to facilitate decision-making in a design project.[5] In addition to acquiring new knowledge, the students add to the project the knowledge from the previous workshops, specifically the principles of configuration and mastery of form and aesthetics.

The objectives of this workshop are focused on: (i) applying the theoretical foundations of UCD; (ii) identify the types of users involved in the projects to be developed, once identified, recognise what type of information will be obtained from each one and what are the best tools and methods to use; and, (iii) understand that each method has a stated objective, a developed process, data obtained, information analysed and a result.

Among the results that are expected to be achieved in the UCDP are the following: (i) use the theoretical and conceptual bases of the UCD in design proposals for functional products; (ii) develop the ability to conceptualise, investigate and discuss projects around the user; (iii) apply identity and expression criteria to the products (aesthetic criteria) in the design of cultural products;

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4   Product Design Career. 2019. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. (Spanish)

5   Product Design Career. 2019. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. (Spanish)

(iv) apply data and ergonomic variables in product design (human factor engineering, perceptual analysis, cognitive psychology and usability); (v) carry out interdisciplinary work for the configuration and validation of products through the user-centred design model and emotional design; and, (vi) interpret the sensitivity of the objects and their relationship with the users and their particularities.[6]

As for the students, it seeks to encourage them to test and apply the knowledge acquired and do it in the best possible way, even if there are flaws, which are fundamental in the learning process. It is important to generate analysis of results to reflect on the correct application of the methods and methodology, the recognition of successes and errors and identify the quantity and quality of the information obtained; in addition, it allows to explore different tools to expand the research and the developed work.

The creative development process seeks to break the pre-established schemes during the research phase. It is therefore necessary to consider the relevant creative methods for each project and explore creativity exercises to encourage brain exercise.

On the other hand, in relation to the verification phase, the objective is to learn that each stage of the project needs validation and that it is constant, each step allows to understand if we are moving in the right direction or to identify the pertinent changes. Therefore, it is necessary to assume that the design process is iterative and seeks to develop fast models and prototypes for validation, in addition to learning that the detailing and specification process is carried out by deepening the necessary changes and adjustments. It is necessary to take into account that, given the emphasis of the UCDP, usability, user experience and emotion tests are essential. It is necessary to consider that the iterative process allows us to identify opportunities and learning from the mistakes made to generate a solid result through awareness, reflection and criticism. Finally, it should be noted that experimenting in academia is the opportunity to acquire knowledge, skills and abilities that will be applied in professional life.

Next, we will delve into the pedagogical process proposed in the UCDP.

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6   Product Design Career. 2019. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. (Spanish)

4.2.   Pedagogical Proposal

Regarding this proposal, the author follows Claxton 's opinion:

> "People's learning depends not so much on the challenges and uncertainties that their world contains, but on how they perceive themselves. Even the most everyday environment is full of things that can be treated as problematic, if we see them as such."[7]

The choice of these proposals has made it possible to determine an ideal cognitive process for students, as well as dynamic strategies focused on the context to solve real problems. This gives foundation to the designer's empathic capacity and the ability to reflect on their environment to respond correctly.

This is a transcendental moment for the country that has opened a space for design as an element that transcends the transformation of Ecuador towards a more equitable social space to diversify its production, seek and improve the care of its resources.

The pedagogical principles that are worked on this subject are built from various proposals: (i) cognitivism, (ii) Ignatian Pedagogical Paradigm (IPP), (iii) Kolb 's experiential cycle, (iv) project-based learning (PbL), (v) challenge-based learning (CBL) and (vi) problem-based learning (PbL).

Next, each of these proposals will be deepened and how they support the teaching-learning process, and the development of this research proposal will be explained.

4.2.1.   Cognitivism

Cognitivism is included since learning is the process by which cognitive structures are created and modified. To be inserted in the teaching-learning process and establish a model, it is necessary to understand how the mental processes are that students experience in the construction of their knowledge and in their reflection process.

These structures are the set of systematised and hierarchical knowledge, stored in memory that allow the subject to respond to new or similar situations. Hence, the importance of knowing how the student processes information,

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7   CLAXTON, G. 2001. *Learn: The challenge of continuous learning.* Barcelona: Paidos. Pp. 211. (Spanish)

what psychic operations are involved to codify knowledge, how the data obtained and perceived during the processes of interaction with the environment and society are organised.[8]

For the learning process, the consciously and unconsciously accumulated knowledge that students do in their lives and in their professional training, vertical cumulative learning, is important. By imparting new knowledge, the aim is to motivate their association with their previous experiences, make them aware and generate significant learning, in addition to encouraging reflection. It is therefore necessary to motivate the cognitive process of students through dialogue and discussion of new concepts so that, through this process, they can recover experiences, objects and images from memory as a context recognition strategy. In addition, this provokes in the students the search for references, the permanence in a state of attention and encourages the observation of their environment, making them more active as Duran suggests:

> "The cognitive current studies superior mental processes in which thought, memories and the way in which information is processed, have an impact on the responses that the subject will make to solve a situation or problem. In addition, it considers that the subject actively learns as he participates in experiences, searches for information, and reorganises what he already knows to increase his understanding."[9]

It is necessary to sensitise students to promote openness to new knowledge and experimentation in their context, in order to transform the information, they receive, the experience they live and develop a response according to reality, as Duran comments:

> "Learning as an active mental process of acquisition, memory and use of knowledge, involves the participation of sensations, perception, attention, memory and thought. The human mind, just like a computer, once it receives information, it performs operations (analysis, interpretation) to change its form and content, stores it, retrieves it when needed, and finally generates answers."[10]

The types of learning that are applied and sought within this subject are: (i) repetitive, (ii) significant, (iii) receptive and (iv) by discovery.

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8   DURAN, J.C. 2004. *Theories of learning and pedagogical models*. Quito: Central University of Ecuador. (Spanish)

9   DURAN, J.C. 2004. *Theories of learning and pedagogical models*. Quito: Central University of Ecuador. Pp. 34-35. (Spanish)

10 DURAN, J.C. 2004. *Theories of learning and pedagogical models*. Quito: Central University of Ecuador. Pp. 34-35. (Spanish)

"**Repetitive learning**. This type of learning is revealed when the student arbitrarily associates the new knowledge. It occurs because the subject does not have basic prior knowledge that allows him to understand something new, which is why he memorises the knowledge arbitrarily and literally, resulting in rote learning […]."[11]

This type of learning is applied in the research, creative development and testing stages of the UCDP.

In the method application phase, these tools are new to students; while they may have heard of them, they have not used them for the design process. It is clear that the students need to apply the methods in the project, this requires an established process that at the beginning is mechanical and repetitive (to follow the step by step) and that presents a structure of the method, which allows us to overcome the fear of experimenting and failing. This process helps students develop the necessary self-confidence to try something new and to get a result, even if it is wrong. Once the exercises are done individually and in groups, and the results, successes and errors are analysed, so as to increase their training and learning. Feedback is essential for the assimilation of knowledge because it goes from a mechanical process to a conscious process that allows acquiring tools that will be used in new projects, in subsequent semesters or in the professional field.

"**Meaningful learning**. This type of learning occurs when the new knowledge is clearly and substantially related to what the student already knows, that is, when the new learning is effectively related to the knowledge structures that the learner has.

For significant learning to occur, the presence of the following conditions is necessary: (i) The content of the learning needs to be potentially significant, that is, it allows it to be assimilated in an important way. (ii) The student must have the previously formed basic concepts in their cognitive structures, so that the new knowledge can be linked to the previous one in a representative and understandable way. (iii) The student must show a positive activity towards significant learning, that is, they must be willing to relate the learning material with the cognitive structures they possess."[12]

Significant learning in the UCDP is applied within the project process and the configuration of the product. Students learn about the phases of the project and the necessary elements to configure the product, topics that are worked on both in the Fundamentals of Design Project and in the Product Design Project.

11   DURAN, J.C. 2004. *Theories of learning and pedagogical models*. Quito: Central University of Ecuador. Pp. 35. (Spanish)

12   DURAN, J.C. 2004. *Theories of learning and pedagogical models*. Quito: Central University of Ecuador. Pp. 35-36. (Spanish)

Students know what the stages and the process are, but they do not know the emphasis of the user, therefore, they apply the new concepts by combining them with the previous ones, producing accumulation between the previous and the new knowledge. In addition, the choice of topics and application spaces promotes the interest of students so that learning is meaningful.

> "**Receptive learning** . It is so called because the total content of what is to be learned is presented to the student in a finished form. In the learning task, the learner does not have to make any independent discovery. The students are only required to internalise the material presented to them, so that they can retrieve it at a future date. (Conference, book and scientific video)."[13]

This type of learning is applied in the first stage of basic concepts, since apart from the information provided by the professor, students explore knowledge through books, articles and videos, previously analysed and chosen, provided by the professor. In this way, they can contrast the different concepts issued by the authors and generate their own criteria. It is a structured and limited process, since the professor has determined the contents and where the information is obtained from, with the aim of allowing students to explore the concepts in a controlled manner.

> "**Learning through discovery**. In this type of learning, the main content of what is to be learned is not taught but must be discovered by the student. The learning task is to discover something."[14]

This learning is achieved through experimentation and reflection, both in the basic concepts part, as well as in UCD research, creative development and validation. During the consultancies or tutorials on the project, the author (FADA-PUCE professor) and the student discuss the findings made as a result of the investigation and the application of the methods in the different stages.

The four types of learning are complemented by the elements reviewed below.

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13   DURAN, J.C. 2004. *Theories of learning and pedagogical models*. Quito: Central University of Ecuador. Pp. 36-37. (Spanish)

14   DURAN, J.C. 2004. *Theories of learning and pedagogical models*. Quito: Central University of Ecuador. Pp. 37. (Spanish)

4.2.2.   Ignatian Pedagogical Paradigm (IPP)

Part of the pedagogical principles that are incorporated in the development of the teaching model in this subject are originated from the Ignatian Pedagogical Paradigm (IPP). Although the IPP is one of the institutional principles due to its origin, it is considered that it contributes with elements that are in line with the spirit of design. "PUCE's educational system embraces this paradigm because it favours multidisciplinarity, diversity and considers the human being and his life project as transcendental axes; characteristics that are undoubtedly conducive to addressing reflection."[15]

Among the objectives of the IPP are that the student becomes aware of his or her reality and its context (society, natural and cultural environment) and thus transforms it in search of improving it; as Granados says:

> "To relocate oneself in the surrounding reality in the world [...] a mediation between the "*subjects*" and the "*world*" for their understanding and transformation. An instrument for the best interpretation of reality and for social change. A (psycho-social) process [...] embodies the reality of the world and its challenges from a committed pedagogy."[16]

The IPP proposes five stages or steps as pillars of the teaching-learning process, these are: (i) placing reality in its context, (ii) experiencing through life experiences, (iii) reflecting on that experience, (iv) acting accordingly, and (v) evaluating the action and the process that follows.

Placing reality in its context is putting the subject, the fact and its protagonists in their reality and circumstances. Contextualisation consists of placing the subject and the aspect of reality that one wants to experience, know, appropriate and transform in their circumstances.[17]

Part of the designer's task is to know reality in order to project solutions to problems, solve them and transform reality to improve people's lives. In this stage, the approach of the semester projects is involved and in the analytical phase, that is, in the research.

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15   Product Design Career. 2018. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. Pp. 20. (Spanish)

16   GRANADOS, LFSJ 2005. *Ignatian Pedagogical Paradigm* (pp. 1-10). Order of the Society of Jesus. Pp. 2. (Spanish)

17   GRANADOS, LFSJ 2005. *Ignatian Pedagogical Paradigm* (pp. 1-10). Order of the Society of Jesus. (Spanish)

The model applies to real projects in the current context. For this reason, in each semester the development of different projects has been sought and proposed: (i) in 2020_01 the development of a project related to work or study from home (virtual modality) was proposed; and (ii) in 2020_02 two projects were developed, one related to childhood and the development of skills at home and the second focused on new forms of transportation and consumption.

In (iii) 2021_01, issues related to the activities that took place in the pandemic were addressed: urban agriculture (reduced spaces) and gastronomy, these two projects had as their centre a food product, freely chosen by the students.

During (iv) 2021_02, the same strategy was used for a food product transversal to two projects, this was chocolate, one of the flagship products of Ecuador, they collaborated with a local brand to propose experiences with chocolate and improve the presentation of their product. While in (v) 2022_02 two very different projects were proposed, which involved activities and immediate environments: home, university or work.

Experiencing through life experiences is the level of consciousness whose fundamental educational task consists in developing in the person the ability to pay attention in order to perceive reality and the phenomena that are occurring.[18]

The Ignatian experience goes beyond purely intellectual comprehension, it demands mind, heart and will; so, it encourages to involve the imagination and feelings in the understanding of the other.[19]

Experimenting is involved in the analytical and synthetic phase of the project, where the user is researched and experimented with them and their context, to understand it, gather information, define the problem to later project the solution, develop proposals and validate them. Students are promoted to approach real problems in close and local environments, this allows them to experience situations, awaken their senses, get out of the individual (me), know and recognise the other (society), this in order to apply the acquired knowledge and to develop the innate skills and abilities of the designer; fictitious problems are avoided because it does not allow these capacities to be developed.

18   GRANADOS, LFSJ 2005. *Ignatian Pedagogical Paradigm* (pp. 1-10). Order of the Society of Jesus. (Spanish)

19   Product Design Career. 2018. *Redesign of the Product Design Career*. Pontificia Universidad Católica del Ecuador. (Spanish)

Reflecting on that experience is the exercise or step that drives reflection on what has been lived through the experience, what its meaning is, what relationship it has with each dimension of our life and the situation itself, reflecting entails understanding and judging.

To understand is discovering the meaning of the experience and establishing relationships between data that is seen, heard, touched, smelled, etc. It is the spark that illuminates what was presented in the shadows, in sensitive perception.

To judge is to make a judgment, to verify the adequacy between what is understood and what is experienced; between the formulated hypothesis and the data presented by the senses.[20]

Reflecting is linked to analysis in various areas of the process, in the analytical phase when data and information given by the application of research methods are obtained; it is necessary to understand and judge, to generate a clear criterion that allows the development of the proposals. In the synthetic phase, after applying the validation and verification methods, it also requires reflection to determine the changes, adjustments or adaptations that must be developed in the elaborated proposal.

Acting consistently is the action understood as the operative manifestation of a freely assumed decision for the transformation of the person and the institutional and social reality which they live in.[21]

Acting is linked to the synthetic phase of project development, proposals and design in detail; After assimilating the information, the student projects the solution (acts).

Evaluate the action and the process followed. Evaluation is understood as a review of the entire pedagogical process followed throughout each of the steps of the paradigm, to verify and ponder to the extent they have been carried out accurately and efficiently.[22]

The evaluation occurs at each stage, since part of the proposal is the generation of constant feedback, this also goes hand in hand with the iterative design process;

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20 GRANADOS, LFSJ 2005. *Ignatian Pedagogical Paradigm* (pp. 1-10). Order of the Society of Jesus. (Spanish)

21 GRANADOS, LFSJ 2005. *Ignatian Pedagogical Paradigm* (pp. 1-10). Order of the Society of Jesus. (Spanish)

22 GRANADOS, LFSJ 2005. *Ignatian Pedagogical Paradigm* (pp. 1-10). Order of the Society of Jesus. (Spanish)

each stage that is developed requires an evaluation of the results, these are analysed and reflected in individual processes with each student and in groups, since students can learn not only from their experience, but from their peers; in addition, several of the exercises are proposed as a collective construction that implies significant learning and responsibility for ones own actions and those of the other.

The IPP also proposes that the educator be the guide, companion and facilitator, and the disciple (the student) must discover the truth for himself from his openness to the absolute.[23]

4.2.3. Experiential learning and Kolb's experiential cycle

The author agrees with Kolb 's opinion on learning and experimentation: "Learning is the process whereby knowledge is created through the transformation of experience. […] to understand learning we must understand the nature of knowledge and vice versa."[24]

4.2.3.1. The characteristics of experiential learning

Kolb, within his analysis for the development of his experiential learning model, studies three models proposed by: Lewin, Dewye and Piaget; which have generated the characteristics of his proposal, among these are: (i) learning is best conceived as a process, not in terms of results; as Kolb 1984 mentions, experiential learning theory comes from a different set of assumptions since ideas are not fixed and immutable elements of thought, but are formed and reformed through experience; (ii) learning is a continuous process based on experience, that is, knowledge derives and is tested from the student's experience. This is a constant practice; hence, learning focuses on the process and not on the results obtained. In the proposed model, student experimentation is encouraged, tools that must be tested are provided, so that once the process is finished through analysis and reflection, knowledge can be internalised.

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23 GRANADOS, LFSJ 2005. *Ignatian Pedagogical Paradigm* (pp. 1-10). Order of the Society of Jesus. (Spanish)

24 KOLB, D.A. 1984. *Experiential learning: experience as the source of learning and development*. Prentice Hall. Pp. 38. (English)

(iii) The learning process requires the resolution of conflicts between dialecti-cally opposed ways of adapting to the world, knowledge has different points of view, goes from abstract concepts to concrete experiences, so that through experimentation and observation learning can be reached; (iv) learning is a ho-listic process of adaptation to the world; to illustrate this, Kolb proposes figure 16 which shows the cycle of experiential learning in the centre and a model of the process of scientific research externally (Kolb, 1978), with the model of the problem-solving process (Pounds, 1965), the decision-making process (Simon, 1947), and the creative process (Wallas, 1926) in between, this to illustrate that although all models use terms in a different manner, there is a similarity of con-cepts between them.
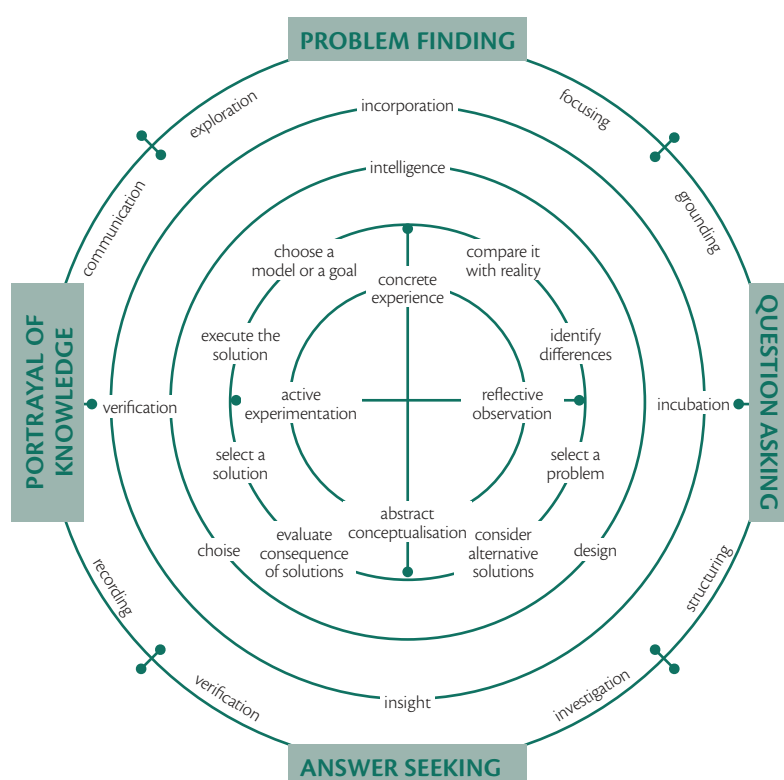
16 Similarities among conceptions of basic adaptive processes: Inquiry/research, creativity, decision making, problem solving, learning.[25]

> "When learning is conceived as a holistic adaptive process, it provides conceptual bridges across life situations such as school, work, portraying learning a continuous, lifelong process. […] Finally, learning conceived holistically includes adaptive activities that vary in their extension through time and space."[26]

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25 KOLB, D.A. 1984. *Experiential learning: experience as the source of learning and development*. Prenti-ce Hall. Pp. 33. (English)

26 KOLB, D.A. 1984. *Experiential learning: experience as the source of learning and development*. Prenti-ce Hall. Pp. 33. (English)

(v) Learning involves transactions between the person and the context, and (vi) learning is the process of creating knowledge; the author mentions that knowledge is the result of the transaction between social or collective and personal knowledge, the exchange of an objective (social) vision to a subjective (individual) one, in which the person reflects on the experience and assimilates the knowledge to integrate it.

> "Knowledge results from the transaction between these objective and subjective experiences in a process called learning. Hence, to understand knowledge, we must understand the psychology of learning process, and to understand learning, we must understand epistemology, the origins, nature, methods and limits of knowledge."[27]

4.2.3.2.　Kolb's experiential cycle

The author explains:

> "This approach to education has numerous benefits because it is a balance between affective (emotional), behavioural, and cognitive (knowledge-based) learning. In addition, learning is inductive, meaning that participants come to their own conclusions about the experience and content, making it easier for them to directly apply their learning to real-world situations."[28]

Kolb's proposal indicates that the student acquires knowledge from experimentation, that is, when carrying out an activity and later reflecting on it through his experience, he generates learning. This cycle contains four stages: concrete experience, reflective observation, abstract conceptualisation and active experimentation.

(i) **Concrete experience** is learning by experiencing, it means that, people learn by being involved in an activity or experience and remembering how it felt. This is the primary way we learn and can serve as the foundation for all other stages in the learning cycle.[29] The concrete experience within the proposal focuses on both the analytical and the synthetic phase, as an example we have the application of methods, since the student has knowledge that he has to apply and only through experimentation, analysis and reflection can he acquire knowledge, even if the project is a justification for learning about the tools,

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27　KOLB, D.A. 1984. *Experiential learning: experience as the source of learning and development.* Prentice Hall. P.p. 37. (English)

28　AFS Intercultural programs. 2014. *Learning is the process by which knowledge is created through the transformation of experience.* AFS Intercultural programs. Pp. 1. (Spanish)

29　AFS Intercultural programs. 2014. *Learning is the process by which knowledge is created through the transformation of experience.* AFS Intercultural programs. (Spanish)

the process is more important than the result, that is, incorporating new tools into their repertoire, as well as delving into specific topic; it is necessary for the student to appropriate the tools that are substantial elements in the development of the discipline.

The (ii) **reflective observation** is learning by processing, a concrete experience is used as a base, the student reflects on the experience to obtain more information or deepen his understanding of it.[30] The reflective observation within the proposed model focuses on both the analytical and the synthetic phase, as an example we have the exploration of the context in the topics developed by period, this allows us to investigate and experiment to deepen previous knowledge, or acquire new knowledge; it also allows students to take ownership of each project since they relate them to previous experiences.

The (iii) **abstract conceptualisation** is learning by generalisation, it is based on the reflection of an experience, the student consciously or unconsciously theorises, classifies or generalises his experience in an effort to generate new information. This *thinking* stage serves to organise knowledge, allowing students to see the *big picture* and identify patterns and norms. This stage is critical for students, with the aim that they are able to transfer their knowledge from one context to another.[31]

(iv) Active experimentation is learning by doing, the student applies or tests their newly acquired knowledge in the real world. The application of learning itself is a new experience from which the cycle starts again.[32]

Both abstract conceptualisation and active experimentation occur as student learning processes, both focus on the analytical and synthetic phases of the model; in theoretical and practical exercises in which students are involved through strategies motivating their processes.

These four phases are summarised in figure 17, since, as Kolb argues, students are not capable of performing both actions on a single axes at the same time (one activity at a time) and for that reason, we have a tendency to perceive and process learning in a particular way. The Y axes is a continuous process,

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30   AFS Intercultural programs. 2014. *Learning is the process by which knowledge is created through the transformation of experience*. AFS Intercultural programs. (Spanish)

31   AFS Intercultural programs. 2014. *Learning is the process by which knowledge is created through the transformation of experience*. AFS Intercultural programs. (Spanish)

32   AFS Intercultural programs. 2014. *Learning is the process by which knowledge is created through the transformation of experience*. AFS Intercultural programs. (Spanish)

how we think, understand and perceive things from abstract conceptualisation to concrete experience; the X axes likewise is a continuum of how we do things from active experimentation to reflective observation.

> "The theory of experiential learning provides a perspective from which approach these practical problems suggesting a typology of different knowledge systems that results from the way the dialectic conflicts between adaptive models of concrete experience and abstract conceptualisation and the modes of active experimentation and reflective observation are characteristically resolved in different fields of inquiry."[33]
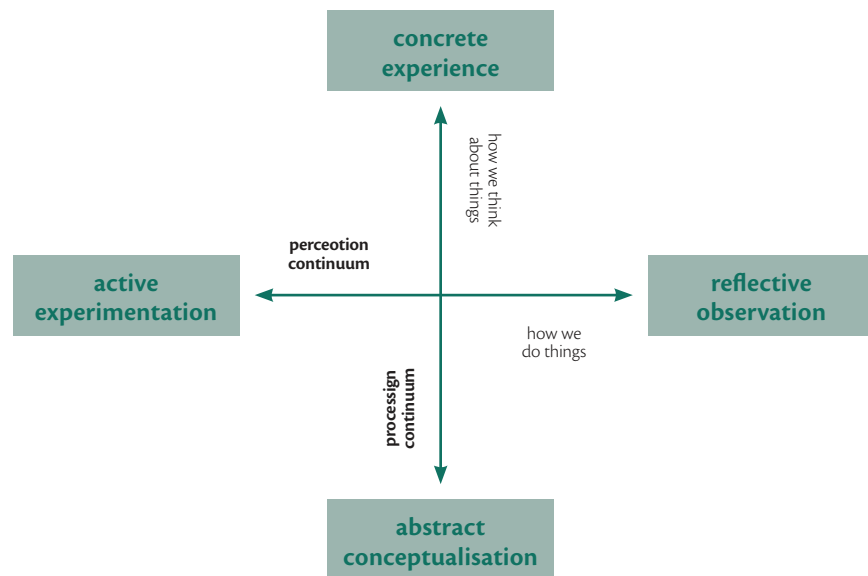
17   Phases of Kolb's experiential cycle.[34]

4.2.4.   Project-based learning (PbL)

The author agrees with the characteristics of project-based learning as described below: "Project Based Learning is a teaching methodology in which students gain knowledge and skills by working for an extended period of time to investigate and respond to an authentic, engaging, and complex question, problem, or challenge."[35]

33   KOLB, D.A. 1984. *Experiential learning: experience as the source of learning and development.* Prentice Hall. Pp. 37. (English)

34   AFS Intercultural programs. 2014. *Learning is the process by which knowledge is created through the transformation of experience.* AFS Intercultural programs. Pp. 2. (Spanish)

35   Buck Institute for Education, PBL Works. 2022. *Project Based Learning* (PBL). https://www.pblworks.org/what-is-pbl. (Spanish)

Project Based Learning (PbL) is a teaching-learning methodology focused on the student who is the protagonist of their educational process and the construction of their knowledge, in addition it is complemented by the acquisition of skills and attitudes that are also important.

Among the most important objectives of PbL we have to train people that are capable of interpreting phenomena and events that occur around them; and develop motivation towards the search and production of knowledge. Several benefits of this methodology have been determined in the teaching-learning process: (i) integration of subjects, a transversal knowledge construction by levels is proposed through an integrating project generated through thesis or thought models; (ii) foster creativity, individual responsibility, collaborative work, critical capacity, decision-making, efficiency, promote and facilitate the expression of personal opinions; (iii) experience the forms of interaction that are currently in demand, with new technologies and media; (iv) combine the learning of fundamental contents (theoretical concepts, research tools, creativity and validation) and develop skills in search of promoting autonomy in learning (experimentation); (v) develop social skills related to group work: negotiation, planning, conducting, monitoring and evaluating one's own intellectual capacities, including problem and conflict resolution; develop criteria and value judgments; (vi) meet social needs, which strengthens students values and commitment to their context; which goes hand in hand with the features of the IPP and Kolb 's experiential learning.

4.2.5.   Challenge-based learning (CBL)

Challenge-Based Learning (CBL) is known to have its origins in two institutions: Apple[36] and the VaNTH ERC[37] Engineering Research Centre. This teaching-learning methodology is focused on the student, in the construction of their knowledge, evaluation and the local context; The application of this methodology requires a clear process. As mentioned by Blanco,[38] et. al (2017)

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36   Apple in 2008 developed the project called "*Apple Classrooms of Tomorrow-Today*". In this project, a method was applied in which the participants worked as a team, not only among students, but also with professors and external specialists. Apple called this method Challenge based Learning (CBL). Author's note.

37   The VaNTH ERC institute is made up of the universities: Vanderbilt, Northwestern, Texas, Harvard and Massachusetts Institute of Technology (MIT), implemented a method called Challenge based Instruction (CBI). Author's note.

38   BLANCO Fidalgo, Ángel; SEIN-ECHALUCE, María Luisa; GARCÍA, Francisco José. (2017). *Aprendizaje Basado en Retos en una asignatura académica universitaria*. Revista Iberoamericana de Informática Educativa. Número 25, Enero-Junio 2017.

the CBL focuses on collaborative work to solve a problem through the phases: (i) challenge, (ii) generation of ideas, (iii) contribution of visions, (iv) investigation, (v) skill test and (vi) publication of the solution.

In general, the CBL seeks to address learning from a contextualised general theme through which several challenges related to it are raised, these challenges require concrete solutions that seek the benefit of society in general or a part of it; for this purpose, tools, resources and the professor's guide are generated for the teaching-learning process. The CBL seeks for the student to investigate the raised problem (real, contextualised, of global, regional or local interest), seek various solutions, develop a clear process and choose the best path; and seeks the professor as a facilitator and generator of tools and information.

Several benefits of this methodology have been determined in the teaching-learning process, among which are: (i) the student achieves a deep understanding of the issues raised, learns to diagnose and define problems, essential activities to propose solutions; (ii) generates sensitivity to the problems raised, develops research, creates models and materialises them, works collaboratively and in a multidisciplinary manner; (iii) the student approaches the community (real context), seeks to interact and get closer to specialised people (multidisciplinary professionals). This teaching-learning methodology has points in common with the process proposed to the IPP, Kolb 's experiential cycle and PbL.

4.2.6.   Problem based learning (PBL)

Problem-Based Learning (PBL) is a teaching-learning methodology in which complex and real problems are used to promote student learning of concepts and principles, as opposed to the direct presentation of facts and concepts such is done in a master class.

Several benefits of PBL have been determined, among which are: (i) students develop skills to analyse information and data, learning to interpret and relate their findings to the previous information provided by the professor; (ii) student autonomy is promoted, this implies that students have responsibility for decision-making, determine the usefulness of the information, as well as analyse what is needed; (iii) useful skills are promoted in the professional and personal fields, such as adapting to changes, critical thinking, reasoning, among others.

The PBL, as well as the PbL and the CBL, share characteristics such as centring the teaching-learning process on the student, and in addition to promoting the generation of knowledge, it is also linked to the development of students' personal skills, which are essential in the working space of the professional designer; these three processes share characteristics reviewed and raised by IPP and Kolb's experiential learning, context and experience in real spaces; in addition, all these educational processes are consistent with the innate process of design (project), which is why they have been introduced as tools within the proposed model.

4.3.   Methodological proposal

The methodological proposal that is incorporated in the development and implementation of the model is the same used for the development of this research, since the construction of knowledge is sought. Next, the process will be briefly reviewed, and the application will be exemplified.

Figure 18 shows in a generalised way the process to generate and accumulate knowledge that is: the base that starts with the pre-existing knowledge of the students which has been accumulated vertically (built in the previous semesters), the channel is the tools, and concepts taught within the subject, the information constructed by the professor (researcher), which allows reaching '*works*' (practice), that is, the application exercises. The information and data obtained are the channel that later in a process of evaluation, analysis and reflection; creates, increases or confirms the knowledge that originated the process, generating a scientific and non-empirical base, a cyclical process in which theoretical concepts are applied through pedagogical strategies (exercises) so that students develop criteria and significant learning.
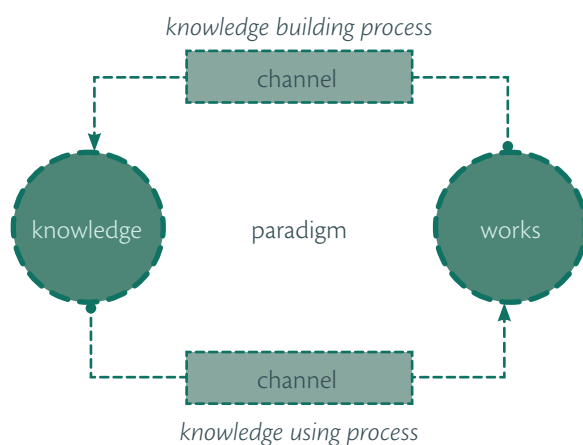
18   Building knowledge process in the classroom.

Figure 19 shows the knowledge construction process in the analytical field and another in the synthetic one. As an example, in the analytical field we can focus on the exercise "*Design, different Perspectives*", students reach the third level with previous knowledge, what they have heard about design and the concepts that have been seen from previous subjects: History of Design, Fundamentals of Design, Product Design Project and Product Semiotics; through these they have developed an approach and a first criterion. The channel used by the professor is: the four design perspectives and the 27 design concepts, material created and provided by the professor; through this information, the exercise (practice) is proposed, which is to analyse the concepts and find new ones, and with this, results are obtained, such as timelines or infographics created by the students. Here a new channel is used, which is discussion and reflection in the classroom where students develop their own criteria that materialises in the elaboration of their own concept, an example is also provided and with this, the cycle is concluded. A new approach is obtained, a new criterion is elaborated, confronted and supported, product of the developed process.

19   Analytical and synthetic process.
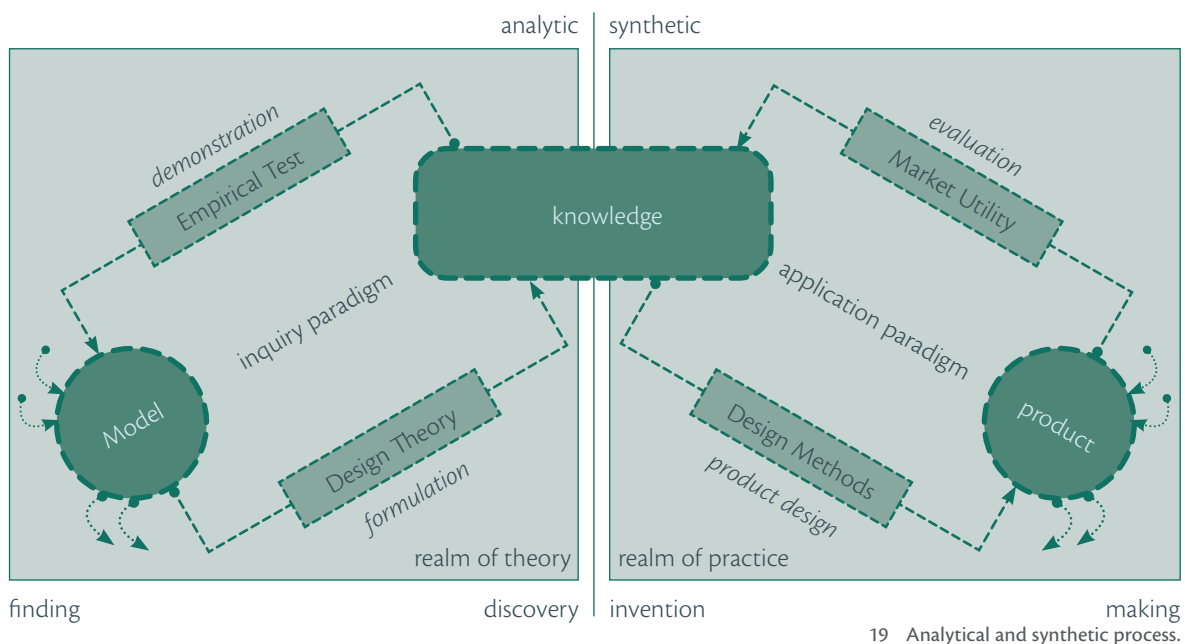
The knowledge construction process in the synthetic phase is proposed in the practical part of the project of the research, creative development and verification phases; as an example, it starts from prior knowledge, the design process is known, in this workshop, the following stages are defined: (i) discover (Research), (ii) define (Problems), (iii) develop (Proposal), (iv) apply (Results) and (v) evaluate (Analysis), from this the route used by the professor is to explain the design methods to research the user in the first phase, through this information the exercise (practice) is proposed, applying the methods with a step-by-step scheme, obtaining information that requires systematisation,

analysis and concluding with a result; a new route is proposed, which is the presentation of results so that the professor can provide feedback through this exercise. At the end of this learning cycle, the student has applied methods following a step by step process that was repetitive at the beginning, at the end it is internalised, information has been obtained and through analysis, the student can determine a problem and get to know the user better.

It is also worth exemplifying the progress of a class, when the theoretical concepts are developed (analytical phase), in which the flipped classroom[39] strategy is used. Bibliographical resources, videos and references are provided with the EVA-MOODLE tool for students to work on independently; within the class, a round table is generated to discuss the topics studied, generate criteria, reinforce knowledge and resolve doubts. With clear concepts, infographics, mental maps or technical sheets are generated that allow reviewing the topics covered when necessary, within the level or in future semesters.

During the development of the project (synthetic phase) the strategy changes, first the professor explains the concepts, provides examples to illustrate the processes; the students assimilate the information and test it, once the knowledge is applied, they reflect on the results. Together with the student, a critical examination is generated to analyse the organisation of the process, the objectives set, the application and the results obtained. It seeks to encourage experimentation to achieve meaningful learning, as well as reflection and criticism as skills and abilities of the designer in the professional practice.

This methodological process is applied throughout this doctoral project and the subject (in each phase/part), which has allowed a cyclical construction of knowledge, based on established pedagogical principles. Therefore, several strategies have been generated for classroom work, among the main ones are: (i) motivate students to try new tools, venture out to experiment, (ii) recognise mistakes and the learning they generate, (iii) analyse and criticise their own proposals objectively with the professor's guidance, (iv) recognise the process, not just focus on the result of the project. Regarding the work of the students (v) encourage collaborative work, where the generation of knowledge is the responsibility of all those involved, (vi) generate information together and obtain information for each individual project.

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39 Flipped classroom is a pedagogical model that it transforms certain parts of the learning process by taking it outside the classroom while increasing or giving greater importance to other activities within the classroom. In this way, students work on the one hand in an individual space and at their own pace outside the classroom, while learning inside the classroom becomes much more dynamic and interactive, where educators guide and lead their students in said learning through the collaboration. Source: PUCE 2020 training.

4.4.   Teaching model for the development of responsible objects

The development of this model is based on the subject of the User-Centred Design Project, for which its structure is defined; it goes on to the characteristics of the model built from the pedagogical and methodological base; this section will proceed to deepen the theoretical concepts of each phase of the structure, the information of a method in each phase is exemplified,[40] then the exercises are expanded by phase and illustrated with images of the achieved results. This is followed by the characteristics for each academic period in which the developed theme and the adjustments made are exposed; and the different modalities of the academic periods are explained. Finally, an analysis of the model is made to define successes, limitations and errors.

4.4.1.   The User-Centred Design (UCD) thesis

User-Centred Design (UCD), also known as Human-Centred Design (HCP), is a design model that focuses on the user-person. While the design is developed and projected for the people, it can be said that the UCD is a relatively young approach; this is said, since at the beginning with the industrial revolution, design was focused on production and the industry focused on solving production problems. Once the latter were overcome it focused on the functionality of the product proposed by the modern movement with emphasis on rationalism both from form as materiality and with the maxim *form follows function*; then in the form and aesthetics that was widely explored in postmodernity; later on materiality and production processes as a response to environmental problems and in the pursuit of productive sustainability; so that in recent decades the emphasis has changed with the transformation of the role of the user, in reference to the user as an active element of the design process; in table 16 the proposal by Rodríguez (2014) in which we can observe the change in the focus on the design centred on the form to the one that is user-centred, in which it is observed from the process on how the emphases of the project have been transformed.

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40   Extended information on each method used is found in the annexes. Author's note.

Subject	Learning outcomes	Form-focused design	User-centred design
Exploratory phase and initial investigation	Start of the process	Briefing	Wicked problems[41]
	Emphasis	Function	Experience
	Indicators	Quantitative aspects	Qualitative aspects
	Market	Demographic	Tribal attitudes
Aspects of the design process	Process focus	Design methods	Design thinking[42]
	Purpose	Creative	Innovative
	Technological	Standardisation	Personalisation
	Working mode	Multidisciplinary	Interdisciplinary
Articulations	Supports	Engineering (under a multidisciplinary approach)	Anthropology (under interdisciplinary approach)

17   Proposal by Rodríguez, 2014, in his chapter *The paradigm shift from form-focused design to user-focused design*.[43]

From this brief introduction to the UCD and the shift in design emphasis, the established model is explored below.

4.4.2.   UCDP Model Features

To develop the model, first we take into account the participants: (i) students, (a) individual, (b) groups or teams; and (ii) professors; and the relationships that intervene between these: (i) student-professor, (ii) student-classmates, this happens in order to establish interactions and activities, in addition part of the pedagogical strategies are focused on knowledge that is built individually and is also a collective construction, since students, by sharing experiences, comparing knowledge and reflecting together, build knowledge and develop meaningful learning.

Secondly, a classification of the competences that students must acquire and develop has been determined: (i) cognitive abilities that are given by the understanding of topics, the application of knowledge, and the solution of problems; (ii) mental models: (a) conceptual, (b) structural, (c) causal; and (iii) learning topics, structured from the simple to the complex.

41   **Wicked Problems**: is a concept used in social planning to describe a problem that is difficult or impossible to solve because it presents incomplete, contradictory and changing requirements that are generally difficult to Recognise. The term wicked is used in a sense that implies resistance to solution. Since there are complex interdependencies in this type of problem, efforts to solve one aspect of it could reveal or create new problems. Soruce: RODRÍGUEZ Morales et al., 2014.

42   As a style of thinking the Design Thinking —design as a way of thought— considers the possibility of combining empathy for the context of a problem, creativity in generating ideas and solutions, and rationality to analyse and adjust solutions to the context. While design thinking has become part of the popular lexicon in contemporary design and engineering practice, as well as business and management, its broader use in describing a particular style of thinking in creative action is having a growing influence on 21st century education in all disciplines. Soruce: RODRÍGUEZ Morales et al., 2014.

43   RODRÍGUEZ Morales, L., BEDOYA Pereda, D., MORALES Zaragoza, N., & PEÑALOSA Castro, E. 2014. User-centred design. Methods and interactions (AM Losada & O. Salinas Flores, Eds.; First Edition). Editorial Designio. Pp. 11. (Spanish)

Thirdly, for the development of the contents based on the general scheme proposed by the degree, minimum content and learning results, the following points are established to take into account: (i) establish a learning context based on challenges, projects or problems, which allow the approach to a real context prepared for experimentation as suggested by the IPP and Kolb; (ii) this context is defined by a theme established by the professor; for which antecedents are raised and established, which pertain to the subject that allow to introduce and to prepare the student for the learning of the case; (iii) develop the specific resources of the subject by period, in addition to the material related to the contents of the UCD level, for which the following is required: build own resources, search for available and complementary resources such as bibliography (books and articles), audio-visual material (videos, films, podcasts, etc.) and experts; define activities and establish schedules; (iv) organise activities to apply the knowledge learned; and (v) carry out integration and reflection activities that seek to synthesise learning and encourage dialogue.

Lastly, the professor's actions are defined in correspondence with the previously reviewed points: (i) define the context and topic prior to the start of the academic period; (ii) prepare and choose the resources considering the competencies to be achieved: understanding and application; conceptual, structural and causal models; increase in the complexity of knowledge; (iii) guided inquiry through the resources generated and reflective through student exploration; (iv) guide for dialectical argumentation in the classroom; (v) generating micro and macro scripts to propose activities, it refers to time dedicated to the work in each stage. According to these points and taking into account the pedagogical and methodological proposal, the model explained in table 18 is developed.

Model			
Phases	Acoording to the the subject, the level and the axes.		
Macro contents (script)	General Design topic and context		
Micro contents (script)	Especific Design topic and context		
Activities	Acoording to the macro and micro contents.		
Participants	Students	Professor	Students teams
Cognitive abilities	Comprehension	Application	Problem resolution
Mental models	Conceptual	Structural	Causal
Resources	Develop according to the cognitive abilities and mental models.		
Teaching action	• Prepare resources • Choose resources • Guided inquiry • Guide to argumentation • Reflective inquiry		

18   Characteristics of the model developed.

4.4.3.   Structure of the UCDP

The structure of the UCDP is articulated in four parts: the first one deals with the basic concepts, such as the definition and basic characteristics of the user-centered design, usability, principles of universal design, principles of good design emotional design and user experience (UX), this theoretical order is defined as an analytical phase, this allows defining teaching-learning strategies and definition of exercises. The second part focuses on research in the UCD to get to know the contexts, habits and behaviours of users, the methods and research tools of the UCD, definition and types of user and project requirements, of a theoretical and practical order, is defined as part of the analytical phase of the project, this allows to define teaching-learning strategies and exercises. The third part seeks creative development in the UCD, through which the design concept, creative methods, as well as the development of proposals and detailed design are addressed.

Finally, the fourth part is focused on the verification in the UCD and on the evaluation methods of universal design, emotional design, usability and user experience,[44] of a practical order, parts three and four are defined as a synthetic phase of the project, this allows to develop teaching-learning strategies and definition of exercises. This information in synthesise in table 19.

1	User Centred Design (UCD). Basic concepts (Analytical phase)	Design, different perspectives	
		Definition and characteristics of the UCD	
		Design Principles	Universal Design: seven principles
			Principles of Good Design: 10 principles
		Usability	
		Emotional Design	
		User experience (UX)	
2	Analytical phase (Project). Research in UCD	Contexts, habits and user behaviours	
		User definition and user types	
		Methods and tools of UCD investigation	Qualitative
			Quantitative
		Project requirements	
		Problem definition	

44   Pontificia Universidad Católica del Ecuador. 2021. *User Centered Design Workshop Syllabus*. Quito. Pontificia Universidad Católica del Ecuador (Spanish)

3	Synthetic phase (Project). Creative Development	Design Concept	
		Creative methods	
		Design in detail	Technical drawings, mock-ups, models and prototypes
4	Synthetic phase (Project). Verification	General methods of verification and Design evaluation	Design Principles
			Usability
			Emotional Design
			User experience (UX)

Below, the contents of the third semester are deepened for the application of the developed model.

4.4.4.   User Centred Design (UCD)

4.4.4.1.   Basic concepts

4.4.4.1.1.   Design, different perspectives

As an introduction to the subject, the process begins with design and four different perspectives, under the proposal of Ortiz[45] (2014):

Design and politics. The developed design as a strategy of competitiveness, identity and communication. In competitiveness and identity, a country brand is generated for differentiation, recognition and promoting quality, also the design is used as a means of communication, to support ideological and political messages.

Design and society. Design as an object of identity, differentiation and recognition. It generates individual identity through differentiation, which is inserted in group spheres (urban tribes) that in turn seek differentiation and recognition.

These phenomena are recognised and fostered by globalisation. Design is a factor of social recognition, since it is a modeller of society. Design as a means of generating lifestyles, stratification of society through objects and develops the taste that the individual possesses.

45   ORTIZ, I. 2014. *Ethics and Design: Ethical Responsibilities of the Design Project*. University of Lisbon. (Spanish)

Design and economy. This refers to design used as a tactical tool for production and brand identity. In production, design as a driver of the economy, especially in times of recession, for injection and circulation of capital. In identity as the differentiation factor between products and producers, it appeals to the idealisation of products. We remember that innovation and creativity are promoted through design.

Design and culture. Design as a strategy for democratisation and cultural identity. Democratisation through mass production, since costs drop, and products that were previously destined for the elites become accessible to the majority of the population, both knowledge and taste are free and attainable. Design generates regional cultural identity that is a global differentiator and producer of cultural typologies.

To move on to design and its different meanings or concepts from the perspective of designers around the world at different times, points of view are addressed in terms of production, aesthetics, philosophical, among others. These concepts have been compiled from famous theorists such as Papanek, Löbach, Maldonado, among others; institutions such as the International Council of Societies of Industrial Design (ICSID) which later became the World Design Organization (WDO), Industrial Designers Society of America (IDSA); local professors like Hurtado, Jácome and Maldonado; and regional designers like Sánchez and González. This information is summarised in the table 20.

Designer	Year	Activity	Concept
Diego Hurtado Gomezjurado	2008	Architect-Designer, product design professor. Interview.	"Design is a response to the needs and desires of large masses of a certain population that materialises in a satisfier."
Guido Diaz	2008	Architect-Designer, professor of Architecture. Interview.	"[…] Design does not go to something specific, design is everything […] the designer investigates a situation and creates an object that changes that situation, the object has to have a purpose to fulfil a function"
Angel Jácome Gallardo	2008	Architect-Designer, product design professor. Interview.	"Design is a social and cultural attitude that responds to a sublime order of emotions and feelings of the human being."
Marcelo Maldonado	2008	Designer, professor of Graphic Design. Interview.	"[…] Design is the need to communicate, visual communication design, communicates through images: industrial design, utilitarian, craft or industrial needs […]"
Mauricio Sánchez[46]	2005	Morphogenesis of the object of use	"Industrial design is the activity in charge of conceiving the object form from a conceptual perspective, to the extent that its position is scientific, which, from that ideal approximation to the reality of its knowledge discourse, in short, is the concretion of a conceptual proposal in a morphology".

46   SÁNCHEZ Mauricio. 2005. *Morphogenesis of the Object of Use* (Second edition). Jorge Tadeo Lozano University of Bogota Foundation. (Spanish)

Bernd Lobach[47]	1976	Industrial design. Basis for the configuration of industrial products	"Designing is a process of adapting the object environment to the physical and mental needs of men in society."
N. Butz[48]	1976	Industrial design, creation, embellishment and function of what the industry produces	"Industrial design is creation and also culture, art, science and technique because it has to analyse reactions, tastes, needs, environment, function, materials, procedures or means of manufacturing and cost indices, adding to these those factors of sensitivity and beauty in the aspect control so that the object is resolved in an attractive way, that makes it desirable and well-adjusted to its time"
Thomas Maldonado[49]	1976	Industrial design reconsidered	"Industrial design is a design activity that consists of determining the formal properties (functional and structural relationships) of industrially produced objects."
St. Gregory[50]	1966	Design Methods	"The relationship of a product with its situation, in order to satisfy it."
ICSID International Council of Societies of Industrial Design[51]	1957	World organisation that promotes the incorporation of industrial design in world activities.	"Design is a project activity that consists of determining the formal properties of industrially produced objects."
WDO World Design Organization[52]	2022	World organisation that promotes the incorporation of industrial design in world activities. Formerly ICSID	"Industrial Design is a strategic problem-solving process that drives innovation, builds business success, and leads to a better quality of life through innovative products, systems, services, and experiences. Industrial Design bridges the gap between what is and what's possible. It is a transdisciplinary profession that harnesses creativity to solve problems and co-create solutions with the intent of making a product, system, service, experience or a business, better. At its heart, Industrial Design provides a more optimistic way of looking at the future by reframing problems as opportunities. It links innovation, technology, research, business, and customers to provide new value and competitive advantage across economic, social, and environmental spheres."
Victor Papanek[53]	1977	Design for the real world	"Design is the conscious effort to establish a significant order"

47   LÖBACH Bernd. (1981). Industrial design. Gustavo Gili. (Spanish)

48   BUTZ, N. (1976) Industrial design, creation, embellishment and function of what industry produces. Barcelona: LEDA. (Spanish)

49   MALDONADO Thomas. (1993). *Industrial Design Reconsidered* (3rd ed.). Gustavo Gili. (Spanish)

50   GREGORY 1966, Cited by C. Jones 1982. (Spanish)

51   The International Council of Societies of Industrial Design (ICSID) was founded in London in 1957 with the aim of promoting the status of industrial designers, raising the standard of industrial design through training and education, and encouraging cooperation between industrial designers around the world. By the end of the 1960s ICSID included over 40 member societies from more than 30 countries. The ICSID archive documents the initiatives, ambitions and influence of this international organisation that continues to make a major contribution to the representation of industrial design and designers across political boundaries and economic disparities. Author's note.

52   The World Design Organization (WDO) was founded in 1957 from a group of international organisations focused on industrial design. Formerly known as the International Council of Societies of Industrial Design, the WDO is a worldwide society that promotes better design around the world. Today, the WDO includes over 170 member organisations in more than 40 nations, representing an estimated 150,000 designers. Author's note.

53   PAPANEK, Victor, (1977), *Designing for the real world: human ecology and social change.* Madrid: Hermann Blume. (Spanish)

IDSA Industrial Designers Society of America[54]	2022	North American organisation that promotes industrial design	"Industrial Design (ID) is the professional practice of designing products, devices, objects, and services used by millions of people around the world every day. Industrial designers typically focus on the physical appearance, functionality, and manufacturability of a product, though they are often involved in far more during a development cycle. All of this ultimately extends to the overall lasting value and experience a product or service provides for end-users. Every object that you interact with on a daily basis in your home, office, school, or public setting is the result of a design process. During this process, myriad decisions are made by an industrial designer (and their team) that are aimed at improving your life through well-executed design."
J.B. Reswick[55]	1965	Prospectus for an Engineering Design Centre	"A creative activity that supposes the achievement of something new and useful without previous existence".
JK Page	1966	Building for people	"The imaginative leap from present reality to future possibilities."
Christopher Jones[56]	1970	Design Methods	"The act of designing is the beginning of a change in the things made by man […] besides the realisation of a complete leap of faith."
George Nelson	1974	Problems of design	"Design […] is a manifestation of the ability of the spirit to transcend its limitations" "Design is an attempt to make a contribution through change. When a contribution is not made or cannot be made, the only process available to give the illusion of change is styling."
Matchett[57]	1968	Design Methods	"The optimal solution of a set of true needs in a particular set of circumstances."
Joan Costa[58]	1994	Design, communication and culture	"If designing implies subjecting the creation of forms to a purpose, the purpose of design is always to respond to a human need. Its true dimension and its social role are acquired by giving a formal response to a function, that is, the mode of action by virtue of which an object fulfils the purpose for which it was created."
From engineering[59]	2002	Ecodesign, life cycle engineering for the development of sustainable products	"Activity that converts an idea suggested by a market need, into a set of specifications for production."
Bruce Archer[60]	1965	Design Methods	"[…] selecting the right materials and shaping them to meet functional and aesthetic needs within the limitations of the available means of production."
Christopher Alexander[61]	1963	Design Methods	"The discovery of the true physical components of a physical structure."

54 https://www.idsa.org/what-industrial-design

55 RESWICK, JB. *Prospectus for an Engineering Design Centre*. Cleveland, OH: Case Institute of Technology, 1965. (English)

56 JONES JC. (1978). *Design Methods*. Gustavo Gili. (Spanish)

57 MATCHETT 1968, Cited by C. Jones 1982. (Spanish)

58 COSTA J. (1994). *Design communication and culture*. Fundesco. (Spanish)

59 HOOD, Salvador; GÓMEZ, Tomás, (2002), *Eco design Life cycle engineering for the development of sustainable products*, (1st ed.), Valencia: Editorial UPV. (Spanish)

60 ARCHER, 1965. Cited by C. Jones 1982. (Spanish)

61 ALEXANDER, 1963. Cited by C. Jones 1982. (Spanish)

Guillermo Gonzalez Ruiz	1994	Design Study, on the construction of ideas and their application in reality	"The end, the purpose, the objective of Design is to create useful objects for the needs of man in his habitat, in his social and physical environment."
Asimow[62]	1962	Design Methods	"Making a decision, in the face of uncertainty, with large penalties for error."
P.J. Broker[63]	1964	Design Methods	"Simulate what we want to build (or do), before building it (or doing it), as many times as necessary to trust the final result."
Michael Farr[64]	1966	Design Methods	"The factor that conditions those parts of the product that come into contact with people."
Fielden[65]	1963	Design Methods	"Technical design is the use of scientific principles, technical information, and imagination in defining a mechanical structure, machine, or system that performs specific functions with maximum economy and efficiency."

20   Design concepts.[66]
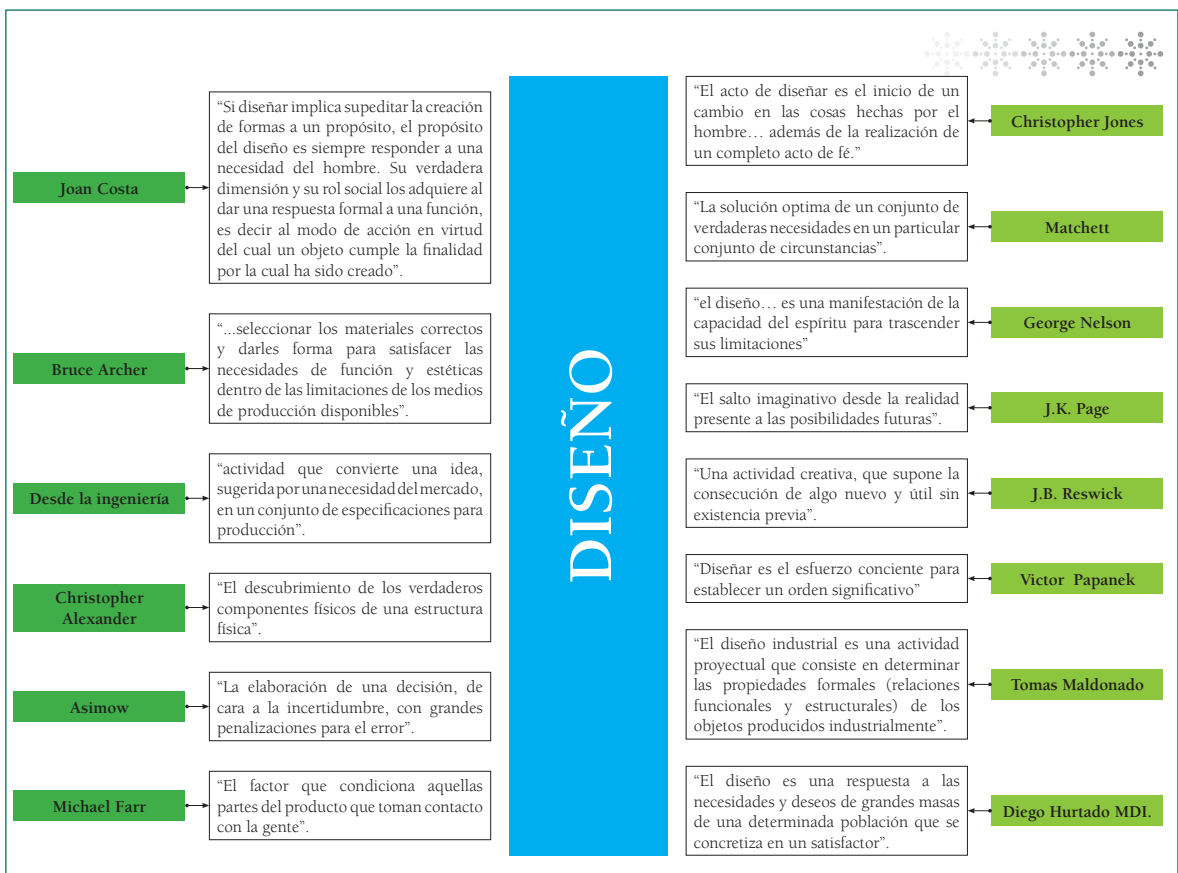
20   Developed teaching material by Ortiz (2020). Design concepts.

62   ASIMOW, 1962. Cited by C. Jones 1982. (Spanish)

63   BROKER, 1964. Cited by C. Jones 1982. (Spanish)

64   FARR, 1966. Cited by C. Jones 1982. (Spanish)

65   FIELDEN, 1963. Cited by C. Jones 1982. (Spanish)

66   ORTIZ, I. 2009. *Ecodesign under a Latin American Thought, state of the art*. Pontificia Universidad Católica del Ecuador. This document has been revised, edited, and supplemented over the years. Author's note. (Spanish)

Finally, the concept developed by Ortiz 2014-2016 shown in figure 21 is proposed as an example, which synthesises: Design means to designate, it is communication through the object, so it is to generate a sign (product, system, service, process or experience) that has a meaning, the object is saying what it is: denotation, the objective or function of the object (product, system, service, process or experience), it is tangible; and it is significant, that means to say beyond what the object is: connotation, the concept or thought (ideas, beliefs, values or attitudes) of the object (product, system, service, process or experience), it is intangible, it is perceptible through its characteristics (material and formal).
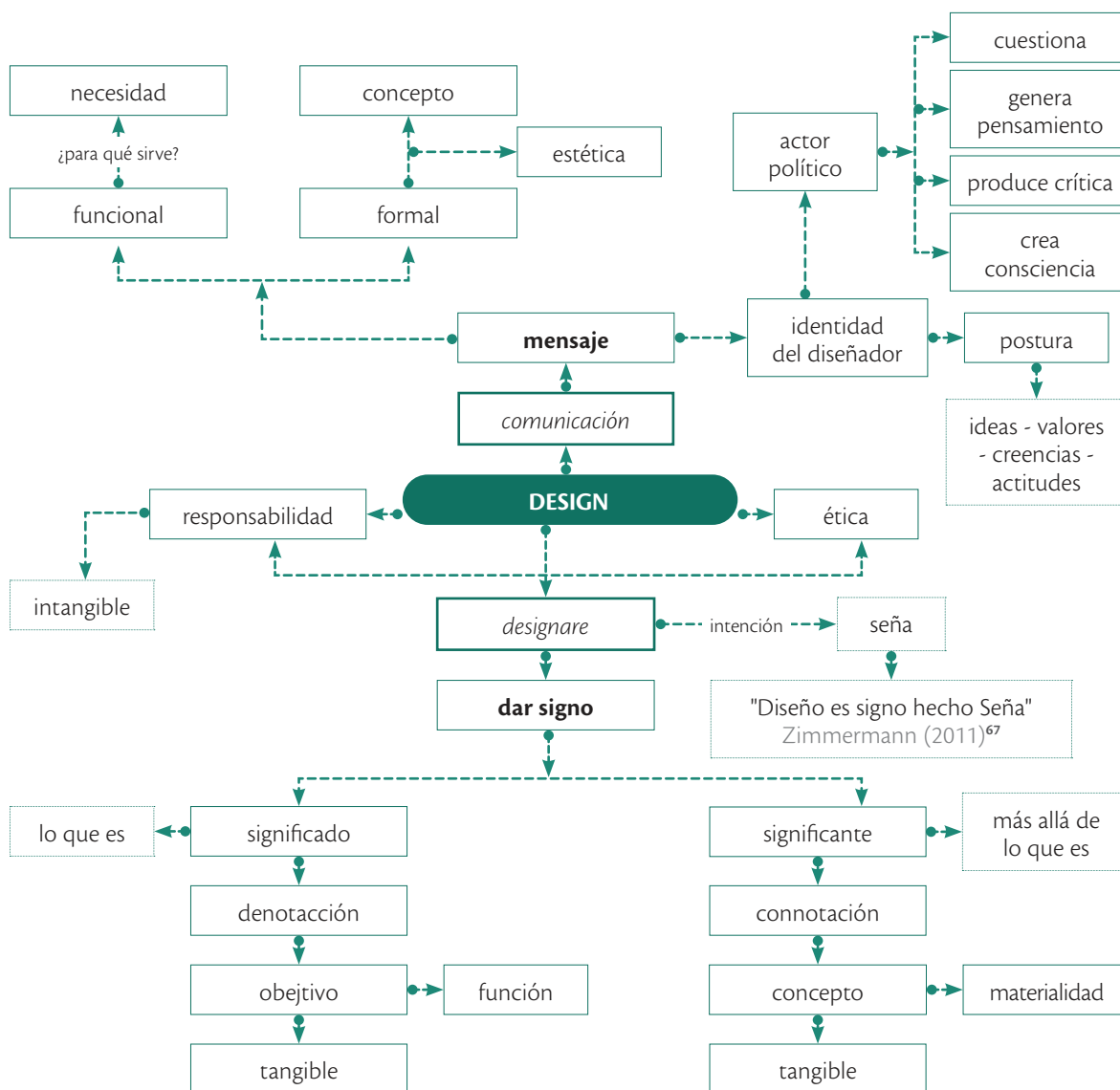
21 Developed teaching material by Ortiz (2016-2019). Design concept from Ortiz.[68]

67 ZIMMERMANN, Yves. 2011. *El diseño como concepto universal* (Parte 1-2-3) https://foroalfa.org/articulos/el-diseno-como-concepto-universal-parte-1. (Spanish)

68 As an exercise developed for the class, it maintains the original language. Author's note.

This introduction to different perspectives of design seeks to broaden the knowledge that one has about the discipline, the design concepts up to this point of formation (third semester) that have been seen, are from history as mentioned in the previous chapter "supported by the concept that designing is the action of projecting, that is, conceiving an object to be produced";[69] from the Fundamentals of Product Design based on Wong 2014:

> "[…] Good design is the best visual expression of the essence of "something", being a message or a product. To do it faithfully and effectively, the designer must seek the best possible way for this "something" to be shaped, manufactured, distributed, used and related to its environment. Its creation must not only be aesthetic but also functional, while it reflects or guides the taste of its time."[70]

And the concept from form in the Product Design Project that is based on *Morphogenesis of the Object of Use* of Sánchez. It is necessary that students have different points of view that generate criteria in their training.

4.4.4.1.2.   Definition and characteristics of the UCD

For the definition and characteristics of the UCD we use as a reference the following texts: *Interactive design, theory and application of the UCD*[71] (2013); and *Beautiful users*[72] (2014) to illustrate the history of the UCD and the design for people.

The definition of UCD is described by Pratt, A. and Nunes, J. (2013) The User-Centred Design UCD is an approach to design that focuses on the user of a product or an application to create a certain product. The UCD implies that the designer studies in depth the needs, desires and limitations of the target audience (user) to whom the final product is directed, and from this analysis makes the decisions that proceed to make its creation; it also implies that the designer carry out a field study to test the proposal and a real approach to the user exists.

To generate a historical account of the UCD we have some moments to take into account; the user has had several roles within the design process, going from representations of the ideal or normative type of people, as individuals of different abilities and characteristics, also as subjects to be observed and measured; and as partners in the problem-solving process.

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69   Page 75 of this dissertation. Author's note.

70   WONG W. 2014. *Design Fundamentals*. Gustavo Gili Editorial. Pp. 41. (Spanish)

71   PRATT, A., & Nunes, J. (2013). *Interactive Design: UCD Theory and Application*. Barcelona: Ocean. (Spanish)

72   LUPTON, E., CARPENTIER, T., & LAMBERT, T. 2014. *Beautiful users: Designing for people*. New York: Princeton Architectural Press - Cooper Hewitt, Smithsonian Design Museum. (English)

Henry Dreyfuss with his work team since the thirties includes the term of the human factor to introduce the philosophy that machines must adapt to people and not vice versa, which would be reflected in his book *Designing for people* (1955), with this approach to the human factor linked to anthropometry, two books were published in the field of Architecture and interior design, by Ernest Neufert: *The Art of Projecting in Architecture* (1936), an anthropometric database for the configuration of space, and *Anatomy for Interior Design* (1948) by Francis de N. Schroder, who promotes the projection of comfortable spaces adapted to people.

In 1940, in the context of the World War II, in the search to understand the problems and errors of the armament (tanks, planes, weapons), engineering applied to people was introduced, linked to physical ergonomics that emphasises the human body and its characteristics through anatomy, anthropometry, biomechanics and physiology; it begins to think about objects that are physically adapted to people, objects that not only respond to the requirements of production and companies, but also products that respond to people.

In 1960, cognitive ergonomics was introduced, which seeks that objects, in addition to physically adapting to people, must take into account the senses (sensory elements), memory and deduction capacity of users (cognitive activities); that is to say, mental processes are taken into account for the development of products, services, systems, processes and experiences, the person in all of its dimensions. In 1970, ethnographic research techniques were introduced into the design processes, which allowed us to get closer to the people, their cultures, introducing a more human dimension in the projection of objects.

With this information, there are some first references that the UCD addresses: (i) it determines possible actions, in a produced object the actions of use are analysed and in the projection of an object the possible actions of use are analysed; (ii) make things visible, that is, how the object is read (interfaces): use and function; (iii) evaluate the current state of the object (redesign) or of the context (design), the problem has been solved or it needs to be solved; (iv) natural correspondences between intentions (designer) and actions (user), between actions (use, interaction) and results (function).

After reviewing the information provided by the professor and analysing it, is intended that the students adopt specific actions in their user-centred design process, among which we have: (i) understand and specify the context of use of products, services, systems, processes and experiences;

(ii) specify the requirements and requests of the user; (iv) produce and project design solutions with the new approach; (v) evaluate the designed proposals based on the defined requirements and requests.

Based on what has been studied and analysed, six characteristics of the project are defined based on the UCD, these are: (i) explicit understanding of users, tasks and environments; (ii) users are involved throughout the project development process; (iii) the design proposal is refined by user-centred evaluations; (iv) the design process is iterative; (v) the products, services, systems, processes and experiences are aimed at the user; (vi) the design team includes multidisciplinary skills and perspectives, which ones (disciplines) must be identified and how they are integrated into the process.

4.4.4.1.3. Design Principles

As part of the introductory process, design principles are reviewed. Currently, there are various approaches to design to cover the needs of the user, given the change in the paradigm that was mentioned from business-centred design and form to move to a user-centred or people-centred design; some of these by context are: from Europe the approach of *Design for All*, from the United Kingdom the *Inclusive Design* is employed, and from the United States the concept of *Universal Design*. The *seven principles of Universal Design*[73] are addressed, a concrete tool for their assimilation and learning, "Good design enables, bad design disables."[74]

The seven principles of universal design established in 1997 by the group led by Ronald Mace[75], are intended to be a guide for the development of products, spaces and communication elements that are designed for all people without discrimination of age or disability "Universal Design (UD) is a design process that enables and empowers a diverse population by improving human performance, health and well-being, and social participation"[76]. This is used as one of the key concepts for social innovation.

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73 It should be noted that in 2012 the conceptual framework of Universal Design was redefined and expanded by Steinfeld and Maisel from the IDEA Centre of the University at Buffalo, they were defined as twelve objectives. However, for the development of this proposal, the initial proposal of the 7 principles is taken. Author's note.

74 Stockholm Declaration of the Institute for Design and Disability (EIDD), May 2004. Author's note.

75 Ronald Lawrence Mace, (1941 - June 29, 1998) was an American architect, product designer, educator, and consultant. He is best known for coining the term universal design and for his work advocating for people with disabilities. Author's note.

76 © Steinfeld and Maisel, 2012.

Principles of Universal Design	Fair Usability	Design is useful and saleable to people with different abilities.	• Provides the same meaning of use to all users: identical if possible; otherwise, equivalent. • Avoid segregation or categorisation of any user. • Confidentiality, safety and security components must be available to all users in an equivalent way. • The design must be attractive to all users.
	Flexibility of use	The design allows for a wide range of individual preferences and abilities.	• Make a choice in methods of use. • It admits both left and right handling. • Promotes user accuracy and precision. • It brings adaptability to the user's ability.
	Simple and intuitive use	The purpose of the product is easy to understand, regardless of the user's experience, knowledge, language skills or possible concentration level.	• Eliminate unnecessary complexity. • Corresponds to the intuition and expectations of the user. • It admits a wide range of language and literacy skills. • Handles information consistently with its importance. • Provides effective suggestions and feedback during and after the action of use.
	Perceptible information	The design effectively communicates the information necessary to the user regardless of the environmental conditions or his sensory abilities.	• Use different methods (visual, verbal, tactile) to redundant the presentation of essential information. • Provides adequate differentiation between essential and background information. • Maximise the readability of essential information. • Differentiate elements in ways that can be described (for example, making it easy to give instructions and directions). • Provides compatibility with a variety of techniques or devices used by people with sensory limitations.
	Tolerance for errors	The design minimises the dangers and adverse consequences of accidental or unintentional use.	• Arrange the elements in order to minimise dangers and errors: the most used elements, the most accessible; the most dangerous elements, eliminated, isolated or shielded. • Provides warnings about errors and dangers. • It provides elements of protection against the consequence of failures. • Discourage unintended use in actions that require caution.
	Low physical exertion	The design can be used efficiently and comfortably under minimal fatigue conditions.	• It allows the user to maintain a neutral body position. • Reasonable use of force to operate. • Minimise repetitive actions. • Minimise sustained physical effort.
	Size and space for approach and use	Appropriate size and space are guaranteed for approach, access, manipulation and use, regardless of body size, posture and mobility.	• Provides a clear view of the important elements for each seated or standing user. • It makes it comfortable to reach all components for any seated or standing user. • Allows for variations in hand and grip size. • Provides adequate space for the use of aids or assistants.

21   7 Principles of Universal Design.[77]

77   MACE, Ronald and working group. *The 7 Principles*. Centre of Excellence in Universal Design. National disability authority. https://bit.ly/3t8AAEy. (English)

On the other hand, the 10 principles of good design by Dieter Rams, one of to-day's most prestigious designers with great transcendence in the development of contemporary design;[78] this material is reviewed as it is a concrete tool of timeless character.

Principles of Good Design	**Good design is innovative**	The possibilities for innovation are not, by any means, exhausted. Technological development is always offering new opportunities for innovative design. But innovative design always develops in tandem with innovative technology and can never be an end in itself.
	Good design makes a product useful	A product is bought to be used. It must satisfy certain criteria, not only functional, but also psychological and aesthetic. Good design emphasises the usefulness of a product while disregarding anything that could possibly detract from it.
	Good design is aesthetic	The aesthetic quality of a product is integral to its usefulness because products we use every day affect our person and our well-being. But only well-executed objects can be beautiful
	Good design makes a product understandable	It clarifies the product's structure. Better still, it can make the product talk. At best, it is self-explanatory.
	Good design is unobtrusive	Products fulfilling a purpose are like tools. They are neither decorative objects nor works of art. Their design should therefore be both neutral and restrained, to leave room for the user's self-expression.
	Good design is honest	It does not make a product more innovative, powerful or valuable than it really is. It does not attempt to manipulate the consumer with promises that cannot be kept.
	Good design is long-lasting.	It avoids being fashionable and therefore never appears antiquated. Unlike fashionable design, it lasts many years —even in today's throwaway society.
	Good design is thoroughly down to the last detail.	Nothing must be arbitrary or left to chance. Care and accuracy in the design process show respect towards the user.
	Good design is environmental-friendly.	Design makes an important contribution to the preservation of the environment. It conserves resources and minimises physical and visual pollution throughout the lifecycle of the product.
	Good design is as little design as possible	Less, but better —because it concentrates on the essential aspects, and the products are not burdened with non-essentials. Back to purity, back to simplicity.

22   10 principles of Good Design.[79]

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78   These principles are reviewed in the 2009 documentary *Objectified* and the 2020 documentary *Rams*. Students are encouraged to watch these documentaries. Author's note.

79   GARRETA Domingo, Muriel. 2020. *Dieter Rams: 10 Timeless Commandments for Good Design*. Interaction Design Foundation. https://bit.ly/3WCZmKp (English)

4.4.4.1.4. Usability

For the definition of use, *Design by use*[80] (2013) is used.

> "Use makes the user enter into a specific type of object relationship that is located between form and function. The familiar conditions of form and function seem to disintegrate when considering an object's use because, in principle, we can use everything for anything in a more or less successful way. Contrary to a dedicated function, use is not the entelechy of an object. If something is used for purposes other than those it was intended for, then a purpose different from the one defined by a standardised function has been chosen."

For the concept of usability, the *Handbook of usability*[81] (2008) is used.

> "Usability is a quality that many products possess, but many, many more lack […] To be usable, a product or service should be useful, efficient, effective, satisfying, learnable, and accessible […] Usefulness concerns the degree to which a product enables a user to achieve his or her goals and is an assessment of the user's willingness to use the product at all. Efficiency is the quickness with which the user's goal can be accomplished accurately and completely and is usually a measure of time […] Effectiveness refers to the extent to which the product behaves in the way that users expect it to and the ease with which users can use it to do what they intend […] Learnability is a part of effectiveness and has to do with the user's ability to operate the system to some defined level of competence after some predetermined amount and period of training (which may be no time at all) […] Satisfaction refers to the user's perceptions, feelings, and opinions of the product […] Accessibility and usability are siblings. In the broadest sense, accessibility is about having access to the products needed to accomplish a goal."

When we begin to inquire into use and usability, we always question what usable means, what the usability of a product, service, system, process or experience means, and we can conclude that usability refers to the absence of frustration when a person or user utilises an object, we can say a product (service, system, process or experience) is usable when the user can do what he wants in the way he expects to do it, without obstacles, without doubts or without questioning.

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80 BRANDES, U., Stich, S.; Wender, M. 2013. *Design by Use: The Everyday Metamorphosis of Things*. Basel: De Gruyter. (English)

81 RUBIN, J., & Chisnell, D. 2008. *Handbook of usability testing: How to plan, design, and conduct effective tests*. Indianapolis, Ind: Wiley Pub. (English)

Usability has characteristics such as (i) utility, that is, the degree to which a product allows a user to achieve their goal; (ii) efficiency, that is, the speed with which the user reaches the objective (making an object work) correctly and completely stated, efficiency is generally measured in time, it is quantifiable; (iii) effectiveness, which has to do with how the object behaves according to the user's expectation and the ease with which it can be used; (iv) learning capacity, this has to do with effectiveness, is also the ability of a user to operate a system after being trained, associate it with an analogous element or relearn a system; (v) satisfaction, is linked to the perception of the user, their emotions and opinions about the product, service, system, process or experience, quality characteristics; and (vi) tolerance to error, pertaining to the flexibility in the use of an object that minimises the risks and adversities caused by involuntary or accidental actions, it also reflects on the user's ability to make errors in the use of objects and their recovery capacity to achieve the proposed objective.

When we talk about usability, we must differentiate between the use of the function of the object; the use and usability of the object is linked to praxis, that is, the set of actions that I must carry out for the object to fulfil its objective, that is, to reach its function. For example, in the case of an object, an electric kettle, its function is to heat the water, but what are the activities, praxis, that I have to carry out so that the water is hot (accomplish its function): (i) uncover the kettle and check if there is water or not, (ii) take it to the sink, (iii) put the kettle under the faucet, (iv) open the faucet, (v) check how far the water reaches, (vi) close the faucet, (vii) close the lid of the kettle, (viii) move it to the connection point (base), (ix) check if it is connected or connect it, (x) activate the heating button (interface), (xi) wait for it to heat, (xii) it is finished when I hear that the button returns to its original point, or when the kettle makes a hissing sound due to the water vapour, or I observe the water vapour, or the light is off (indicators). A good usability is given when the praxis is carried out without any difficulty, taking into account the characteristics described above.

22   Usability of a kettle.

"I distinguish between complexity and complicated. I use the word "complexity" to describe a state of the world. The word "complicated" describes a state of mind",[82] we must understand that the design of things (the parts and the whole) determines their understanding. Design has an internal logic, a foundation that once it is achieved makes everything understandable, this characteristics in accordance with the principles set forth by Mae and Rams; another aspect to take into account is our set of capabilities and skills that allow us to understand products, services, systems, processes or experiences.

These concepts are constantly reinforced during the development of the UCDP and during the different phases of the project, in order for students to identify how to apply them and thus achieve understanding and learning.

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82   NORMAN, D. 2011. *Living with Complexity* (First edition). MIT Press. Pp. 2. (English)

4.4.4.1.5. Emotional Design

For the emotional design concept, the texts *Living with complexity*[83] and *Emotional design, why we love or hate everyday things*[84] (2011, 2007) are use, them introduces this vision to the development of design projects; Norman's proposal interweaves the behaviour and mental response we have about objects, and the characteristics that designers must take into account when making decisions about projected objects. The author proposes three levels of design (and behaviour): visceral, behavioural (behaviour) and reflective (reflection), next, we will see the characteristics of each of these.

Visceral design. It is linked to the appearance of products, services, systems, processes or experiences; we can say that it is the most basic and instinctive (sensory) level of our brain that reacts by the emotion that objects provoke, this is related to previous experiences with similar objects or with what they represent; this can cause a good or bad emotion and is linked to the acceptance or rejection of the product. "The visceral level is pre-consciousness, pre-thought. This is where appearance matters, and first impressions are formed. Visceral design is about the initial impact of a product, about its appearance, touch, and feel."[85]

The taste of the user and their experience intervene, it must be taken into account that each experience is individual, what the object means and how we assimilate it, depends on each individual and can vary from person to person. We have as an example of products linked to this experience in the merchandising of films or series (Star Wars, Friends, Avengers, etc.), objects are not always functional nor usable, however they are acquired due to the "*irrational*" emotion they provoke in people. It can be concluded that in these objects their aesthetics prevail over their functionality and usability, qualitative characteristics; They are basic or primary function objects with low complexity.

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83   NORMAN, D. 2011. *Living with Complexity* (First edition). MIT Press. (English)

84   NORMAN, D.A. (2007). *Emotional design: Why we love (or hate) everyday things.* New York: Basic Books. (English)

85   NORMAN, D.A. (2007). *Emotional design: Why we love (or hate) everyday things.* New York: Basic Books. Pp. 36-37. (English)

23   Same object, different presentations.

Behavioural Design. It is linked to the function of the product, service, systems, processes or experiences. This has to do with the praxis and function of the object, that is, how I understand it, how I use it and how it works.

> "The behavioural level is about use, about experience with a product. But experience itself has many facets: function, performance, and usability. […] Performance is about how well the product does those desired functions—if the performance is inadequate, the product fails. Usability describes the ease with which the user of the product can understand how it works and how to get it to perform."[86]

At this level, individual taste or desire does not intervene, but the performance of the object (praxis and function) that is measured by actions and objectives to be achieved, that is, there are quantifiable characteristics of the product's performance. This level is directly related to characteristics of usability: usefulness, efficiency, effectiveness, learning capacity, satisfaction, and error tolerance; so it is essential to understand that projecting an element has an enormous responsibility, since it intervenes in the conduct and behaviour of the individual and therefore of society; one of the mistakes that is continually made is to think that the user adapts to the object and this causes problems that are not perceived immediately but over a long time, both physical (postural, back pain, carpal tunnel, etc.), and cognitive (hearing sensitivity, light, etc.). It can be concluded that at this level function and usability prevail over aesthetics.

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86   NORMAN, D.A. (2007). *Emotional design: Why we love (or hate) everyday things.* New York: Basic Books. Pp. 37. (English)

24   Tools, objects where the function is essential.

Reflective Design. As Norman mentions, reflective design covers quite a wide field, it is related to the message, the culture, the meaning of the product and its use; at this level, the impression of the person is related to the product in all its fields, at this level the two previous ones come together (aesthetics-form and function-use); and also, how this product is a reflection of it, that is, how it represents it in front of others. "Of the three levels, the reflective one is the most vulnerable to variability through culture, experience, education, and individual differences. This level can also override the others."[87]

It can be affirmed that only at the reflective level is where the consciousness and the highest levels of feeling, emotions and cognition of the user reside; and that their interpretation, understanding and reasoning come from this level,

> "The visceral and behavioural levels are about "now", your feelings and experiences while actually seeing or using the product. But the reflective level extends much longer—through reflection you remember the past and contemplate the future. Reflective design, therefore, is about long-term relations, about the feelings of satisfaction produced by owning, displaying, and using a product."[88]

87   NORMAN, D.A. (2007). *Emotional design: Why we love (or hate) everyday things*. New York: Basic Books. Pp. 38. (English)

88   NORMAN, D.A. (2007). *Emotional design: Why we love (or hate) everyday things*. New York: Basic Books. Pp. 38. (English)

The reflective level is within the conscious level (cognition) of our brain while the visceral and behavioural are in the unconscious (sensation, affection and memory) of our brain, one responds to emotion and the other to previous knowledge (how things work). It can be concluded that objects belonging to this level have a complementary relationship of function-use and form-aesthetics, their quantitative and qualitative characteristics are a reflection of the user.

25   Objects that reflect the user, a fusion between aesthetics and function. Personalised by the needs of the user.

4.4.4.1.6.   User experience (UX)

In the world we live in, we breathe and experience design at every step, since we have built an artificial world that makes life easier for us, so the use/user experience (UX) has always existed, however, it is until the last years that it has increased in its strength and gained the space that it now demands; the UX is considered the continuity of what in the eighties was called *human computer interaction* (HCI) and in the nineties interaction design.

The user/use experience has become a field of design that is gaining more and more ground, becoming a field of action and a new line of discipline. The intention of introducing the concept of user experience in the development of this level is to broaden the perception of the design of the form (aesthetics), function (objective) and user (praxis) and introduce important elements such as the perception and interaction of the object, although they are elements that are implicit in the projection of products, services, systems, and processes, they are not always taken into account. The UX vision of concepts, development, and the design process complements the vision of user-centred design.

Thus, we can review the concept that defines the user experience developed by the *International Organization for Standardization* (ISO): "A person's perceptions and responses that results from the use or anticipated use of a product, system or services."[89]

As mentioned, product design has evolved over time, initially focused on production, it began to focus on form and function, later it incorporated elements related to the user first in the physical field, adapting the objects to the human body for its proper use; and then in the psychological, in the latter the spaces have been expanded to incorporate perception, interaction, reaction (emotion); understanding this relationship between the user and the object is also a response to technological evolution, the internet, new media and the development of complex objects such as personal computers, smartphones, tablets, among others; the UX has been closely related to the development of these products, as well as web pages and applications, however, it is an important element in the projection of products, services, systems and processes; "User-centred design establishes experience as its guiding axes, which, among other things, expands the designer's field of action […] Another effect of adopting this position is to venture into territories close to psychology and anthropology."[90]

In UX design, seven factors have been developed that describe the user experience: (i) utility that is linked to the function of the product (service, system or process), means that it fulfils the objective for which it was proposed; (ii) usability, a concept that has been previously developed; (iii) findable, in tangible products (objects) it is related to the interfaces that allow object-user interaction (interfaces such as buttons) and intangible products (apps, web) it is related to the ease of finding information, easy navigation; (iv) credible, this factor is linked to the principle of honesty proposed by Rams, which mentions that a product must communicate the intention for which it was created, avoiding manipulation and misinformation to the user; (v) desirable, also linked to Rams' principle of aesthetics, as well as Norman's proposal of the visceral level-design in which the object must be attractive and generate instinctive emotion in the user; (vi) accessible, which refers to the principles of universal design already mentioned and (vii) value, linked to both the company and the user, the value is provided in different ways and depends on the user: monetary, emotional value, use, function, aesthetic, among others.

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89 ISO 9241-210, *Ergonomics of human-system interaction—Part 210: Human-centred design for interactive systems*. https://www.iso.org/standard/77520.html

90 RODRÍGUEZ Morales, L., BEDOYA Pereda, D., MORALES Zaragoza, N., & PEÑALOSA Castro, E. 2014. User-centred design. Methods and interactions (AM Losada & O. Salinas Flores, Eds.; First Edition). Editorial Designio. Pp. 12. (Spanish)

These seven factors are linked together to ensure that a product generates a good user experience, and that the object-user interaction is intuitive, smooth and pleasant; since many of the problems and errors that occur with the object are the product of a bad experience (understanding, interacting, and using an object), UX seeks to make the objects as intuitive as possible, that is, they do not require a user manual.

Primeras referencias

DETERMINAR acciones posibles.

HACER cosas visibles.

EVALUAR el estado actual

CORRESPONDENCIAS naturales entre intenciones y acciones necesarias, entre acciones y resultados.
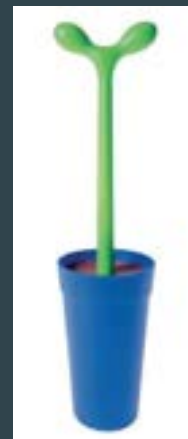
Aspectos

- El diseño de las cosas determina su entendimiento. El diseño tiene una lógica interna, un fundamento que una vez que es alcanzado hace que todo se entienda.

- Otro elemento es nuesto conjunto de capacidades y habilidades que nos permiten entender sistemas y objetos.

26   Developed teaching material by Ortiz (2020-2022).

4.4.4.2. Exercises Unit 1

Exercise	Concept	Objectives	Methodology	Result
• Investigate design concepts other than those reviewed in the class. • Generate a new bank of concepts with all the students. • Develop an approximation to a proper definition of design.	Design, different perspectives	• Introduce different design perspectives. • Analyse and reflect on perspectives. • Identify a related design line. • Develop your own definition of design. • Support an investigation: bibliography, webgraphy, interviews, etc.	• Investigate designers, institutions or associations in search of new concepts. • Interview professors and national, regional or international designers. • Discussion and dialogue between students and guided by the professor.	• Time lines • Infographic • Mental maps • New concepts
• Read the articles provided in class. • Synthesise the information.	Definition and characteristics of the UCD	• Introduce the thesis of User-Centred Design (UCD). • Generate a timeline of its development. • Identify and synthesise the concept of the UCD and its characteristics	• Research • Read, analyse and synthesise. • Discussion and dialogue to clarify doubts.	• Timelines • Mental maps • Infographic
Analyse the principles learned in objects (design) (between three or five)	Design Principles	• Introduce the principles of universal design and good design. • Investigate objects (design). • Analyse and identify the principles learned.	• Investigate objects, they can be design or everyday icons. • Analyse its function, form and the purpose for which it was created. • Identify the principles learned.	• Infographic • Object tokens
• Read the articles provided in class. • Synthesise the information. • Register in your immediate environment: home, work, university, travel experiences around usability	Usability	• Introduce the concept of usability and its components. • Identify and synthesise the concept of usability. • Recognise in their environment the concept learned (good or bad usability).	• Research • Read, analyse and synthesise. • Discussion and dialogue to clarify doubts. • Recognise and register through photographs.	• Mental maps • Infographic • Photography diary
• Read the articles provided in class. • Synthesise the information. • Review the videos provided in the virtual classroom. • Analyse the principles learned in objects (design) (between 3 or 5).	Emotional Design	Introduce the three levels of emotional design.	• Research • Read, analyse and synthesise. • Discussion and dialogue to clarify doubts. • Recognise and register through photographs. • Identify the characteristics of the three levels of emotional design in objects.	• Infographic • Object tokens

• Synthesise the information. • Review the videos provided in the virtual classroom. • Register in your immediate environment: home, work, university, travel elements around the user experience.	User experience (UX)	• Introduce the concept of UX. • Identify and synthesise the concept of user experience (UX) • Recognise the concept learned in your environment (good or bad UX).	• Research • Read, analyse and synthesise. • Discussion and dialogue, to clarify doubts. • Recognise and register through photographs.	• Infographic • Mental maps • Photography diary

23   Exercises Unit 1.

4.4.4.3.   Results

Andrés Castillo.

Matías Ruiz.

Andrés Castillo.

Principios del buen diseño y diseño universal

Máquina de escribir: Olivetti Valentine
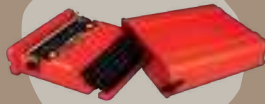
El buen diseño es:

Innovador
Incluye ser portátil.

Útil
Es practico.

Estético
Diseño minimalista e intenso color rojo.

Consecuente
Todo tiene un proposito.

100mm

330mm

Menos es más
-Reducción de dimensiones
-Reducción de peso
-Estuche de plástico

Uso flexible
Es regulable.

Cadena Mateo.

Diseño Centrado En El Usuario.

El diseño centrado en el usuario es responsable de dos cosas: por un lado, que la experiencia del usuario sea positiva en cuanto al grado de interacción, fluidez y comprensión del contenido ofrecido; y por otro lado, para satisfacer todas tus necesidades.

CARACTERISTICAS DEL DCU

1. Entender el contexto del usuario.

Identifique quién usará el objeto, por qué lo usará y en qué circunstancias.

Las empresas y los usuarios se esfuerzan por cumplir con el fin de cumplir con las expectativas establecidas.

2. Incluir requisitos.

3. Desarrollar soluciones.

Este proceso debe llevarse a cabo en las diferentes etapas del desarrollo del producto.

La evaluación previa a la comercialización del producto es necesaria para verificar la viabilidad

4. Evaluar el diseño.

Matias Ruiz.

Principios del buen diseño
Caso de estudio

Lámpara Anglepoise

En 1932 George Cawardine, un ingeniero especializado en suspensiones de automóviles aplicó su conocimiento a un sistema de muelles revolucionario en su época.

Duradera
- Esta lámpara se fabrica con un estándar tan alto que cuando se recuperó un bombardero derribado del lago Ness en 1986 las luces aún funcionaban después de instalar baterías nuevas a pesar de estar sumergida durante cuatro décadas.

Minuciosa
- El diseño de las juntas y la tensión del resorte mantienen a la lámpara en una amplia gama de posiciones sin mover su base.

Discreta
- La lámpara cumple su función vital de brindar luz sin tener que ocupar u obstruir otros elementos.

Simple
- Sus compuestos se concentran en los elementos más esenciales; su funcionalidad.
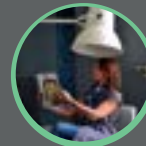
Estética
- Su estética connota simbolismos industriales, dando alusión a su uso en diferentes tipos de actividades.

Entendible
- Su estructura fácil de entender, permite el movimiento fácil y fluido en una posición fija y estable.

Camilo Beltrán.

27   Results from students in different periods (2020-2022).

4.4.5. Second Part: Analytical phase. Research in UCD

4.4.5.1. Concepts

4.4.5.1.1. Contexts, habits and use behaviours

Context is defined as the set of circumstances (characteristics) that surround a situation (territorial, social, political, historical, economic) and without which it cannot be understood correctly. The context is important since it allows to understand the user in a defined circumstance and the use of a product, service, system, process or experience can be different depending on the context in which it is analysed, for example, a table analysed from the point of view of place has different uses; in an office it can be: desk, meeting table, work table; in a school it can be a game table, study table, desk, reading table; in a house it can be: kitchen table (preparing food), dining table (consuming food), side table (storage, ornaments, lamps), night table, coffee table in the living room, etc. The context allows us to perceive or identify different characteristics such as: spatial, cultural-anthropological, sociological, economic, political, even religious that can influence the development or projection of solutions.

While the contexts are related to space-place and space-time, behaviours and habits are related to people, they are part of daily life, habits and behaviours are the usual activities or ways of behaving in a person, or group, the way to develop an activity, or fulfil a function.

4.4.5.1.2. User definition and user types

It is important when we talk about users to differentiate them from consumers, since it can cause confusion; the term consumer is associated with the consumption of goods or services, which are available in the market and which serve to satisfy some type of need or desire; the consumer is associated with a transaction or exchange, that is, to obtain a good or service, meaning that the person has to give something in exchange (money), in this context the product is a commodity. On the other hand, the concept of user is linked to the individual or person who regularly uses a product or service; the user is routinely using a product or service and can identify its proper functioning or the problems that develop with it.

Regarding the types of users, the proposal is to generate a user priority pyramid, in which it is necessary to identify who and how they intervene in the project and interact with the solution. This pyramid is made up of: the target group, or typical users, who are the ones who directly intervene with the object and who will constantly interact with it; users who are not part of the target group who are indirectly involved; the users who have extreme experiences, completely different from those of the typical user and the experts who are interdisciplinary professionals who contribute with specific and technical information to the project.

As an example we have the development of a ludic element for children between three and five years old: the direct user, who is the one who will interact (use continuously) with the object is the child, so we must take into account the type of shapes and colours that the child perceives, and the skills and characteristics that they are developing and acquiring in this age range, the indirect user is the parent, sibling, educator or relative who acquires the object and interacts with it on certain occasions (when playing with the child), the expert user will be the pedagogue or child psychologist who have a scientific and technical knowledge about the child; the extreme user will be a person who owns the object and interacts with it, perhaps at the same time as the child but does not correspond to the child's age range (it can be a tester or a collector), who will contribute from a completely different point of view.

USUARIO DIRECTO

PERSONA QUE
VA A INTERACTUAR
DIRECTAMENTE CON
EL OBJETO O SERVICIO.

28   Developed teaching material by Ortiz (2020-2022).

4.4.5.2.   UCD Research Methods and Tools

To introduce ourselves to the design process, the differences and characteristics between methodology, methods and tools are reviewed. The methodology is a process (macro) that contains several steps or rooms in which sub-processes or methods are developed. In the case of design, the methodology is project related and five phases have been defined for this proposal: (i) discover (Research), (ii) define (Problem), (iii) develop (Proposal), (iv) apply (Results) and (v) evaluate (Analysis). The method is an ordered and systematic (micro) process that is carried out to obtain a result. The tools are instruments that are used to develop the processes (methods).

As for the methods "in the case of user-centred design, they refer to qualitative data and analysis, which indicate not so much the correctness of a solution but rather its relevance and coherence, that is, they act more as guides than as parameters."[91] At this stage, we find ourselves in the first phase of the project process (i) discover (Research) so the methods used seek to deepen the knowledge of the topic raised (by academic period) and meet the users who are involved in the project. The definition of methods to be used has been carried out after studying and analysing different proposals, among which are: *IDEO Method Cards*[92] (2003), *Delft design Guide*[93] (2017-2020), *Universal methods of design: 125 ways to research complex problems, develop innovative ideas, and design effective solutions*[94] (2012-2019), *Design thinking, basics design*[95] (2010), and *Research methods for product design*[96] (2013). These tools have been used since they provide an easy understanding of the methods and their application, exemplifying with case studies that facilitate their understanding. The chosen methods provide qualitative and quantitative information for the development of the project and allows to approach and know the user in a direct way, their contexts, habits, needs and desires. Table 23 shows the methods that have been introduced in this phase.

91   RODRÍGUEZ Morales, L., BEDOYA Pereda, D., MORALES Zaragoza, N., & PEÑALOSA Castro, E. 2014. User-centred design. Methods and interactions (AM Losada & O. Salinas Flores, Eds.; First Edition). Editorial Designio. Pp. 12. (Spanish)

92   IDEO Method Cards are a tool to showcase methods we use to inspire great design and keep people at the center of our design process. Each of the 51 cards describes one method and includes a brief story about how and when to use it. Author's note.

93   van BOEIJEN, A., DAALHUIZEN, J., & ZIJLSTRA, J. 2018. *Delft Design Guide. Perspectives - Models - Approaches - Methods* (2nd ed.). BIS Publisher. (English)

94   HANINGTON B. & MARTIN B. 2019. *Universal methods of design: 125 ways to research complex problems develop innovative ideas, and design effective solutions*. Rockport. Retrieved November 10 2022 from https://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=2372052. (English)

95   AMBROSE G. & HARRIS P. 2010. *Design thinking basics design*. 08. AVA. (English)

96   MILTON A. & RODGERS P. (2013). *Research methods for product design*. Blume. (English)

Method	Definition	Obtains
Focus group	Group in which different topics related to a product or a discussion topic will be analysed, defined by the student and in pursuit of the topic raised. It is generally made up of people from the target group, the product or topic being developed, between six and ten participants is recommended.	Qualitative and quantitative information, depends on the type of questions that are addressed. Points of view and ways of doing activities are obtained.
Context mapping	This method involves the user as an "*expert in his experience*". The user can express their personal experience where a product, system, service or process plays a specific role.	Qualitative information, different activities can be determined in specific contexts, helps to identify habits and problems.
Personas	It is a method that represents a user archetype, describing and visualising their behaviour, values and needs.	Qualitative and quantitative information; helps to understand and communicate behaviours, values and needs of groups represented in an archetype.
Trend analysis	The method helps to identify and analyse user needs and business opportunities to develop business strategies, design visions, and new product ideas.	It provides quantitative information, modes of consumption, types of product, helps to project new visions.
Customer journey	This method helps to have insights in all the stages that the user goes through while experiencing the use of a product or service.	Qualitative information, allows obtaining extended information from the user's perspective.
Interviews	They are face-to-face consultations that can be useful to understand consumer perception, opinions, motivations and concern with the performance of products and services, or even the knowledge of an expert in the field.	Qualitative information, it is encouraged to use this method with extreme users or experts, to deepen knowledge.
Perceptual map	They are visual representations of what consumers think about products and brands. It helps to evaluate how the consumer/user perceives the product or brand in relation to that of the competitors.	Qualitative and quantitative information, the use of this method is encouraged to obtain product characteristics and possible requirements.
SWOT Analysis	This method helps to systematically analyse the position of a company/proposal.	This method is used when working with brands to determine their problems and opportunities.

24   UCD Research Methods.[97]

ETAPAS

- Descubrir
- Definir
- Desarrollar
- Evaluar y decidir
- Articular y simular
- Aprender
- Observar
- Preguntar
- Probar

29   Developed teaching material by Ortiz (2020-2022).

97   van BOEIJEN, A., DAALHUIZEN, J., & ZIJLSTRA, J. 2018. *Delft Design Guide. Perspectives - Models - Approaches - Methods* (2nd ed.). BIS Publisher. (English)

The structure of a method is shown below in table 24, synthesising the compiled information: brief description or objective, when and how it is used, the possible process since it may vary, the limitations it has and the advice (tips) for its application, the example is the *Focus Groups* method. Additionally, complimentary tools and materials such as web pages and videos have been incorporated for students to review and deepen their knowledge.

Focus group	• Group in which different topics related to a product or a discussion topic will be analysed, defined by the student and in pursuit of the topic raised. • It is generally made up of people from the target group, the product or topic being developed, between six and ten participants is recommended.

When?	• It can be used in the different phases of the product development process.
	   • **Research:** Contextual information about products, usability, and user feedback on existing products.
	   • **Verification:** Testing concepts, for the corresponding feedback or to choose the proposed concepts.
	• To know the opinions and needs of users on the subject / object.

How?	• At least three sessions with the target group are suggested. • Participants between six and ten, in the team there must be a moderator and a person in charge of collecting information, it is recommended that the moderator be a person with experience and charisma to lead the exercise, in the case of students this activity is an opportunity to discover or strengthen their own abilities. • It is recommended to perform a test, to moderate or verify the list of topics that will be reviewed during the activity. • The focus group can be combined with other methods such as collages, which allow participants to sometimes express abstract concepts. • Online focus groups can be performed, during the lockdown period of the pandemic and use of virtuality when teaching the subject, this tool was very useful for students. • The results depend on the objectives that are set: to know the needs of the users, ideas for new products, acceptance of the product, perception of disadvantages or problems with existing products.
Possible process (customisable)	1. Make a list of topics (topic guide), problems, examples or particular questions that will be addressed. 2. Perform a test pilot and if a change is necessary, a process of reflection is encouraged throughout the test. 3. Invite the participants, from the target group (choose from the characteristics of the user), the students are told that it is necessary to generate a protocol, in addition to demonstrating professionalism and seriousness and maintaining cordiality with the participants. 4. Developing the focus group takes between 1:30 to 2 hours. In general, it is requested to document it with video, photos, notes, etc., then the transcript should be done, and analysis of the information obtained is carried out. 5. Analyse and report the results, show the most important opinions, illustrate the framework of opinions by topic. Use the relevant tools to communicate the results and findings, through: infographics, posters or sheets, among others.
Limitations	• If the participants do not have experience with the product or knowledge on the subject, there are no significant results. • The results depend on the participants, their personalities and the disposition to carry out the exercise; it depends on the management of the moderator to obtain the necessary information for the project.
Advice	• It is recommended to start with general topics of the subject to be discussed; you can search for examples of product usability or product concepts, so that participants understand the context. • When testing concepts, explaining and presenting them is crucial. • You must have clear concepts, and always ask the participants if it is understandable and comprehensible. • Distribute time coherently between the topics to be discussed, organisation is very important, both for the participants and for the team. • Illustrating the discoveries with phrases from the participants, it is important to humanise the acquired information.

25   *Focus group.*[98]

98   van BOEIJEN, A., DAALHUIZEN, J., & ZIJLSTRA, J. 2018. *Delft Design Guide. Perspectives - Models - Approaches - Methods* (2nd ed.). BIS Publisher. (English)

FOCUS GROUP/GRUPOS FOCALES

- Grupo en el cual se trataran diferentes temas referente a un producto o a un tema de discusión.
- Por lo general está conformado por personas del grupo objetivo, del producto que se está desarrollando. (Recomendado de 6 a 10 participantes)

Cuándo?

- Puede ser utilizada en las diferentes fases del proceso de desarrollo de producto.
- **Investigación**: Información contextual sobre productos, uso y opiniones del usuario sobre productos existente.
- **Comprobación**: Probando conceptos, para la retroalimentación correspondiente o para escoger los conceptos propuestos.
- Para conocer la opiniones y necesidades de los usuarios sobre el tema/objeto.

FOCUS GROUP/GRUPOS FOCALES

Posible proceso

- Hacer una lista de temas (guía de temas), problemáticas, ejemplos o preguntas particulares.
- Testear los temas en una prueba piloto y si es necesario cambiar.
- Invitar a los participantes,del grupo objetivo (escoger las características del usuario)
- Hacer el grupo focal, lleva entre 1:30 a 2 horas. Por lo general documentado (video, fotos, apuntes), luego se realiza transcripción y análisis.
- Analizar y reportar los resultados, mostrar las opiniones más importantes, ilustrar por temas el marco de opiniones.

One of the objectives sought to be achieved with this model and procedure is for students to develop orderly and systematised processes to organise information and have useful results; it is considered important to move away from the thought that design is a messy process, of inspiration and result (*black box*); and move on to a process of order, succession of phases, (*transparent box*)[99]. This is promoted since it avoids frustration in the student and provides tools so that they can face any situation that arises.

4.4.5.3.   Project requirements

The project requirements are a sample of the important characteristics that the design proposal must achieve to be successful, it specifically describes the design objectives and in a first validation, it is used to choose the proposals that are going to be developed.

The list of requirements is drawn up once the first phase (i) discover (Investigation) is completed as a synthesis and conclusion and introduces the second (ii) define (Problems), this is done based on the analysis of the entire information collected and reviewed about the design problem.

In some instances, a product, system, service, process or experience is considered to be "*good*" to the extent that it meets its list of requirements, however, meeting the requirements for the sake of meeting them, does not indicate whether the product is "*good*". It should be considered that the list of requirements evolves during the product development process as the proposal becomes more concrete and detailed, as the design process is also an iterative process. To develop the list of requirements it is necessary to create a structure that helps to find the solution. This structure is defined from the perspective of the designer, in this case from the student; however, it is important not to forget the user emphasis.

Initially the list of requirements serves as a check list of elements to be acomplish or taken into account, ensuring that the requirements are valid and specific; during the process, new perspectives on the design problem generate new requirements, which is why they are reviewed, updated or changed, if necessary, as part of the iterative process as mentioned.

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99   The *black box* and the *transparent box* are terms coined by John Christopher Jones in his book Design Methods, to explain the design processes. Author's note.

It is necessary to define the requirements in numerical, quantifiable terms, in addition to referencing and mentioning the sources from which the information was obtained; it is suggested to give a numerical structure to cite them when necessary; however, it is suggested not to spend a lot of time on the list of requirements, as it can harm the creative phase.

When the list of requirements is developed as mentioned, an attempt is initially made to carry out a structure based on a check list, students are encouraged to define as many requirements as possible, the students are motivated to identify the lack of knowledge, since through this synthesis the gaps are found, and it is necessary to continue gathering it through complementary research. It is important to make a distinction between demands (must be achieved) and desires (ideas or proposals). Once the list of requirements is finished, it is necessary to scrutinise it and eliminate any overlapping or ambiguous, or similar items. It also seeks to define whether there is a hierarchy between the requirements.

It is recommended to the students that each requirement must be valid, not redundant, it must be concise, feasible and operative, in addition its writing should be clear and not extensive.

4.4.5.4.   Problem definition

It is the second phase of the design process, in which the need is to (ii) define (Problem), since to continue with the development of the project it is necessary to ensure that the correct problem is going to be worked on. This stage occurs after the research and before the development of proposals.

The problem is defined according to the owner of the problem, meaning that according to the perspective of the designer, in this case, the student. The problem is the description of the current state of a situation, adding all the causes that generate it and the desirable situation that is sought to be achieved, the professor's guide at this stage is important, since the problem must be addressed from the design perspective, and not from other disciplines, a common error.

For a good development of this phase, students are urged to build a hierarchy of problems, based on all the information collected, you can start with a big problem and divide it into small ones thinking about causes and effects. It is proposed to the students that the problem can be reformulated as an opportunity, to motivate them and change their mental scheme and move on to the next stage.

As a tool to help students in this phase, it is necessary to answer the following guiding questions (there may be more): what is the problem? who has the problem? what are the relevant context factors? what are the goals you seek to achieve? what are the side effects that can be avoided? what actions can be allowed? After answering these questions, these are reviewed, and a paragraph is produced where the design problem is described in a structured way.

CONTEXTMAPPING/MAPA DE CONTEXTO

- Se utiliza herramientas para que los usuarios puedan expresar sus experiencias de manera lúdica y de la misma manera puedan estar más conscientes de su experiencia.
- Se les pide que hagan un mapa del contexto en el que utilizan el objeto o servicio , esto les permite expresar los objetivos, motivaciones, significados, necesidades y prácticas.

Cómo?

- Antes de empezar, es mejor conocer o participar de una sesión, para entender que envuelve este método.
- Al haber hecho una previa te permite empatizar con tus participantes cuando realices tu sesión,
- También es necesario planificar con anticipación tu mapa de contexto, porque puede ser difícil encontrar participantes, tiempo y un espacio para desarrollarlo.

ENTREVISTAS

Son consultas cara a cara que pueden ser útiles para entender la percepción de los consumidores, opiniones, motivaciones y preocupación con el desempeño de productos y servicios, o también el conocimiento de un experto en el campo.

Cuándo?

- Provee de conocimiento y ayuda a comprender mejor un determinado fenómeno/contexto/problema
- Puede ser utilizada en las diferentes fases del proceso de desarrollo de producto.
- **Investigación**: Información contextual sobre productos o sobre problemas
- **Comprobación**: Probando conceptos, para la retroalimentación correspondiente.
- Cuando el desarrollo del producto, no es completamente nuevo para los usuarios.

31 Developed teaching material by Ortiz (2020-2022).

4.4.5.5. Exercises Unit 2

Exercise	Concept	Objectives	Methodology	Result
Identify the types of users learned in objects (between three or five)	User definition and user types	• Introduce the concept of user. • Define types of users. • Identify users by projects. • Recognise the type of information that I can obtain by type of user	Research projects and identify the types of users involved in them.	• Infographic • Object and user files
Apply the learned method to a person in your immediate environment.	Contexts, habits and user behaviours	• Introduce the observation of the environment and users. • Apply the first tool to know the user, *personas.*[100] • Generate tools and attitudes in the student to get closer to the user.	• Observation. • Application of methods. • Interview a classmate, friend, or family member. • Submit the file.	*Personas*
• Apply research methods to the project. • Investigate complementary information for the project.	Methods and tools UCD investigation	• Introduce the design project. General context, BRIEF or information. • Define the research in the design project. • Apply research methods: quantitative and qualitative. • Obtain information for the project.	• Discussion and dialogue, to clarify doubts. • Research, primary sources. • Apply the methods learned. • Analyse and communicate information	• Mental maps • Infographic • Summary files • Videos
Make a list of requirements, define categories, organise.	Project re-quirements	• Introduce the concept of project requirements . • Make the list of requirements. • Analyse, identify and organise categories and importance of requirements.	• Analyse information. • Develop the list of requirements	Chart
Define the problem in a summary paragraph.	Problem definition	Identify the design problem, main features, and possible approach routes.	Define the problem.	Paragraph

26   Exercises Unit 2.

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100 It is a method that represents an archetype of a user, describing and visualising their behaviour, values and needs. This method helps to understand and communicate these behaviours, values and real life needs in the Design project. **Source: van BOEIJEN et al., 2018.**

4.4.5.6.   Results

DEFINICIÓN DEL PROBLEMA

La marca Iana Mullo no es muy conocida y posee poca participación en el mercado, su falta de variedad e innovación perjudica directamente a sus ganancias económicas, y sobre todo, la marca no posee suficiente reconocimiento a la historia detrás de el proceso de elaboración del chocolate, mejorando estos aspectos podríamos ayudar a la marca no solo a tener un mayor reconocimiento en el país, sino también a incrementar sus ingresos.

Melisa Aguilar, Óscar Calero, Felipe Madrid, Damaris Herrera.

Matheo Pérez.

Análisis FODA

Fortalezas

- Historia arqueológica representada en el empaque y producto
- La forma del chocolate es diferente al resto
- Reconocimiento del producto por su imagen y marketing
- Producto orgánico con mezcla de sabores y larga duración
- Única identidad por packaging y analogía entre spondylus y cacao.

Debilidades

- Falta de variedad de sabores en el mercado
- No hay slogan llamativo
- Falta publicidad para el reconocimiento de la marca
- Alto precio tanto en el producto como en la produción

Oportunidades

- Diferentes canales para promocionar y llegar a más consumidores
- Potenciar sus sabores y dar una imagen más clara de "chips"
- Favorecer a comunidades con cultivo de cacao
- Crecimiento de la marca para oportunidades de empleo y ganancias
- Presentar historia de la marca a extranjeros

Amenazas

- Cambios de intereses del consumidor por falta de sabores
- Empresas más reconocidas y grandes tengan el mismo producto
- Falta de materia prima
- No hay exportación y al ser empresa pequeña se puede considerar con menos seriedad
- Economía afectada tanto del consumidor como de la empresa por pandemia

Lian Reinoso.

Matias Ruíz, Andrés Castillo.

162
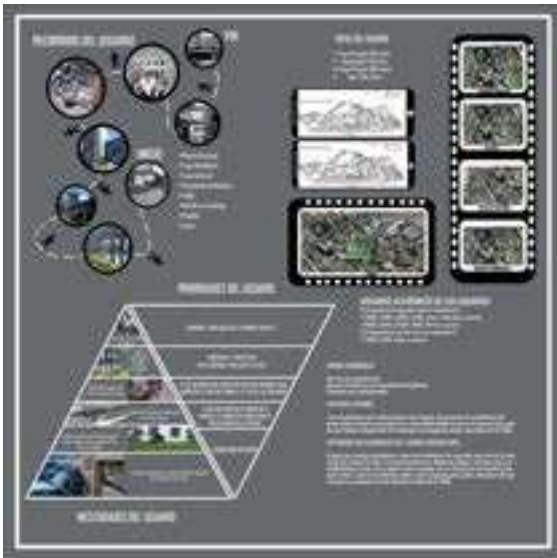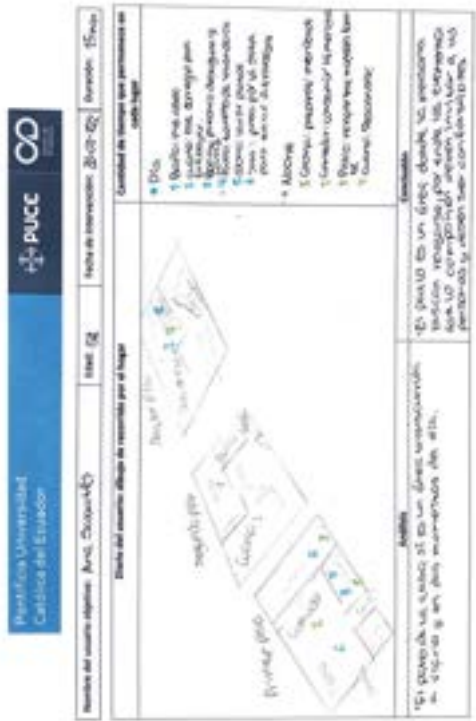
Matias Ruíz.

OBSERVACIÓN

ANÁLISIS:

Lugares de la observación:
-Mitad del mundo
-Supermaxi 12 de octubre

En la mitad del mundo existe un museo del cacao, ahí pude observar como solo las personas extranjeras se acercaban a comprar chocolate, esto sucede puesto que la historia tras el chocolate y su proceso de fabricación les provoca intriga de como sera su sabor final. La marca del chocolate era "mitad del mundo". Este chocolate se vende al 50 %, 70% y al 100% cacao. La mayoría de personas extranjeras compraron el del 70%.

En del supermaxi de la 12 de octubre fue todo lo contrario, la mayoría de personas compraron chocolates con un porcentaje de cacao muy bajo como Manicho, Kinder o Galak. Muchas de las personas no se mostraban indecisos al seleccionar el chocolate que iban a comprar, sin embargo, vi como dos extranjeras si se tardaron mucho en escoger el chocolate que consumirían, especialmente en la zona de Pacari. Por otro lado, pude observar como un hombre vino directo a coger un chocolate Pacari, no dudó en lo absoluto,, supongo que hay personas que ya no necesitan seguir probando más sabores porque ya tienen unos con los que se sienten conformes.
Me percaté también que las personas se fijan mucho en su tabla de valores nutricionales, la mayoría los observaba un rato, leía su tabla y se los llevaba.

CONCLUSIONES:

En conclusión la marca de Pacari provoca mucha indecisión en las personas al comprar su producto por la gran variedad de sabores que posee.

También pudimos deducir que los extranjeros están mucho mas interesados en los chocolates de alta gama hechos en Ecuador, esto puesto a que a ellos les atrae bastante la identidad cultura del país.

Y finalmente las personas se vuelven fieles a algunas marcas, y aunque pasen los años van a seguir consumiendo los mismos chocolates, en su gran mayoría estos tienen un porcentaje de cacao muy bajo.

Nathali Gamarra, Ana Yazán, Amy Coyago.

	Función	Usuario
Empaque	1. Debe tener un empaque hermético 2. La presentación debe ser apta para cualquier escala 3. Alejarse de los productos que sean estéticamente similares. 4. Colores llamativos, captando la atención del usuario 5. Evitar uso de plástico 6. Fácil de identificar 7. Que muestre la historia 8. Tenga poca conductividad del calor	1. Fácil de abrir 2. El usuario se sienta identificado con el producto y su historia. 3. Representa exclusividad 4. Representa al Ecuador 5. Se entiende la historia de manera sencilla
Bite	1. No debe verse armonioso 2. Debe representar la marca 3. Debe tener un detalle distintivo 4. Que sea visualmente atractivo	1. Fácil de comer 2. Que no tenga mucha azucar para que no influya de manera significativa a la alimentación 3. Debe tener un agregado en el sabor 4. La textura del chocolate debe ser crujiente
Empresa	1. Mantener los costos de producción no tan elevados 2. Llevar a cabo las ideas pensando en el capital 3. Debe respetar el medio ambiente	1. Debe ser fácil de encontrar.

Melisa Aguilar

Melisa Aguilar, Óscar Calero, Felipe Madrid, Damaris Herrera.

32   Results from students in different periods (2020-2022).

4.4.6. Third part: Synthetic phase. Creative development

4.4.6.1. Design Concept

The objective of the design concept is to communicate to people (audience-users), in the most efficient way possible, the focus or approach that the designer will have to solve the defined design problem. For the elaboration of the design concept, the text by Rengel has been taken: *Shaping Interior Space,*[101] which clearly illustrates how the design concept is defined.

According to Rengel, when defining the design concept, designers make the following mistakes: (i) definitions that describe the project objectives from the perspective of the problem; (ii) definitions that remain obvious; (iii) definitions that use too many adjectives without saying much; and (iv) definitions that are lengthy descriptions of each characteristic or feature of the project.

The transition between the steps: list of requirements, definition of the design problem and design concept; they are commonly imperceptible to students, although each one is an input for the next one, students tend to confuse them, the problem as an enumeration of sub problems defined by the requirements, and the concept of design as a redundancy of the design problem for which the guidance and constant feedback through analysis and guided reflection is important for students.

Therefore, the author proposes that the best definition of the design concept has these three characteristics: (i) talk about the solution rather than the problem, for which three key questions are raised that must be resolved: What? about the design idea, How? regarding the general design strategy, But how? on the more specific design strategists; (ii) it is selective since, although the project has several problems and characteristics, we must focus on the one who directs or leads the project; (iii) and economic, the concept of right size, that is, it is not necessary to use too many words, but a paragraph that synthesises the idea.

The design concept must be described in a paragraph that will initially be generic and that is modified and specified while the project is being developed. It must be taken into account that each step of the project, as well as the project itself, are developed iteratively.

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101 RENGEL, RJ. 2020. *Shaping interior space* (Fourth). Fairchild Books. (English)

4.4.6.2.   Creative Methods

Once the phases have been completed: (i) discover (Research) and (ii) define (Problem), the analytical stage of the project is necessary to generate a mental break in the students who have been developing exhaustive research work, so in the first instance, creative tools (music, photography, cinema, dance, series, etc.) are used to break with the previous process and prepare the brain for the next stage. It is necessary to enrich and sensitise the mind with different aesthetic references.

At this stage, we are in the third phase of the project process (iii) develop (Proposal) so the methods used seek to explore alternative solutions to the problem detected, developing and devising proposals. Table 27 shows the methods that have been introduced in this phase, the chosen methods incorporate dynamic and group or teamwork that promotes getting out of the pre-established schemes by each student and generating different perspectives.

It should be noted that this phase is considered the most difficult and complex, the student needs to have a rich cultural background that allows an exhaustive aesthetic exploration; the application of these methods requires the student's openness to experiment without prejudices or pre-established ideas.

Method	Definition	Obtains
Analogies and metaphors	This method allows creativity to be explored by analysing references relevant to the project, through which analogies and metaphors are applied.	Through analogies technical solutions are discovered, such as structures, unions, etc.; with the metaphors, formal abstractions are obtained that allow to generate proposals.
Brain writing and brain drawing	These methods are an alternative to brainstorming, it is an exploration through drawing and writing. These ideas drawn or written on paper are handed several times to team members for ideas to be built on or contributed to ideas.	These contribute with different perspectives to the generation of proposals, help to actively explore and devise.
SCAMPER	It is a creative method that can help create ideas through the application of seven heuristics (a set of methods or techniques to solve problems): sustitude, combine, adapt, modify, put to another use, eliminate and reverse.	This method is applied once ideas or proposals have been developed, it helps to explore alternatives through heuristics.

27   UCD Creative methods.[102]

Next, the structure of a method is shown in the table 28, the example is the method of *Analogies and Metaphors*. Additionally, supplementary tools and materials such as web pages and videos have been incorporated for students to review and deepen their knowledge.

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102 van BOEIJEN, A., DAALHUIZEN, J., & ZIJLSTRA, J. 2018. *Delft Design Guide. Perspectives - Models - Approaches - Methods* (2nd ed.). BIS Publisher. (English)

Analogies and metaphors	This method allows creativity to be explored by analysing references relevant to the project, through which analogies and metaphors are applied.	
When?	Analogies	• During the generation of ideas. • They are used for conceptualisation, beginning with the clear definition of a problem. • Analogies close or distant to the problem can be used, although the repertoire of references to be analysed may be close or distant, and requires coherence.
	Metaphors	• During idea generation. • They are used to frame the problem and to analyse. • They are used to communicate particular messages to users (cultural perception). • The inspiration should be possible to relate (easy perception).
How?	• Find material that inspires us. • If we want more creativity, we can search in faraway domains. • When you find the material, ask yourself why this source of inspiration is associated with the design proposal. • Then it is decided which one is going to be implemented (analogy or metaphor) in the new design solution. • When making analogies, be careful not to copy or transfer the attributes to the design solution. • Seek to change and enhance solutions through abstraction and transformation.	
Possible process (customisable)	Analogies	1. Framing of the design problem to be solved. 2. Search for situations or examples where the problem has been successfully solved. 3. Application to retrieve and process the resources of the inspiration field. Abstract, transform and transfer to the solution of the design problem. 4. Transform them for the application in the solution of the problem.
	Metaphors	1. Framing of the qualities of the experience that you want to provide to the user through the solution of the design problem. 2. Specific search for an entity that has the qualities that you want to transmit. 3. Application to retrieve the resources of the field of inspiration. Abstract the essence of the properties. 4. Transform them for the application in the solution of the problem.
Limitations	• It can take a long time to find and identify the right sources of inspiration and information. • Identify if this resource can be used in the design project, pertinent and low complexity projects.	
Advice	• When using analogies near and far, the success is in abstraction and transformation, not literal application. • Look for the qualities that you want to emphasise in the object for the use of metaphors. Work on the references, make them subtle and not obvious.	

28   Analogies and Metaphors.[103]

ANALOGÍAS Y METÁFORAS

Posible proceso

- Encuadre
  - Analogía: el problema de diseño a ser resuelto.
  - Metáfora: cualidades de la experiencia que se quiere brindar al usuario a través de la solución del problema de diseño.
- Búsqueda
  - Analogía: situaciones o ejemplos donde el problema haya sido resuelto exitosamente.
  - Metáfora: concreta de una entidad que tenga las cualidades que se quiere transmitir.
- Aplicación
  - Analogía: Recuperar y procesar los recursos del campo de inspiración. Abstraer, transformar y transferir a la solución del problema de diseño.
  - Metáfora: Recuperar los recursos del campo de inspiración. Abstraer la esencia de las propiedades. Transformarlas para la aplicación en la solución del problema.

103 van BOEIJEN, A., DAALHUIZEN, J., & ZIJLSTRA, J. 2018. *Delft Design Guide. Perspectives - Models - Approaches - Methods* (2nd ed.). BIS Publisher. (English)

ANALOGÍAS Y METÁFORAS
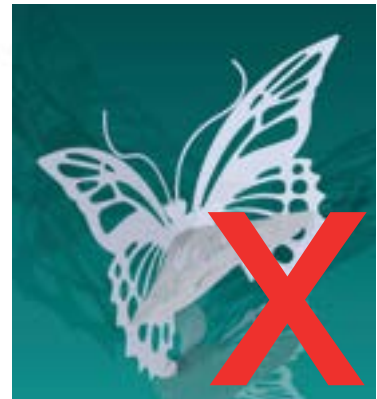
ANALOGÍAS Y METÁFORAS

ANALOGÍAS Y METÁFORAS

Podemos usar las analogías y las metáforas para buscar inspiración .

Cuándo?

- Durante la generación de ideas.
- Las analogías son utilizadas para la conceptualización, empezando por la clara definición de un problema.
- Se pueden utilizar analogías cercanas o lejanas al problema.
- Las metáforas son utilizadas para encuadrar el problema y analizar.
- Son utilizadas para comunicar mensajes particulares a los usuarios.
- Al utilizar metáforas la inspiración debería ser posible relacionar.

33   Developed teaching material by Ortiz (2020-2022). Example of the application of methods in iconic design furniture.

4.4.6.3.   Design in detail

The detailed design process occurs once the ideation or creative development phase has been completed, different proposals have been explored and a first validation of the proposals and the developed concept has been carried out, through a comparison with the list of requirements. The relevant option to move on to the development process is objectively identified. It is important to motivate in students the objectivity of the processes and move away from the subjectivity of personal tastes; making this rupture is important since the students in the previous levels, the Product Design Project to learn the contents, the develop of projects is focused on themselves; making the transition from self (individual) to the other (society) is a complex exercise for students.

Once the option is chosen, the proposal is developed, the interface design is introduced, the anthropometry and biomechanics requirements are taken into account; the materiality and possible forms of production, understanding the artisanal or industrial processes of the context; in this phase, the subjects are already integrated transversally and each one from its expertise contributes to the development of the project. Common techniques such as sketching and rapid model development are used; when the project has advanced and the characteristics have been defined, a more precise model is requested, first at a 1:5 scale and later at 1:10; this with the intention of being clear about each of the parts and the whole of the project.

For this phase, the ID cards tool has been implemented: "ID cards give you name, examples and descriptions of the main design representations used by industrial/product designers during the development of new products".[104] This tool guides an optimal result in the tools and products required in this phase.

Once all the details have been defined and the process has been quickly validated, it is concluded with technical sheets, which allow the construction of a functional prototype on a real scale.

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104 ID Cards are one of the products of the Loughborough School of Design PhD undertaken by Dr Eujin Pei and supervised by Dr. Mark Evans and Dr. Ian Campbell. The aim of the research was to improve the collaboration between industrial/product designers and engineers during the DNP. © Evans, MA, and Pei, E., ID Cards, Loughborough University 2010. ISBN: 978 1 907382 35 2

4.4.6.4.   Exercises Unit 3

Exercise	Concept	Objectives	Methodology	Result
Define the concept in a summary paragraph.	Design Concept	Define the design concept to be addressed.	Define concept	Paragraph
• Perform exercises to motivate creativity. • Apply creative methods. • Develop proposals.	Creative methods	• Exercise creativity. • Apply creative methods. • Develop proposals and alternatives.	• Discussion and dialogue, to clarify doubts. • Apply the methods learned. • Analyse and communicate information	• Sketches • Scale models • Models
• Choose proposal. • Proposal development: details, joints, scale. • Elaboration of models and prototype	Design in detail	• Choose a proposal. • Develop the proposal. • Elaborate sheets, renders. • Develop models and prototype	• Develop technical sheets. • Elaborate models an rapid prototypes. • Develop models on 1:5 and 1:10 scale • Make a prototype closer to reality.	• Technical sheets. • Prototype

29   Exercises Unit 3.

4.4.6.5.   Results

Melisa Aguilar, Óscar Calero, Felipe Madrid, Damaris Herrera.

Alejandra Sabatlles, Mateo Cadena.

Andrés Castillo, Matheo Pérez, Matías Ruiz.

Melisa Aguilar, Óscar Calero, Felipe Madrid, Damaris Herrera.
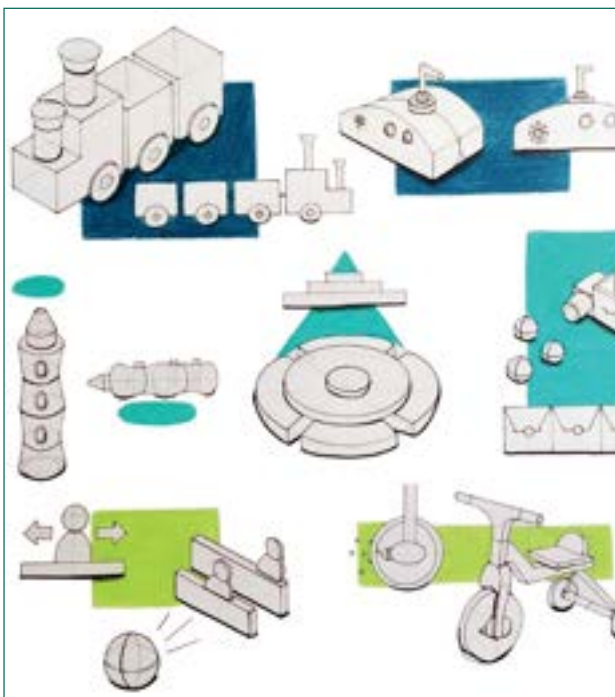
Nicole Chacón.
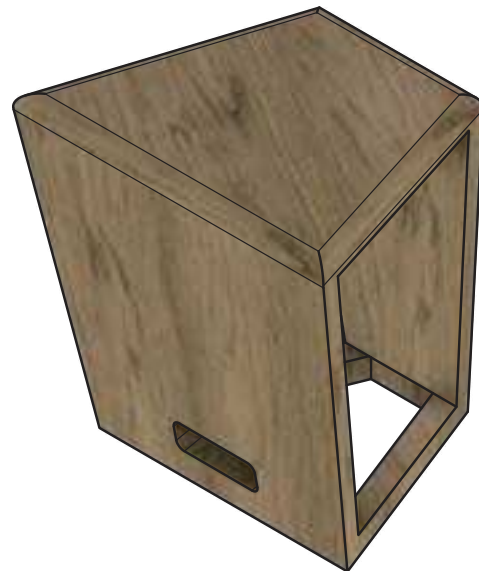
Alejandra Sabat[es, Mateo Cadena.

34   Results from students in different periods (2020-2022).

4.4.7.   Fourth part: Synthetic phase. Verification

4.4.7.1.   General Methods of verification and evaluation of the Design

Once the phase is finished (iii) develop (Proposal) we proceed to (iv) apply (Results), the fourth stage, once the functional prototype is developed, the project process is evaluated and we are introduced to validate and verify, where students confront their decisions to reality with the users or target group, so the methods used, seek correspondence between the concepts learned and applied in the proposal and what the user thinks, understands or experiences. Table 29 shows the methods that have been introduced in this phase, the chosen methods incorporate the new perspectives for students and are complemented by the methods developed in the Physical Ergonomics subject.

Method	Definition	Obtains
Product concept evaluation	This method serves to understand how potential users or target groups value the design concept developed.	This allows to determine which aspects should be optimised, which is understandable and which is not. It is also linked to theoretical concepts learned and transferred to the project.
Interaction, prototyping and evaluation	It is a method that helps to simulate and test how people experience interactions with the designed object.	It helps to evaluate interaction with the object and its interfaces.
Emotion measurement (PREMO)	PREMO is a non-verbal and self-information instrument that measures the user's emotional response to products.	This method has several complementary tools, it also allows the student to have an approach to understand the emotions of the user and what causes their proposal
Usability evaluation	It serves to validate the usability of the product, allows you to understand the quality of your design (ideas or concepts) through the conditions of use. The proposal can be modified based on the results obtained by this method.	It provides the student with information about the characteristics of the product's use and usability.

30   UCD Verification Methods.[105]

Below in table 31 is the structure of a method, the example is the *Usability Evaluation* method. Additionally, complementary tools and materials have been incorporated, such as web pages, physical material and videos, so that students review and deepen their knowledge.

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105   van BOEIJEN, A., DAALHUIZEN, J., & ZIJLSTRA, J. 2018. *Delft Design Guide. Perspectives - Models - Approaches - Methods* (2nd ed.). BIS Publisher. (English)

Usability evaluation	It serves to validate the usability of the product, allows to understand the quality of the design (ideas or concepts) through the conditions of use.
	The proposal should be modified based on the results obtained by this method.

When?	• The usability evaluation can be carried out at different points of the design process, it must be taken into account that at each point of the process different elements will be evaluated:
	  • At the beginning, the use of existing similar products is tested and analysed.
	  • Ideas and concepts can be tested at an early stage using sketches, scenarios or storyboards for simulation.
	  • Always, use an intermediate or final design to evaluate; using 3D models that can specifically simulate form and functionality.
	  • Towards the end, the use of almost fully functional prototypes is evaluated.
	• Additionally, useful information is discovered such as errors, misunderstandings, or possible improvements. It seeks to solve these discoveries and opportunities to improve the security and experience of use of the object by the user.
	• The results of the evaluations help to generate new requirements for efficiency, effectiveness and satisfaction.

How?	• Using a representation of the object and observing users in real situations. • Observe what signs of use are perceived and encountered by users during the use of the object. Understand perception and cognition, by how, through these elements they can achieve the objective (function). • Observe the intended use of the object and the non-intended one. • An optimal preparation with materials and participants is required, for example, to obtain a qualitative evaluation you need at least four to ten people. • The result is a new list of requirements for the redesign of the proposal. • The evaluation can be recorded (video and voice) or photographed for analysis and communication.
Possible process (customisable)	1. Make a storyboard of the actual and desired users and use of the object. 2. Decide which part of product use needs to be evaluated, how, or in what context. 3. Describe the assumptions in detail: what product features users will perceive, understand and operate in a specific situation. (Usability characteristics = signs of use) 4. Ask open-ended research questions, such as: How do people use the product? What elements do you gather as signs of use? 5. Set up the investigation: representations of the product (models, storyboards), the context or environment, instructions and questions for the participants. 6. Prepare the participants, manage their expectations, as well as privacy issues.[106] Record the activities. Observe the intended and unintended use of the object. 7. Analyse the results qualitatively (problems and opportunities) and/or quantitatively (counting incidents: errors or successes). 8. Communicate the results and the redesign of the product according to the information obtained. Ideas for improvement usually emerge during the evaluation.
Advice	• Ask someone less involved in the project to conduct the evaluation to avoid influencing users. • The validity of the results will improve and increase as research experience is gained. • No professional recruiting or formal spaces are needed. It is always necessary to carry out evaluations of the project, it is promoted in the students that it is better to evaluate, than to never do it. • Handle privacy issues beforehand.

31 Usability Evaluation.[107]

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106 It is important to clarify the issues of privacy of information, images, videos, voice recordings with the participants; students learn to work on these issues. In Ecuador, the issue of data privacy is not developed and serious mistakes can be made, if care is not taken with the information that is handled, so it is important to give the necessary instructions to students. Author's note.

107 van BOEIJEN, A., DAALHUIZEN, J., & ZIJLSTRA, J. 2018. *Delft Design Guide. Perspectives - Models - Approaches - Methods* (2nd ed.). BIS Publisher. (English)

At the end of the evaluation, validation or verification stage, the last phase (v) evaluate (Analysis) begins, with the results obtained, decisions are made, redesign, that is, to improve the proposal. For students, this stage of confrontation of their process and the transformation of their proposal is important, since it is very common for them to think that they took absolutely everything into account for the development of their proposal, that the elements are recognisable and understandable; however, at this stage they realise that this is not the reality, it is an important lesson to have on their path.

Interacción, prototipado y evaluación

Posible proceso

1. Hacer un sketch de escenario o storyboard de las interacciones esperadas.
2. Crear un prototipo de interacción, versión simple y cruda del objeto, enfocándonos en los aspectos de diseño que se quiere probar.
3. Usuarios y actores deben interactuar con él como si fuera el diseño final. Este proceso se debe repetir varias veces hasta depurar los detalles a cabalidad. Durante este paso enfocarse en las acciones que realiza el usuario y no en las palabras. Asegurarse de que los observadores están grabando las interacciones.
4. Evaluar las experiencias y sus cualidades de interacción durante el uso.

35   Developed teaching material by Ortiz (2020-2022).

4.4.7.2   Exercises Unit 4

Exercise	Concept	Objectives	Methodology	Result
• Apply validation and veri-fication methods. • Analyse information. • Give feedback to the project and define changes and adjustments. • Edit the requirements thoughtfully.	General methods of testing and evaluation in Design	• Introduce the concept of validation and verification. • Apply verification methods: quantitative and qualitative. • Define changes and adjustments to the proposal. • Develop a new list of requirements. • Relate the concepts learned to validation methods.	• Discussion and dialogue, to clarify doubts. • Apply the methods learned. • Analyse and communicate information.	• Mental maps • Infographic • Summary files • Videos • Chart

32   Exercises Unit 4.

4.4.7.3.   Results

Validación/ Mesa auxiliar de Exterior

Características

El mobiliario aparte de ofrecer una superficie de apoyo, proporciona tres asientos ocultos en el interior de la mesa. Favoreciendo así un mejor aprovechamiento del espacio.

Funcionamiento

Se extrae el taburete del interior de la mesa y se rota 180° para poder ser utilizado.

Comentarios del usuario

Los usuarios consideran que el proyecto es novedoso y práctico para el hogar, sin embargo, se les dificultó intuir el proceso para utilizar el taburete, espesificamente la parte de rotarlo.

Sugerencias del usuario

Los usuarios sugieren que los asientos sean más livianos, además de contar con indicadores de uso para comprender su funcionamiento. A su vez, indican que se podría reducir la altura de la mesa auxiliar para que esta también sirva como una superficie en la que se pueda comer.

Mateo Cadena Cusme / Alejandra Sabatés Vera

Validación de requerimientos

Requerimientos	SI	No
Superficie de apoyo	●	
Genera sobreesfuerzo	●	
Dimensión de superficie adecuada	●	
Se acopla a espacios reducidos		●
Espacio de reposo	●	
Comodidad al guardar		●

Mateo Cadena, Alejandra Sabatés.

Arte Gráfico lapidario

Cerámica

Usabilidad: envase reutilizable al ser cerámico, su principal función es almacenar.

Melisa Aguilar.

FUNCION
Mobiliario de descanso, convivencia que pro-porciona seguridad, comodidad y privacidad al momento de convivir o descasar.

PRAXIS
Para la utilizacion del mobi-liario el usuario tiene la opcion de:
- Acostarse
- Treparse
- Sentarse

RETROALIMENTACION
El mobiliario no cuenta con los optimos elementos para su pro-ceso de descenso

CARACTERÍSTICAS
El mobiliario cuenta con la dimensión adecua-da para su estabilidad , ademas de contar con una ligereza media para su fácil trasporte.

El mobiliario cuenta con un espacio en el que se pueda descansar o realizar activi-dades en conjunto con otros alumnos.

USUARIOS
Destinado para el alumnado de la fada

TESTIMONIOS
Al publico en general le pa-recio un producto llamativo debido a su composicion y su funcionalidad.

RECOMENDACIONES
La estructura principal debe ser en su totalidad de metal sin quitar los procesos de errajes, aunque eleve el costo de produc-cion
Buscar un elemento mas resistente y capaz de soportar las cargas humeas como la red contoneas.

Los cambios en la lista de requerimientos se podrían realizar siempre y cuando para una producción en serie se cambien los siguientes requerimientos:
- Impermeables
- Aislantes de sonido
-Sensación de pertenencia
-Colores de la Universidad
-Escala Proxemica
- Estudiantil

Andrés Castillo, Matheo Pérez, Matias Ruiz.

36   Results from students in different periods (2020-2022).

4.5. Defenitive model aplied to UCDP

Phases	Macro contents (script)	Micro contents (script)	Activities	Participants	Cognitive abilities	Mental models	Resources	Teaching action
1 User Centred Design (UCD). Basic concepts (Analytical phase)	Design, different perspectives	Concepts of designers, and institutions	Investigate design concepts other than those reviewed in the class.	Student	Comprehension		• Table 20 • Web: • https://wdo.org/ WDO • https://www.idsa.org/ IDSA	• Craft resources • Guided inquiry • Guide to argumentation
			Generate a new bank of concepts with all the students.	Students - professor	Problem resolution	Conceptual		• Reflective inquiry • Guide to argumentation
		Construction of own concept	Develop an approximation to a proper definition of design	Student	Application		Example figure 21	• Craft resources • Guide to argumentation
	UCD	Definition and characteristics	Read the articles provided in class.				Readings: • *"Diseño centrado en el usuario"* • *"Del usuario al ciudadano. Una revisión de las metodologías de desarrollo de diseño basadas en usuario desde el Humanismo Digital."* • *"Diseño centrado en el usuario: De la usabilidad a la etnografía."*	• Craft resources • Choose resources
			Synthesise the information.	Student	Comprehension	• Conceptual • Causes		• Guided inquiry • Guide for argumentation
	Principles of Design	Universal Design: seven principles	Analyse the principles learned in objects (design) (between three or five)	Student	• Comprehension • Application	• Conceptual • Causes	Table 21	• Choose resources • Guide for argumentation
		Principles of Good Design: 10 principles					Table 22	

#	Unit	Topic	Content	Activity	Actor	Cognitive level	Type	Readings	Strategies
1	User Centred Designw (UCD). Basic concepts (Analytical phase)	Usability	Definition and characteristics: • Utility • Efficiency • Effectiveness • Learning capacity • Satisfaction • Error tolerance	Read the articles provided in class.	Student	Comprehension	Conceptual	Readings: "Legibility and usability of the product, denotative and connotative functions of the product" Brief of Industrial Design (33-36) "What makes something useful" Handbook of usability (3-11)	• Choose resources • Guided inquiry
				Synthesise the information.		Comprehension			Guide to argumentation
				Register in your immediate environment: home, work, university, journey of experiences around usability		Application		Presentation: http://bit.ly/3tD6pFy	Craft resources
		Emotional Design	Definition, characteristics and the three levels: • Visceral design • Behavioural Design • Thoughtful Design	Read the articles provided in class.	Student	Comprehension	Conceptual	Readings: • "Three levels of design: Visceral, Behavioural and Reflexive" (21-33) Emotional design. Donald-Norman • "Living with complexity" Donald Norman (1-32 pgs.)	• Choose resources. • Guided inquiry
				Synthesise the information.		Comprehension			Guide to argumentation
				Review the videos provided in the virtual classroom				Video: https://bit.ly/3EEbNyF	• Choose resources • Guided inquiry
				Analyse the principles learned in objects (design) (between three or five)		Application		Presentation: http://bit.ly/3tD6pFy	Craft resources

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#	Topic	Concepts	Activity	Agent	Cognitive	Type	Resources/Links	Resource actions
1	User Centred Designw (UCD). Basic concepts (Analytical phase)	Definition, characteristics, the seven factors: • Utility • Usability • Findable • Credible • Desirable • Accessible • Worth	Read the articles provided in class.				Web Articles: • "User experience (UX) Design" http:/bit.ly/3TIDBGg • "The 7 Factors that influence user experience" http://bit.ly/3TFUTnr	• Choose resources • Guided inquiry
	User experience (UX)		Synthesise the information.	Student	Comprehension	Conceptual		Guide to argumentation
			Review the videos provided in the virtual classroom				Video: http://bit.ly/3Gp7dWm	• Choose resources • Guided inquiry
			Register in your immediate environment: home, work, university, travel elements around the user experience		Application		Presentation: http://bit.ly/3tD6pFy	Craft resources
2	Analytical phase (Project). Research in DCU	User definition and user types — Concept and types	Identify the types of users learned in objects (between 3 or 5)	Student	• Comprehension • Application	Conceptual	• Video: http://bit.ly/3TMfE0R • Presentation (Annexes)	• Craft resources • Guide to argumentation • Choose resources • Guided inquiry
		Contexts, habits and user behaviours — • Definition of concepts • Personas method	Apply the Personas method to a person in the immediate environment.	• Student • Student (coupled)	• Comprehension • Application • Problem resolution	• Conceptual • Structural • Causes	Presentation (Annexes)	• Craft resources • Guide to argumentation • Choose resources • Guided inquiry

#	Phase	Methods and tools DCU investigation	Method	Activity			Resources	
2	Analytical phase (Project). Research in DCU		Focus groups	Apply method.			Video: • https://youtu.be/3TwgVQJZPsw • https://youtube/VBsWSXXrXH4 • Presentation (Annexes)	• Craft resources • Guide to argumentation • Choose resources • Guided inquiry
				Analyse information.			• Video: https://youtu.be/WdK_k61wBAU • Tool: https://youtu.be/4lYi9evw5tc	
				Communicate results				
			Context mapping	Apply method.			• Resource: http://contextmapping.com/about/ • Presentation (Annexes)	
				Analyse information.	• Student • Student (teams)	• Comprehension • Application • Problem resolution	• Conceptual • Structural • Causes	
				Communicate results			• Video: https://youtu.be/WdK_k61wBAU • Tool: https://youtu.be/4lYi9evw5tc	
			Trend analysis	Apply method.			Presentation (Annexes)	
				Analyse information.			• Video: https://youtu.be/WdK_k61wBAU • Tool: https://youtu.be/4lYi9evw5tc	
				Communicate results				
			Customer journey	Apply method.			• Video: • https://youtu.be/lSmVM7k1Mpo • http://bit.ly/3OlljAo • Presentation (Annexes)	
				Analyse information.			• Video: https://youtu.be/WdK_k61wBAU • Tool: https://youtu.be/4lYi9evw5tc	
				Communicate results				

Phase	Topic	Tool	Activities	Actor	Cognitive level	Resources	Support
2 Analytical phase (Project). Research in DCU	Methods and tools DCU investigation	Interviews	Apply method. Analyse information. Communicate results			• Video: https://youtu.be/tOEJToVU_l0 • Presentation (Annexes)	• Craft resources • Guide to argumentation • Choose resources • Guided inquiry
		Perceptual map	Apply method. Analyse information. Communicate results	• Student • Student (teams	• Comprehension • Application • Problem resolution / • Conceptual • Structural • Causes	• Video: https://youtu.be/WdK_k61wBAU • Tool: https://youtu.be/4lYi9evw5tc / Presentation (Annexes)	
		SWOT Analysis	Apply method. Analyse information. Communicate results			Presentation (Annexes) / • Video: https://youtu.be/WdK_k61wBAU • Tool:https://youtu.be/4lYi9evw5tc	
	Project requirements	Hierarchies, organisation	Make a list of requirements, define categories, organise.	Student	• Comprehension • Application / Conceptual	Presentation (Annexes)	• Craft resources • Guide to argumentation • Choose resources • Guided inquiry
	Problem definition	Guiding questions	Define the problem in a summary paragraph.	Student		Presentation (Annexes)	• Craft resources • Guide to argumentation • Choose resources • Guided inquiry

Phase	Topic	Method	Activity	Actor	Level	Knowledge	Resources	Strategies
3 Synthetic phase (Project). Creative Development	Design Concept		Define the concept in a summary paragraph.	Student	• Comprehension • Application	Conceptual	Presentation (Annexes)	• Craft resources • Guide to argumentation • Choose resources • Guided inquiry
	Creative methods	Creative exercises	Perform exercises to motivate creativity.	• Student • Student (teams)	Application	• Conceptual • Structural • Causes	• Tool: https://stormboard.com • Video: http://bit.ly/3TZkR5L	• Craft resources • Guide to argumentation • Choose resources • Guided inquiry
		Analogies and metaphors	Apply creative methods.	• Student • Student (teams)	• Application • Problem resolution	• Conceptual • Structural • Causes	Presentation (Annexes)	
			Develop proposals.		Comprehension		Videos: • https://youtu.be/7N2v0bpNFKA • https://youtube/cGgJJKvpCEs • http://bit.ly/3TIRzlj	
	Creative methods	Brain writing and brain drawing	Apply creative methods.	• Student • Student (teams)	• Application • Problem resolution	• Conceptual • Structural • Causes	Presentation (Annexes)	• Craft resources • Guide to argumentation • Choose resources • Guided inquiry
			Develop proposals.		Comprehension		Videos: • https://youtu.be/7N2v0bpNFKA • https://youtube/cGgJJKvpCEs • http://bit.ly/3TIRzlj	

3	Synthetic phase (Project). Creative Development	Creative methods	SCAMPER	Apply creative methods.		• Application • Problem resolution			
				Develop proposals.	• Student • Student (teams)	Comprehension	• Conceptual • Structural • Causes	Videos: • https://youtu.be/7N2v0bpNFKA • https://youtu.be/cGgJJKvpCEs • http://bit.ly/3TlRzIj	• Craft resources • Guide to argumentation • Choose resources • Guided inquiry
		Design in detail	Technical sheets, mock-ups, models and prototypes	Choose proposal.		Comprehension		Examples	
				Proposal development: details, unions, scale.	• Student • Student (teams)	• Application • Problem resolution	• Conceptual • Structural	• Resource: http://bit.ly/3Ar7EeP • ID Cards	• Craft resources • Guide to argumentation
				Elaboration of models and prototype		• Application • Problem resolution	• Causes	• ID Cards	• Choose resources • Guided inquiry

Presentation (Annexes)

			Activity	Competency		Resource	
4 Synthetic phase (Project). Verification	General verification methods and Design evaluation	Product concept evaluation	Apply method.	• Application • Problem resolution		Presentation (Annexes)	
			Analyse information.	Comprehension			
			• Edit the requirements thoughtfully. • Transform the proposal.	• Comprehension • Application		Examples	
		Usability evaluation	Apply method.	• Application • Problem resolution	• Student • Student (teams)	Presentation (Annexes)	
			Analyse information.	Comprehension	• Conceptual • Structural • Causes	Examples	• Craft resources • Guide to argumentation • Choose resources • Guided inquiry
			• Edit the requirements thoughtfully. • Transform the proposal.	• Comprehension • Application		• Presentation (Annexes) • Resource: http://bit.ly/3tB6pG3	
		Emotion measurement (PREMO)	Apply method.	• Application • Problem resolution			
			Analyse information.	Comprehension		Examples	
			• Edit the requirements thoughtfully. • Transform the proposal.	• Comprehension • Application		Presentation (Annexes)	
		Interaction, prototyping and evaluation	Apply method.	• Application • Problem resolution			
			Analyse information.	Comprehension		Examples	
			• Edit the requirements thoughtfully. • Transform the proposal.	• Comprehension • Application			

4.6.　　Projects per semester

4.6.1.　　Period 2020-01

Period	2020-01
Modality	Virtual
Number of students	8
Number of Projects	1
Theme	Tele-work and tele-study

33　Characteristics of the subject period 2020-01.

The UCDP subject for the first semester of 2020 began the first week of March, unexpectedly two weeks later, education turned to a virtual modality, given the pandemic caused by SARS COVID-19, this involved rethinking the organisation of the classroom, adapting it to the new reality and, adjusting to the restrictions and limitations of the home.

It was decided to develop an exercise (project) throughout the semester, focused on the activities that were being carried out by tele-working and tele-study, framing the experience that each one was having from home, and the accessibility of information, users and experiences.

Students were encouraged to apply observation at home: parents or relatives who combined their spaces to work; siblings or relatives who received classes (school or university) at home. Once the user is defined, the five phases of this proposal begin: (i) discover (Research), (ii) define (Problem), (iii) develop (Proposal), (iv) apply (Results) and (v) evaluate (Analysis). During this period, work was performed through individual projects per student. Below, the results obtained are displayed.
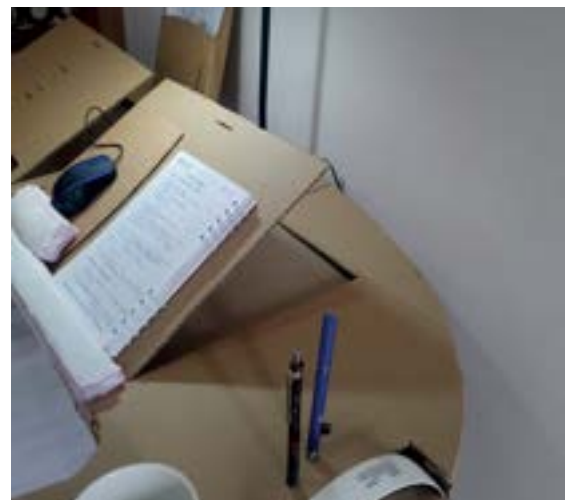
37　Furniture for tele-work, student: Lorena Terán.

4.6.2.   Period 2020-02

Period	2020-02	
Modality	Virtual	
Number of students	9	
Number of Projects	2	
Theme	Game for children	Transportation for shopping

34   Characteristics of the subject period 2020-02.

In this period, after identifying the necessary adjustments to the proposed model, it was decided to develop two exercises (projects), taking into account the problems of the new context (pandemic).

The proposal was to divide the development of the project into two parts, and apply them in each exercise, in the first project the first three phases are emphasised: (i) discover (Research), (ii) define (Problems), (iii) develop (Proposal), for this to work, the user was predefined (children), however the students had to define the age range; and basic information was provided, as well as bibliographic guides for individual student inquiry; the objective was for the students to apply in depth the methods of user research and creative development, however in phase (iii) develop (Proposal) a first approximation of proposals is reached and confronted with the list of requirements, it is not possible to deepen or develop a proposal in detail.

The second project focused on transportation and shopping, the new consumption dynamics that were established in the pandemic and that completely transformed how shopping was done. For this project, information on consumer trends was provided, but the objective was for students to define the user and apply the first three phases autonomously: (i) discover (Research), (ii) define (Problem), (iii) develop (Proposal); the application of prior knowledge was evidenced with the aim of generating significant learning. The third phase (iii) developed (Proposal) was deepened, until reaching the prototype development; in addition, emphasis was placed on: (iv) applying (Results) and (v) evaluating (Analysis).

During this period, we worked with individual projects per student. Below, you can see the obtained results.

38   Transportation, students: Andrés Puga y Jorge Rosales.

4.6.3.   Period 2021-01

Period	2021-01	
Modality	Virtual	
Number of students	3	
Number of Projects	2	
Theme	Urban agriculture	New trends at home: kitchen

35   Characteristics of the subject period 2021-01.

In this period, the proposal of two projects per semester was maintained, and work was done under the theme of urban agriculture and food preparation. An element was proposed that connects these two themes, the choice of the transversal product was left to the discretion of the students. For the choice of these topics, the trends that developed in the pandemic were analysed, people turned to caring for plants and cooking as a way of escaping from confinement and mobility restrictions.

This period, being the third in virtual modality, caused reluctance in the students and poor results at work. Another important factor to mention during this period, is that there were three students and at the beginning of the second project one of the students withdrew from the course for personal reasons. During this period, the work with individual projects per student was maintained. Below, you can see the obtained results.

4.6.4.   Period 2021-02

Period	2021-02	
Modality	Hybrid	
Number of students	10	
Number of Projects	2	
Theme	Food design chocolate (bite)	Food design chocolate (experience)

36   Characteristics of the subject period 2021-02.

In this period, the proposal of two projects per semester was maintained, however, some elements were adjusted, the first project was carried out individually, the second as a group; research methods such as focus groups could be carried out as a group in the individual project.

As a transversal theme to the projects, chocolate was chosen (food design) and work with a small local brand took place, this was done with the objective that students feel the reality of entrepreneurship, and what were the problems that they developed due to the pandemic; additionally, they sought to motivate students when facing a real client. The first project focused on improving the presentation of the product and the second on proposing an experience in relation to the consumption of chocolate.

This period was developed in a hybrid modality, days were held of face-to-face work at the university and others of remote work at home, which caused confusion in the students and resumed some strategies to improve the socialisation of the students.

This group had the particularity of starting their university studies in a pandemic, this period was the first to have access to the campus and its infrastructure, many did not know each other personally, they had only interacted in virtual classes, which caused some social conflicts that were solved during the semester. Below, you can see the obtained results.

MATERIALES

Bite-Chocolate

Elemento de Sujeción de moldes- PLA

Negativo y Cortante –PLA Molde será en Silicona Alimentaria

Envase-Bambú y una lámina de acetato de .45mm para la visibilidad

40   Working with the Iana Mullu, a local brand of chocolate, student Felipe Madrid.

4.6.5.   Period 2022-01

Period	2022-01	
Modality	face-to-face	
Number of students	8	
Number of Projects	2	
Theme	Furniture	Fashion

37   Characteristics of the subject period 2022-01.

In this period, the proposal of two projects per semester was maintained, with the adjustments implemented in the preceding period. Two different themes were chosen: the first was furniture, the second was clothing; however, user research was motivated to provide them with information to develop the two projects as a resource optimisation strategy.

This strategy was chosen to encourage the use of the FADA-PUCE infrastructure; during the previous semesters, the resourcefulness of the students in terms of the use of materials and processes for the development of prototypes was promoted; however, in career meetings it was identified that the students presented shortcomings in the use of materials and machinery, which is essential within the designer's repertoire.

This period was developed in face-to-face mode, the effects of the pandemic on students could be perceived: attention deficit, lack of organisation of activities, lack of discipline and informality. Short exercises were promoted with other groups of the Architecture career, this with the aim of promoting team and multidisciplinary work. Below, you can see the results obtained.

41   Fashion and furniture design, students Mateo Pérez, Mateo Cadena, Andrés Castillo, Matias Ruíz and Alejandra Sabatés.

4.7.   The different modalities: virtual, hybrid and face-to-face

Of the seven periods that the UCDP has been implemented (2019-02 - 2022-02), the model developed in this doctoral research has been applied during five (2020-01 - 2022-01). In the first period 2019-02 a tentative proposal was developed, it was a pre-pandemic face-to-face period, in which two professors worked on, the topic that was developed was Tableware for typical food of the province of Manabí, however, there is no developed scheme nor the elaborated contents, there is only a record of the results.

Three periods were developed virtually (2020-01 - 2020-02 - 2021-01), this sudden change led to a rapid analysis of the subject, for the implementation of strategies that allow learning results to be achieved in this new modality. Virtuality facilitates theoretical classes, that is, the first part of the subject on basic concepts, since through resources, presentations, videos, readings, and exercises, students better perceive the content and assimilate it, in addition to online tools, such as *Piktochart*, *Creately*, *Adobe Spark*, *Canva*, among others, facilitate the exercises for students, obtaining optimal results. Exercises are proposed that allowed students to synthesise the information and resources such as infographics, files and mental maps were generated that they can constantly review during the semester and in subsequent periods.

During the practical phases of the project development, the dynamics became more complex since the methods require some analysis and modifications to do it in a virtual way. Its remote application was achieved by identifying the relevant users per project in the circle of close friends and family. The digital video conference tools: *Zoom* and *Google Teams*, have been used to hold meetings and apply research and verification methods.

As for the creative methods, tools such as *Jamboard*, *Stormboard*, among others, allow collaborative work, for exercises that motivate creativity, and the development of ideas and proposals. Manual or digital tools can be used to allow the communication of students' ideas. In addition, individual and collective methods are proposed that enrich the generation of ideas.

Regarding the development of study models and rapid prototypes, there were limitations in access to materials, depending on the location of the students, this allowed to be recursive and identify what I have at home and how I can take advantage of it, analysing the characteristics of the material and the requirements of the object. Once the proposal has been developed in detail,

closer to the final object (prototype); verifications are required that can be carried out virtually or in person depending on the requirement, for example, a verification such as the *PREMO*[108] method and its tool that measures the person's reactions and emotions regarding the object, can be carried out virtually; images of the object are shown, it is briefly explained and people validate it by giving their answer. In relation to validations such as usability and interaction it is impossible to perform it virtually, with this we must recognise in the immediate environment, who is within the target group to interact with the object and validate it. Each applied method requires planning, execution, collection, analysis and results for which exhaustive records are made, where the required information is obtained.

A period was developed in a hybrid modality (2021-02), this required some adjustments identifying new strategies, in addition to listening to the experience and feedback of the students, group work was implemented for the development of projects, since the application of both methods of research, to know the user as the validation and verification methods require more time, the exercises that are developed individually and in groups were identified so they will not affect the learning results.

One period was developed in face-to-face mode (2022-01), this was the last period that the model was applied, it was developed in person, in this period the individual and group work adjustments were maintained, however, this period presented greater difficulties, the social and psychological changes taking place in students in the post-pandemic period has presented some challenges that have required the generation of new pedagogical strategies. The virtual classroom resources developed as complements and support material in the model, lost their place as support, the students were saturated by virtual and visual complements, they required more complements and physical dynamics.

This also allows us to conclude that a model is a living entity that changes and adapts according to the requirements of the context, while the pedagogical, methodological and theoretical foundations are strong, allowing flexibility, adaptation and transformation.

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108 PREMO is a non-verbal and self-information instrument that measures the user's emotional response to products. Source: van BOEIJEN, et al. 2018.

4.8.   Analysis

4.8.1.   Successes

The successes of this process have been made possible by the strong theoretical, pedagogical and methodological base that has been built in the subject and the model. Among which we can mention within the theoretical field (i) clear concepts, (ii) coherent choice of theoretical references and sources of information, (iii) clear structure of the information.

In the pedagogical area: (i) choice of proposals that complement each other; (ii) promote the observation of the environment, the daily life that surrounds us in relation to objects and daily activities, in the three modalities that this model has been developed, it has been promoted to identify the problems and resources that we have at our disposal, either from home, in hybrid environments or back in the classroom; (iii) a diversity of topics has been developed in the projects according to the current context: tele work and tele education (virtuality), transportation and new forms of consumption during the pandemic, pandemic trends: urban agriculture and home cooking, entrepreneurship and food design, and close environments and clothing; these topics have been analysed taking into account the current context, current issues are sought that allow students access to research and experimentation as pedagogical strategies in order to achieve meaningful learning; (iv) promote the resourcefulness of students with the use of materials that exist at home or are easily accessible for the generation of models and prototypes of experimentation, pedagogical strategies that are part of the teaching-learning methodologies chosen.

In the methodological field: (i) development of a clear, cyclical process that allows the construction of knowledge, (ii) development of exercises and activities as channels to generate processes and practices that allow the development of the knowledge construction cycle; (iii) analysis and proposal for the application of methods in all phases of the project in a virtual, hybrid, and face-to-face manner, depending on the relevance of each case.

4.8.2. Limitations and errors

In the implementation of this model in the different modalities of the subject there have been limitations and errors among which are: (i) limitation with the students since each one perceives information differently, to reach an optimal result in most of the students, it has taken two periods, through analysis of results and adjustment of strategies; (ii) homogenisation has not been reached in the complexity of the projects developed, there is disparity between the projects of the students, this is mainly evidenced when they developed projects individually, a greater homogeneity is reached in the group development of projects; (iii) the pedagogical process depends very much on the disposition of the students, not all the objectives are achieved with all the students, however the use of the chosen pedagogical principles has helped in the process; (iv) the methodology applied requires the capacity of the students to venture to apply the instruments, the learning is centred on them.

4.9. Chapter conclusions

By way of conclusion, this chapter has initially reviewed the structure by level, the subjects that make up the third level of the degree and what are the contributions to the integrative project; to move on to the characteristics of the User-Centred Design Project UCDP; then we review the elements that make up the pedagogical proposal, which is based on cognoscitivism to understand the mental processes in learning, the Ignatian Pedagogical Paradigm and Kolb's experiential learning, which emphasise the importance of context, experimentation and analysis of experience, as well as teaching-learning methodologies: project, challenge and problem-based learning (PbL, CBL and PBL) that share the need for real contexts and promote the development of different skills in the student; the pedagogical proposal is complemented with the methodological one that is the same as in this doctoral project, its development is exemplified both in the analytical and synthetic areas.

It goes on to the definition of the UCD in a theoretical way and the structure of the model, the four parts that compose it, in each of these the theoretical foundations approached are reviewed, the proposed and developed exercises, as well as the results obtained in the different periods; then the topics per academic period are deepened. Finally, it discusses the modalities in which the proposal and research of this doctoral thesis were developed, the successes, limitations and errors.

5.   Chapter: Analysis and Conclusions

5.1.   Evaluation system

The implementation of the model developed in this thesis was carried out from 2020_01 until 2022_01 with a total of five academic periods. During this time, multiple ways to correct, adjust, improve and define the model that have been applied and evaluated.

Three types of evaluation can be delimited: (i) self-evaluation, from own reflections as part of the cycle of construction of knowledge stated in the development process of this thesis; (ii) co-evaluation, from the academic faculty, developed in exposition spaces and shared experiences with academic peers, meetings: from the beginning and the end of the semester, coordination of axes, career committees; as well as external spaces in which there have been lectures as a part of the research, such as the Teaching Innovation Forum of the Ibero-American Biennial of Design (BID)[1] or the International Virtual Colloquium for Researchers in Design[2] and (iii) hetero-evaluation, conducted by the students during each academic period.

In conjunction with these types of evaluation, information has been collected by the researcher throughout the project, this data is qualitative; and the information that generated from the institution to the professor, has been quantitative data. Four points that respond to the developed methodology for the research have been gathered: (i) contents as the starting point of the process that build up for learning, the channels (ii) pedagogy and (iii) methodology that provide organisation, actions and strategies, and (iv) evaluation as a final element and reflection to increase knowledge. The described quantitative evaluation will be described below.

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1   The BID is an initiative that allows the public to approach the discipline of design and its context, as well as being a meeting point, on the one hand for reflection and thought and, on the other, to establish relationships between professionals, with companies in the sector and academia. Year after year it is consolidated as a forum for generating and sharing ideas. Author's note.

2   The Colloquium is an interdisciplinary and open space for presentation, debate and reflection on the research and publications carried out within the framework of the Latin Design Research and Development Program (2016 - 2022), led by the Faculty of Design and Communication of the University of Palermo. In the Colloquium, advances, reflections, productions and/or results, publications, and projection of each participating line or project are presented. The Colloquium is a space open to all researchers, academics and/or professors of Latin design who seek to know, participate and eventually link academically with the line and/or project of interest. Author's note.

PUCE has developed an evaluation instrument called *Evaluation 360*, which analyses the teaching performance of faculty members from different instances: authorities, academic peers, self and student evaluations. The research takes into account eight points, which as grouped into four themes: (a) contents, which evaluate: (i) the capacity that the faculty member has to learn permanently and update themselves (CAP) and (ii) the generation of resources and strategies focused in virtual, hybrid and in face-to-face environments that the faculty member manages (GRE); (b) the methodology evaluations (i) the creation, organisation, structures and dynamics developed in the classroom (CEV), and the (ii) management of strategies, resources and methodological tools (MERHM); (c) in pedagogy, what is taken into consideration are: (i) the planning and organisational capacities of the professors (CPO) and the (ii) planning and execution of the curriculum (PMIC); and lastly, the (d) evaluation, where the following is considered: (i) creation of elements of evaluation, grading, feedback and transparency with students (CPE), and the (ii) management of tools and evaluation techniques (MHTE) are taken into account.

There are three results: (i) 2020_02, (ii) 2021_01 and (iii) 2022_01 since this instrument was not applied in all periods due to administrative logistics issues of the institution, the evaluation was adjusted in the different periods, the results obtained are shown below:
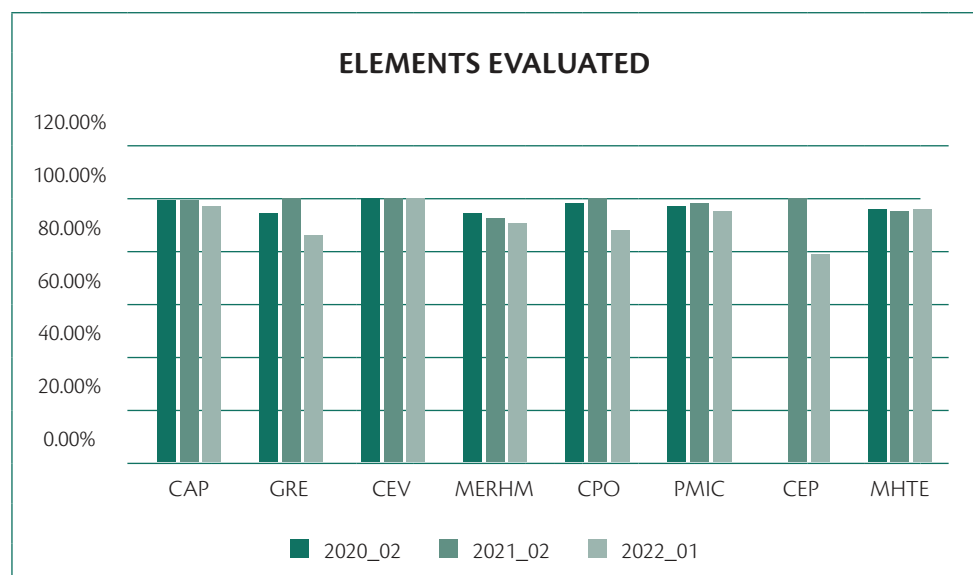
42   Results obtain by the researcher of the evaluation applied by academic period.

	2020_02	2021_02	2022_01
CAP	99,45%	99,15%	97,15%
GRE	95,14%	100%	86,40%
CEV	100%	100%	100%
MERHM	95,16%	92,89%	91,61%
CPO	98,53%	100%	88,11%
PMIC	97,25%	98,01%	95,60%
CPE	-	100%	80%
MHTE	96,91%	95,31%	96,21%
Media	97,49%	98,17%	91,89%

38   Results by evaluation of academic period.

The results of this evaluation allow a comparative analysis between periods, with which it can be concluded that in 2021 the best results were obtained, and in the last period 2022 they were the lowest compared to the previous ones. This occurred since in 2020 the model was developed and its application began, which implies trial, error and adjusting the proposal, in addition to the uncertainty of the pandemic and the development of a completely atypical modality up to now, such as virtuality; during 2021 the performance of the classes was stable and the modality was maintained, methodological and pedagogical strategies were developed according to the new context, the model was constantly adjusted and fed back to improve it; however, by 2022 the modality changed again, which presented difficulties in performance and requires rethinking strategies. This shows that the model is a living entity that needs to be transformed and adapted according to the changes that reality presents.

Regarding the points, the CEV point stands out in methodology , the capacity for creation, organisation, structures and dynamics developed in the classroom; the CAP point continues in contents, which is the professor's learning and updating capacity; in PMIC pedagogy micro curricular planning and execution; and finally in MHTE evaluation, management and evaluation techniques; which indicates that the structure established between macro and micro scripts, activities, the cognitive abilities that are sought to be developed, the established mental models, the resources developed and the actions of the professor are clearly perceived; all elements that constitute the structure of the developed model/methodology. It should be noted that all the evaluated points have a score above 90%, which is positive in terms of the developed instrument.

For the qualitative evaluation, the researcher has collected information through meetings with the students, at the beginning, during and at the end of each academic period, and personal interviews with one or two students per period, with whom pedagogy is evaluated.[3] Meetings with level academic peers for dialogue and discussion on topics and teamwork at the beginning and end of each period, with which methodology is evaluated; with the coordinator of the project axes[4] for content review and evaluation; with the teaching staff, the evaluation of the learning results.

The results of this evaluation allowed to enrich the model. According to what was discussed with students, pedagogical work strategies were established as an example, the micro contents and exercises are developed individually, the macro-ones began to be developed as a team. This increases the complexity of the projects and improves the times and work dynamics between the students. It is confirmed that to learn about project methods a clear structure is necessary, this allows to strengthen in its application and to recognise what the obtained failures and successes are. The introduction of examples as reference elements for students was also implemented.

Regarding the methodology and organisation, it was difficult to maintain a coherent dynamic with the academic peers, since there is too much turnover in the faculty, the only subject that kept the same professor between 2020_01 and 2022_01 is the DCUP; which implied that each period started the cycle again without giving continuity to the transversal actions or evaluating them. It is recommended to maintain the assignments to improve the expertise of professors and strengthen teamwork, it is necessary to set subject managers for an extended period of time.

The contents were reviewed, and it is proposed that adjustments be introduced each year, this allows to apply and evaluate relevance during two periods. A constant revision of the thought models or thesis is recommended to update the contents taught with national, regional and international referents.

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3   This activity has been carried out in class, where the interview was manage as a conversation to make the students comfortable and obtain real incomes.

4   The axes Coordination is a form of organisation of the Product Design Career, which allows for the analysis and adjustment of the contents of the subjects corresponding to each axes (vertically and sequentially) so that they respond to the context, and also ensures that the contents are complied with, and that they are not changed without consensus, a problem that was evident in previous plans. Author's note.

Regarding the evaluation, different instruments were defined according to the proposed exercises, and it is confirmed that feedback, as well as guided reflection are fundamental as a conclusion to the knowledge construction process, this allows closing a cycle and starting a new one, with solid foundations.

5.2.   Conclusions

This dissertation presents the context of Ecuador and Ecuadorian design as a basis to establish the creation of a teaching model for the development of responsible objects in the case study, the Product Design career of FADA-PUCE. Throughout this work, concepts are developed, which are articulated, generating a mesh of knowledge that helps to address each of the proposed topics, as well as delimiting and directing towards our main objective. This is a contribution that was built and increases in the progress of the chapters.

As a conclusion, after the path travelled in this dissertation, we have reached our objectives. We will start with the secondary ones to finish with the main one as the final solution and outcome of the present research. Let us remember that the secondary objectives were raised in the direction and as a complement to the theme of our dissertation.

As a first point, it is concluded that the social, political and economic problems of Ecuador have been constant since the last century. Political and economic instability have caused a delay in industrial and technological development, which has made it difficult for design to be inserted in the country. However, as of 2009, strategies and policies are defined so that this reality changes with the National Development Plans (NDP), specifically the PNBV (2013-2017) and the PNTUV (2017-2021). As part of these strategies, the analysis and evaluation of universities, careers and programs that seeks their relevance in accordance with what is proposed in the NDP to promote the development of the country is promoted; based on this analysis, the development of career and program redesigns was proposed, in which the case study is framed, and the proposal of this thesis is developed.

Secondly, hand in hand with the Ecuadorian context, the path of design in Ecuador develops, it can be affirmed that it is a young profession whose first steps were taken in the late seventies and earlier eighties with the incursion of architects and artists who began to develop activities around the field of design, its appearance occurs first in the professional field and later in the academic field.

Based on the policies and strategies since 2009, the design action field has been expanded and the following have been identified: (i) designers in industries in charge of mass, intermediate and limited production with standardised processes or digital production; (ii) designers in public or private companies; and (iii) independent designers or design studios dedicated to manufacturing and developing products for companies, designing services, and developing their own products.

As mentioned, the country has several problems in the following areas: social, economic, political and industrial; design as a discipline and designers as professionals can contribute to improve the current situation through the responsible projection of products, services, systems, processes and experiences. The creation and application of the model promotes the development of skills in the training of young designers, through which they know the context and the user, define problems and provide solutions that are validated to make them viable and effective.

Design in the academic field, 28 years ago, began the Product Design Career of FADA-PUCE, one of the first spaces for teaching the profession in the country. Four stages or plans have been determined that have marked its development.

The initial (i) 1994-1997, is characterised by comprehensive design training, lasted five years, also offered a degree for technicians and technologists at the end of three years. Two stages of the educational process were identified, (i) the basic cycle shared with Architecture, and (ii) the training cycle in which different types of projects were developed linked to the main areas: product, graphics, interiors and fashion; the final project was developed once the students finished all the academic periods.

In this first plan, there is a lack in the use of project methodology. The processes that were addressed were more experimental (*black box*); regarding the theoretical support, clear trends of thought are not recognised, nor has the content that was addressed in it been identified.

The second plan (ii) 2003, also known as PAC, is established from a technical consultancy that opted for the specialisation of the careers and the difference between Product Design, Graphic Design and Visual Communication, its duration was reduced to four years. Three levels of training are identified: (i) the basic one that kept the year in common with Architecture, and the third semester that was shared with the Graphic Design Career; (ii) a formative level from the fourth to the seventh semester with vertical teaching, in which different skills and complexities came together; (iii) in the eighth semester, which was the professional level,

the final project began. This plan introduces the development of projects by typologies of product and scale (haptics, proxemics and kinetics), as well as learning about different types of materials, their techniques and technologies.

Like the previous one, it also lacked project methodologies, experimentation (*black box*) for product development was maintained, however, it is identified that the theoretical line of thought was linked to Morin's complex thought, theories such as the semiotics of communication and ergonomics were introduced. In the same way, as in the previous plan, there was no clear definition of contents, as a result of poor planning in the mentioned plan. In these two plans, there is no record of teaching-learning methodologies.

The third plan (iii) Q041 2007-2010, this plan maintained the 8 semesters, however, it ends the common year with the Architecture career and begins to have a common year with the Graphic Design career. Three levels of training were defined: (i) the basic cycle, (ii) the training cycle was divided into two parts: Training 1 (lasting one year), and Training 2 (lasting another year) and (iii) the professional cycle. Thematic projects are identified from the third semester: Project III dedicated to objects of use with emphasis on their function; Project IV to objects of use with emphasis on their language, and Project V to objects of immediate surroundings, while Project VI is intended for objects of industrial production, the VII with a transversal project to the two disciplines (products and graphics) with emphasis on Strategic Design.

Q041 was better structured than the previous plan by defining a type of project per semester, the emphasis on the object was maintained and the vertical training was eliminated in order to return to a transversal formation. Problem-based learning (PBL) was introduced as a teaching-learning methodology.

Based on the evaluation of careers and programs developed between 2010 and 2015, it is requested in 2015 to redesign the careers, which proposes the fourth plan or phase of the career, approved by the CES in 2018, came into force in the second period of that year, is the current plan. In this (iv) last plan, the eight semesters of training are maintained, however, the first year is no longer shared with any career and product specialisation starts from the beginning.

Three units were defined: (i) the basic unit that corresponds to the first three semesters in which the principles of composition, configuration and knowledge of the user for the projection of products, systems, services, processes and experiences are learned; (ii) the professional unit that deals with thought models that involve the environment and different actors such as communities and companies and also delves into production processes and optimisation of materials;

it also includes a deeper reflection on the scope of design and the designer's work. The last one is (iii) the curricular integration unit where the final project is developed.

The last proposal contains clearer definitions in its construction and approach; It clearly defines levels of learning, cumulative, sequential and transversal complementary vertical knowledge processes. This proposal changes the focus on product typologies and begins to develop projects based on design thinking models: (i) user-centred design, (ii) sustainable design and eco-design, (iii) participatory design, (iv) design of services and (v) strategic design.

Regarding the Product Design Career, we can conclude that in its process it has defined training cycles; it has transformed project development from experimentation to project methodology; it has changed a teaching in design focused on typologies and scale of products, to one focused on thesis or thought models that allow projects to be diversified to products, services, systems, processes and experiences, which broadens the field of action of the product designer; it has introduced teaching-learning methodologies, moving away from improvisation by providing better tools to its students.

From the analysis of the career, we move on to the development of the model, a structured tool to improve teaching in design. The model requires (i) pedagogy that is built from several proposals: cognitivism, Ignatian Pedagogical Paradigm (PPI), Kolb's experiential cycle, project-based learning (PbL), problem-based learning (PBL) and challenge-based learning (CBL); the choice of these allowed to determine the ideal cognitive process that is established for the students, dynamic and context-focused strategies to solve real problems; which bases the designer's empathic capacity and reflecting on their environment to respond accurately. The (ii) methodology is based on Owen's knowledge construction process and the project methodology defined by the author, which are developed for this dissertation and for the teaching of design, starting from prior knowledge and seeking to develop an exercise-activity, through channels that are resources and tools built by the professor, the student begins his learning process; once completed, guided reflection and feedback is shared, which allows students to increase initial knowledge through meaningful learning and start a new cycle.

The (iii) contents that have been chosen for this subject respond to the thesis of User-Centred Design, in addition, elements such as design principles (Universal Design, Good Design), user experience (UX) and emotional design have been incorporated in order to bring students to social innovation and the development of responsible objects with their environmental and social context.

The design methodology for the development of proposals that is used, has been the one constructed in this research and the methods and tools used have been carefully chosen.

The model organises the contents in (i) macro and (ii) micro scripts that allow the definition of activities; for each one, the participants have been identified among: (i) student, (ii) student team and (iii) professor; the cognitive skills that students must perform: (i) comprehension, (ii) application and (iii) problem solving; the mental models they handle: (i) conceptual, (ii) causal and (iii) structural. Teaching actions have been defined: (i) developing resources and (ii) choosing resources that contribute to (iii) guided inquiry by providing relevant information to students; the (iv) guide for argumentation, and (v) reflective inquiry are of great relevance in the process of knowledge construction, since it allows students to conclude the teaching-learning cycle and to take ownership of the process.

By way of conclusion, after the application of the model developed in this thesis during five academic periods and its quantitative and qualitative evaluation, it is determined that the model is a living and dynamic element, it has a base structure that adapts to changes as modalities (virtual, face-to-face and hybrid), updating contents and pedagogical and methodological strategies; this allows to remain in constant transformation and evolution. The results obtained and the opportunities for improvement have been reflected upon as a closure of the knowledge construction cycle, which has enriched the model.

The model is a basic structure that can be applied to different subjects. It is suggested to present it to the career committee to establish it as one of the instruments of the FADA-PUCE Product Design Career. Its implementation requires a trial period and adaptation to each subject axes, according to their requirements.

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1. https://wdo.org/ World Design organization

2. https://www.idsa.org/ Industrial Designers society of America

3. https://youtu.be/4lYi9evw5tc Como hacer una infografía

4. https://youtu.be/SRec90j6lTY Que es UX

5. https://youtu.be/3TwgVQIZPsw Focus group

6. https://youtu.be/VBsWSXXrXH4 Focus group

7. https://youtu.be/tOEJToVU_l0 Entrevista

8. https://youtu.be/lSmVM7k1Mpo User journey

9. http://contextmapping.com/about/ Contextmapping

10. https://youtu.be/WdK_k61wBAU Pitch

11. https://youtu.be/7N2v0bpNFKA Fundamentos del diseño

12. https://youtu.be/cGglJKvpCEs Fundamentos del color

13. https://stormboard.com/ Stormboard, lluvia de ideas y mas

14. httpswww.youtube.comwatchv=cGglJKvpCEs

15. https://www.youtube.com/watch?v=7N2v0bpNFKA

Annexes

Diseño Centrado
en el Usuario/Personas

●●●

(DCU/DCP/UCD)

CONCEPTO

Enfoque de DISEÑO que se centra en el usuario para crear un determinado producto.

OBJETIVO

- DISEÑADOR estudie a profundidad las necesidades, deseos y limitaciones del público objetivo (USUARIO), a partir del análisis de decisiones.
- Realice un estudio de campo para TESTEARLO.

HISTORIA DEL DCU

- 1940 ingeniería aplicada a las personas + ergonomía = objetos orientados a la adaptación física de los objetos a las personas.
- 1960 ergonomía cognitiva = además de adaptarse físicamente, se debe tener en cuenta SENTIDOS, MEMORIA y CAPACIDAD DE DEDUCCIÓN.
- 1970 técnicas de investigación ETNOGRAFÍA (estudio de pueblos y sus culturas).
- Actualidad diferentes tipo de productos, técnicas y herramientas más desarrolladas.

Primeras referencias

DETERMINAR acciones posibles.

HACER cosas visibles.

EVALUAR el estado actual

CORRESPONDENCIAS naturales entre intenciones y acciones necesarias, entre acciones y resultados.

ESTÁNDARES

- ENTENDER y ESPECIFICAR el contexto de uso.
- ESPECIFICAR los requisitos de usuario y de la organización.
- PRODUCIR soluciones de diseño.
- EVALUAR los diseños en base a los requisitos.

6 PRINCIPIOS

1. COMPRENSIÓN explícita de usuarios, tareas y entornos.
2. Usuarios están INVOLUCRADOS durante el diseño y el desarrollo.
3. Diseño REFINADO por evaluaciones centradas en el usuario.
4. Proceso ITERATIVO.
5. DIRIGIDO a la experiencia del usuario.
6. Equipo de Diseño incluye habilidades y perspectivas MULTIDISCIPLINARES.

MÉTODOS

- Scenarios
- Simplified thinking aloud
- Heuristic evaluation
- Stakeholders meeting
- Analyse context
- Evaluating existing system
- Affinity diagramming
- Scenarios of use
- User roles
- Use case map

- Field studies
- Abstract prototyping
- Usability evaluation
- Iterative design
- ... entre otros

DISEÑO DE PRODUCTOS

BRIEF DE PRESENTACION DE PROYECTOS DE NIVEL

PROYECTO 2

Temática: Movimiento/lúdico

Propuesta: Objeto de transporte para compras

Problemática/necesidad:

A raíz de la pandemia por el COVID-19, los patrones de consumo de los hogares han cambiado para responder a necesidades más seguras e inmediatas de la cotidianidad. Los consumidores volverán a las tiendas como un acto lúdico, experiencial y con agrado para ahorrar y no sacrificar mayormente sus ingresos económicos. Esto propone la ausencia de un transporte público o vehículos privados para optar por movilizaciones más sostenibles como la bicicleta.

Referencia

- https://es.kantar.com/empresas/consumo/2020/mayo-2020-el-confinamiento-revoluciona-el-consumo-en-los-hogares/
- https://retailnewstrends.me/el-nuevo-consumidor-tras-covid-19/
- https://www.nielsen.com/ec/es/insights/article/2020/covid-19-afectara-mas-a-los-consumidores-de-bajos-ingresos-en-latinoamerica/?wgu=11671_16644_15952560903502_5e21e2c69f&wgexpiry=1603032090&afflt=ntrt15490001&afflt_uid=11671_16644_15952560903502_5e21e2c69f&afflt_uid_2=AFFLT_ID_2

Resultados de aprendizaje:

- Comunicar el proyecto de forma clara mediante su representación y presentación adecuada a los distintos involucrados en el proyecto de Diseño, a partir de instrumentos manuales y digitales necesarios.
- Utilizar el pensamiento lógico y divergente para comprender a los sujetos y proponer alternativas de intervención ante los fenómenos productivos.
- Comprender la importancia y aplicación del método proyectual en Diseño mediante las fases genéricas de: identificación de necesidades y problemas, investigación teórica y metodológica, análisis, generación de soluciones, desarrollo de prototipos, pruebas de usuario y la evaluación de resultados.
- Aplicar las TIC para optimizar sus comunicaciones, aprendizajes y el desarrollo del conocimiento, en el marco de los desafíos de la sociedad de la información y comunicación, considerando la responsabilidad social que dicho uso comporta para el desarrollo local y global.
- Diagnosticar las necesidades o problemas del comitente, promotor o cliente; de una oportunidad o de un desafío existente en el ámbito del Diseño de Productos empleando técnicas de investigación adecuadas y definiendo listados de requisitos oportunos.

Usuarios: 25-35 años

Consumidores propensos al ahorro. Les gustan las compras por internet

Análisis contextual: Usuarios directos/Interdisciplina

Descripción metodológica

Taller: Visión en Diseño: Diseño Centrado en el usuario

Métodos de Diseño: Delft Design Methods (Descubrir, Definir, Desarrollar, Evaluar y Decidir, Articular y simular)

Requerimientos mínimos:

- Plegable
- Guardar cosas
- Mecánico movimiento
- Vinculación con la tecnología digital

Entregables:

- Estudio de usuario: Requerimientos objeto, descripción y características del usuario.
- Interacción con el objeto (láminas).
- Lámina conceptual digital
- Estudio biomecánico.
- Comprobaciones en DCU

Cronograma de actividades:

Semanas/Materias	Taller	Bocetación	Materiales	Ergonomía
7	Presentación de brief	Representación digital de formas complejas		Metodologías de comprobación ergonómicas aplicadas al diseño/ Antropometría
8-9	Investigación de usuario			
10-11	Procesos creativos	Representación de mecanismos		
12 Revisión conjunta	Desarrollo de propuestas y construcción			Evaluación de propuestas basadas en modelos digitales
13				
14	Comprobación DCU (interacción, uso, emoción, concepto)	Comunicación lámina conceptual		
15				Procedimientos de comprobación de objetos desde Biomecánica: Marcha, carga, posturas
16 Presentación final	Objeto listo/ modelo de estudio escala 1:2			

https://www.visualcapitalist.com/10-types-of-innovation-the-art-of-discovering-a-breakthrough-product/?fbclid=IwAR3rFzldZpdhqE_e24BATMC0ViokEvax45JiTNngtyyxky0t0UsnhAsMFQM

DISEÑO DE PRODUCTOS

BRIEF DE PRESENTACION DE PROYECTOS DE NIVEL

PROYECTO 1

Temática: Movimiento/lúdico

Propuesta: Objeto que pueda desplazarse de forma mecánica

Problemática/necesidad:

Los niños de 4 años deben afianzar sus destrezas y habilidades, desarrollo de motricidad fina y gruesa, trabajo colaborativo, desarrollo kinestésico, sociabilidad, superar sus límites.

Actividades que desarrollan:

- Los pequeños(as) muestran gran interés por los juegos con personajes imaginarios. En ocasiones les gusta ponerse aditamentos o vestuarios que simbolicen lo que quieren representar dando ¨rienda suelta¨ a la imaginación.
- En este grupo de edad los niños(as) conocen mucho mejor los objetos, son capaces de compararlos y diferenciarlos por su forma, color y tamaño, e incluso, pueden señalar el lugar que ocupan en el espacio: si están arriba, abajo, cerca o lejos (nociones de contraste).
- Se destaca en el desarrollo del pensamiento el interés por conocer la causa de algunos fenómenos de la naturaleza; para qué, por qué, cómo, son preguntas que continuamente hace el niño(a) de este grupo de edad.
- En este sentido el lenguaje del niño(a) se hace más rico y coherente. Con frecuencia establecen diálogos, tanto cuando juegan solos como cuando lo hacen con otros niños. También son capaces de narrar cuentos o historias que ellos mismos inventan, demostrando una vez más la gran imaginación que los caracteriza.
- Los niños(as) de estas edades sienten gran preferencia por la carrera, ejecutando la misma con mayor aumento en la fase de vuelo, mejor ritmo y coordinación que en el grupo de edad anterior. Son capaces de mantenerse corriendo una mayor distancia.
- Les gusta realizar las carreras bordeando objetos, con cambio en la dirección (al frente, atrás, derecha e izquierda) y combinada con otros movimientos como: caminar y correr, correr y lanzar, correr y saltar etc.
- Utilizan ampliamente el espacio y se orientan muy bien en el mismo, ejecutando todos los desplazamientos (caminando, corriendo, saltando, etc.), tanto por o desde el piso, en diferentes direcciones y por arriba de obstáculos. Dentro de estos ejemplos se destaca el salto: separando y uniendo las piernas, lateralmente, pasando cuerdas a pequeñas alturas del piso y saltos desde obstáculos a 24 cm. de altura cayendo con semi-flexión de las piernas.
- También les gusta trepar por barras o cuerdas colocadas verticalmente, realizando el desplazamiento de brazos y piernas aún de forma descoordinada.
- Sin embargo en otro desplazamiento como es el escalamiento, se observan grandes avances en su ejecución con relación al grupo anterior, pues suben la escalera con movimientos alternos de brazos y piernas en un movimiento continuo que demuestra buena coordinación.
- Realizan la reptación (arrastrarse) por el piso, por bancos, por tablas inclinadas, y la ejecutan llevando un brazo al frente y la pierna correspondiente, de forma alterna, pero sin suficiente coordinación, ya que el movimiento se realiza con pausas.
- La cuadrupedia la ejecutan en cuatro puntos de apoyo (pies y manos) por encima de bancos y tablas con movimientos continuos, de forma coordinada.

- Lanzan y capturan objetos combinadamente, pero para la captura (atrape del objeto o pelota) precisan de la ayuda de todo el cuerpo, cuando le lanzan la pelota de aire. Con facilidad ruedan la pelota por bancos y lanzan con las dos manos desde el pecho hacia diferentes lugares, pero aún sin dirigirla con exactitud a un punto de referencia.
- Caminan por tablas y vigas o muros estrechos no sólo hacia delante, sino también lateralmente, demostrando mayor estabilidad corporal. También se desplazan hacia atrás, cuando caminan por tablas colocadas en el piso, manifestándose en esta acción motriz una mayor orientación espacial.

Resultados de aprendizaje:

- Comunicar el proyecto de forma clara mediante su representación y presentación adecuada a los distintos involucrados en el proyecto de Diseño, a partir de instrumentos manuales y digitales necesarios.
- Utilizar el pensamiento lógico y divergente para comprender a los sujetos y proponer alternativas de intervención ante los fenómenos productivos.
- Comprender la importancia y aplicación del método proyectual en Diseño mediante las fases genéricas de: identificación de necesidades y problemas, investigación teórica y metodológica, análisis, generación de soluciones, desarrollo de prototipos, pruebas de usuario y la evaluación de resultados.
- Diagnosticar las necesidades o problemas del comitente, promotor o cliente; de una oportunidad o de un desafío existente en el ámbito del Diseño de Productos empleando técnicas de investigación adecuadas y definiendo listados de requisitos oportunos.

Usuarios: Niños 4

Análisis contextual: Información de parvulario/psicología infantil

Descripción metodológica

Taller: Visión en Diseño: Diseño Centrado en el usuario

Métodos de Diseño: Delft Design Methods (Descubrir, Definir, Desarrollar, Evaluar y Decidir, Articular y simular)

Requerimientos mínimos

- Movimiento mecánico
- Impulso
- Desarrollo de motricidad fina y gruesa

Entregables:

- Estudio de usuario: Requerimientos objeto, descripción y características del usuario.
- Interacción con el objeto (láminas).
- Lámina conceptual manual.
- Estudio antropométrico.

Cronograma:

Semanas/Materias	Taller	Bocetación
1	Presentación de brief	Formas básicas y complejas basadas en la naturaleza
2	Investigación de usuario	
3		
4	Procesos creativos	Representación de movimientos
5 Revisión conjunta		
6	Desarrollo de propuestas y construcción	Representación de movimientos y construcción
7 Entregables compartidos	Objeto listo/ modelo de estudio escala 1:2	Comunicación lámina conceptual

DISEÑO

Ángel Jácome MDI.
"El diseño es una actitud social y cultural que responde a un orden sublime de las emociones y sentimientos del ser humano".

Leopoldo Janes
"El diseño es para engordar el ego y el bolsillo sin importar nada al mundo pero si grandes beneficios al sector industrial. Por cierto si la población no tiene cultura del diseño a quien le venderemos el diseño el día de mañana".

Bernd Löbach
"Diseñar es un proceso de adaptación del entorno objetual a las necesidades físicas y psíquicas de los hombres de la sociedad."

D.I. Mauricio Sánchez
"El diseño industrial es la actividad encargada de concebir la forma objetual desde una perspectiva conceptual, en la medida que su postura es científica, que desde esa aproximación idónea a la realidad de su discurso de conocimiento, en síntesis es la concreción de una propuesta conceptual en una morfología".

Guido Díaz
"...el diseño no acude a algo específico, el diseño es todo... el diseñador investiga una situación y crea un objeto que cambie dicha situación, el objeto tiene que tener un propósito cumplir con una función..."

Marcelo Maldonado
"... el diseño es la necesidad de comunicar, diseño de comunicación visual, comunica mediante imágenes: diseño industrial necesidades utilitarias, artesanales o industriales…"

N. Butz
"El diseño industrial es creación y también cultura, arte, ciencia y técnica por que tiene que analizar reacciones, gustos, necesidades, ambiente, función, materiales, procedimientos o medios de fabricación e índices de costos, aumentándose a estos factores de estudio los de sensibilidad y belleza en el control de aspecto para que el objeto sea resuelto de una manera atractiva, que lo haga deseable y bien ajustado a su época"

Fielden
"El diseño técnico es la utilización de principios científicos, información técnica e imaginación en la definición de una estructura mecánica, maquina o sistema que realice funciones especificas con el máximo de economía y eficiencia".

ICSID Internacional Council Societies of Industrial Design
"El diseño es una actividad proyectual que consiste en determinar las propiedades formales de los objetos producidos industrialmente".

DISEÑO

Joan Costa
"Si diseñar implica supeditar la creación de formas a un propósito, el propósito del diseño es siempre responder a una necesidad del hombre. Su verdadera dimensión y su rol social los adquiere al dar una respuesta formal a una función, es decir al modo de acción en virtud del cual un objeto cumple la finalidad por la cual ha sido creado".

Bruce Archer
"...seleccionar los materiales correctos y darles forma para satisfacer las necesidades de función y estéticas dentro de las limitaciones de los medios de producción disponibles".

Desde la ingeniería
"actividad que convierte una idea, sugerida por una necesidad del mercado, en un conjunto de especificaciones para producción".

Christopher Alexander
"El descubrimiento de los verdaderos componentes físicos de una estructura física".

Asimow
"La elaboración de una decisión, de cara a la incertidumbre, con grandes penalizaciones para el error".

Michael Farr
"El factor que condiciona aquellas partes del producto que toman contacto con la gente".

Christopher Jones
"El acto de diseñar es el inicio de un cambio en las cosas hechas por el hombre… además de la realización de un completo acto de fé."

Matchett
"La solución optima de un conjunto de verdaderas necesidades en un particular conjunto de circunstancias".

George Nelson
"el diseño… es una manifestación de la capacidad del espíritu para trascender sus limitaciones"

J.K. Page
"El salto imaginativo desde la realidad presente a las posibilidades futuras".

J.B. Reswick
"Una actividad creativa, que supone la consecución de algo nuevo y útil sin existencia previa".

Victor Papanek
"Diseñar es el esfuerzo conciente para establecer un orden significativo"

Tomas Maldonado
"El diseño industrial es una actividad proyectual que consiste en determinar las propiedades formales (relaciones funcionales y estructurales) de los objetos producidos industrialmente".

Diego Hurtado MDI.
"El diseño es una respuesta a las necesidades y deseos de grandes masas de una determinada población que se concretiza en un satisfactor".

```
Mano ──┬── parte extremidades superiores ⟶ prolongación del antebrazo
       │
       ├── Funciones ──┬── complejidad estructural ⟶ funciones dispares acciones motoras ⟶ gran fuerza y delicadez
       │               ├── trabajo conjunto ⟶ dos manos transformar manipular ⟶ a través instrumentos
       │               └── acciones sensitivas ⟶ obtener información ⟶ tacto informa el medio
       │
       ├── Biomecánica de la mano ──┬── Huesos conforman ──┬── 8 huesos largos cuboidales muñeca
       │                            │                      ├── 5 huesos largos palmar/metacarpo
       │                            │                      ├── 9 huesos largos/falanges dedos
       │                            │                      └── 5 falangetas yemas dedos
       │                            ├── pluralidad de gestos logra ⟶ colaboración músculos del antebrazo mano
       │                            ├── tres nervios periféricos radial, cubital y median ──┬── funciones motoras posible el movimiento
       │                            │                                                       └── funciones sensitivas fuente táctil de información
       │                            └── yemas ⟶ gran sensibilidad
       │                                piel palmar ⟶ más gruesa ⟶ soportar esfuerzos cargas
       │                                piel dorsal ⟶ fina y elástica ⟶ movimientos articulares
       │
       └── Función prensil ──┬── permite agarrar y sostener ⟶ objeto
                             │
                             ├── Agarre de fuerza ──┬── acción de tomar ⟶ palma de la mano y los dedos ⟶ confiere fuerza y resta precisión
                             │                      ├── agarre simple ⟶ mano adapta ⟶ forma del objeto
                             │                      ├── agarre circular ⟶ mano rodea al objeto ⟶ cierra alrededor ayuda de los dedos
                             │                      ├── agarre transversal ⟶ aporta precisión ⟶ prensión de fuerza eje longitudinal ⟶ controlar dirección
                             │                      └── agarre de precisión ⟶ manipulación menor tamaño ⟶ pulgar opone palma de la mano
                             │
                             └── Agarre precisión ── uso de dedos ⟶ índice y corazón forman pinza con el pulgar
```


VISTA DORSAL DE LOS HUESOS
DE LA MANO IZQUIERDA

| Líderes, jefes y subordinados | ← | Social | → | Toda organización requiere de una estructura con jefes ⟶ autoridad ⟶ implantar reglas que sirvan para el funcionamiento y desarrollo social. |
| | | | | Poder social en un individuo ⟶ capacidad para controlar las acciones de gente que lo rodean, emanando de ello jerarquía y autoridad. |

Microentorno ← El espacio tridimensional ⟶ variable como innumerables son las actividades humanas, su limitación ⟶ burbuja imaginaria que rodea al operario y tiene como dimensión la necesaria utilizable en la ejecución de la actividad, |no va más allá del alcance de manipulación y comando del instrumento, ya sea una herramienta, artefacto o panel.

Sitio de labor

El sitio de labor ⟶ lugar donde se desempeña la actividad.

lugar de operación
- Microentorno existe de antemano ⟶ dificultades para modificarlo a conveniencia ⟶ puede ser ocasional ⟶ circunstancias muy difíciles de controlar.
- Ejemplo: los electrodomésticos de cocina para operar sobre una superficie, se usan en mesones con infinidad de variaciones de tamaño, estabilidad, tipo de superficie; y el ambiente de la cocina varía en iluminación, aireación, etc; esto hace que el ambiente sea tan diverso, como diferencias tengan las cocinas. El lugar de operación siempre tendrá un entorno variable.

puesto de trabajo
- El microentorno es consecuencia del artefacto ⟶ existe la posibilidad de modificarlo para que el operario ⟶ ambiente confortable: se considera como el puesto de trabajo.
- Encerrar al operario en una cámara ⟶ aísle del ambiente exterior desfavorable, ⟶ dentro de este ámbito cerrado ⟶ el operario tenga condiciones ideales para sus requerimientos fisiológicos.
- Ejemplo: el recinto de una oficina o fábrica, que aunque más grande se puede adaptar a condiciones que cubran las necesidades fisiológicas de las personas, tales como: aire acondicionado, calefacción, iluminación apropiada, control de sonido y aireación, comunicación visual y auditiva con el exterior; que cubran las necesidades fisiológicas de las personas.

conjunto operante
- El hombre necesita ejecutar una actividad que sirva para satisfacer una de sus necesidades, ⟶ instrumento o artefacto que le permite realizarla con mayor facilidad, prontitud y precisión: ⟶ asociación compuesta por el hombre y el artefacto al efectuar dicho trabajo
- Objetivo ⟶ rendimiento de una operación para lograr eficiencia[1] ⟶ aprovechando los elementos tecnológicos adaptados a las capacidades humanas. La eficaz[2] interacción de estos componentes en la actividad ⟶ buen desempeño del conjunto. Esta productividad ⟶ busca el estudio ergonómico al determinar las condiciones de la relación hombre-artefacto.

[1] Capacidad de disponer de alguien o de algo para conseguir un efecto determinado. Uso racional de los medios para alcanzar un objetivo predeterminado (es decir, cumplir un objetivo con el mínimo de recursos disponibles y tiempo).
[2] Capacidad de alcanzar el efecto que espera o se desea tras la realización de una acción.

Lectura
- Ergonomía, ⟶ capacidad del hombre para reconocer el significado de los símbolos utilizados para la intercomunicación con el artefacto.
- El pensamiento ⟶ proceso de secuencias simbólicas que requieren de un aprendizaje previo ⟶ están relacionando los símbolos aprendidos con anterioridad ⟶ intentar resolver problemas o tomar decisiones.
- El lenguaje, hablado o escrito, el manejo de ideas abstractas y el pensamiento ⟶ concatenan en un solo cuerpo para la formación de conceptos.
- Ejemplo: El estímulo sensorial provocado por la luz roja de un semáforo ⟶ signo que está avisando que no podemos pasar ⟶ condicionamiento previo; el signo producido por la luz del semáforo es un símbolo que indica la intención de comunicar una señal.

Aprendizaje de la actividad ← Estudio ergonómico considera ⟶ proceso de aprendizaje de una actividad, como el conocimiento y entrenamiento del operario para manejar correctamente y con eficiencia el aparato al ejecutar su función. Aprendizaje ⟶ hacer asociaciones, por parte del individuo, para asemejar o diferenciar una tarea de otra, como aplicación de su conocimiento, por transferencia de aprendizaje ⟶ efecto de aprender a ejecutar una tarea, ⟶ tomando como base el conocimiento previo de otra semejante.

Desempeño de la actividad
- El hombre al valerse de artefactos ⟶ satisfacer una necesidad, realiza la serie de operaciones propias del trabajo, su ejecución será productiva ⟶ consiga el objetivo ⟶ rendimiento óptimo. La medición de este desempeño ⟶ estudio de las operaciones, sus funciones y relaciones.
- La productividad ⟶ resultado del más alto rendimiento, ⟶ recursos empleados y trabajo realizado ⟶ período de tiempo determinado, ⟶ menor número de errores.

Factores de productividad

Entrenamiento — Es el tiempo y recursos requeridos ⟶ operario para adquirir la estructura mental y la destreza necesarias para desempeñarse ⟶ parte de un conjunto operante, ⟶ determinado por las facultades del individuo y el tiempo de aprendizaje.

Precisión — Es la ejecución de una acción ⟶ menor cantidad de errores. Es consecuencia del nivel de entrenamiento, combinado con sus cualidades de respuesta y destreza.

Prontitud — Es la rapidez con que se realiza una acción, ⟶ de la condición de eficacia. Elevar la eficiencia no se logra disminuyendo indefinidamente el tiempo de las acciones.

Satisfacción — Es un factor de naturaleza amplia y compleja por la singularidad de su índole en cada grupo en estudio. Las motivaciones y condiciones del trabajo nunca son iguales, para diferentes individuos.

- Recompensa al esfuerzo ⟶ el hombre, tiene necesidad de ser admirado o respetado por el resto del grupo, si su trabajo es considerado como bueno, junto con la compensación de un salario que satisfaga sus necesidades sociales.
- Desempeño social ⟶ posibilidad de interacción con otros individuos y grupos dentro y fuera de su labor, que le permite desarrollar una posición satisfactoria en la comunidad.
- Seguridad física y psicológica ⟶ riesgos propios del trabajo a desempeñar: seguridad industrial y la de mantener un empleo constante.
- Confort ⟶ facilidades del puesto de trabajo: ambiente controlado para su bienestar físico y social.

Variables del desempeño individual: rendimiento. Para lograr el óptimo desempeño se deben estudiar las siguientes variables:

- La información rápida y veraz recibida por el operario.
- La atención prestada por él mismo para una pronta y acertada acción.
- Mandos a su disposición, con condiciones ajustadas a las cualidades de los operarios.
- Las ayudas disponibles: manuales, accesorios, ayudantes y otros.

Componentes del conjunto operante

Los elementos usados para informar, iniciar, regular, suspender, verificar, ordenar y ejecutar funciones ⟶ sistema que gobierna un artefacto, ⟶ mandos y siempre deben estar localizados al alcance para ser manipulados.

En todos los sistemas que involucran elementos de operación, ⟶ esquema información-razonamiento-acción, donde el estímulo, el discernimiento y los medios de ejecución, ⟶ determinantes; entendiendo a éstas como las capacidades del hombre ⟶ conocimiento de la tecnología disponible.

Mandos

Dispositivos que permiten ⟶ necesidades de control y ejecución que requiere el aparato. Su participación en la ejecución del trabajo ⟶ leer, verificar, regular y ordenar la operación ⟶ ajustar la actividad a las mejores posibilidades de operación del aparato.

Instrumentos de lectura

Tableros (displays), indicadores y pantallas

Aparatos que presentan ⟶ sentidos del hombre la información necesaria y oportuna ⟶ tomar las decisiones de acción del artefacto ⟶ indicadores.

Distancia de manipulación

Requiere el operario ⟶ manejar los mandos de la máquina o artefacto; mientras que distancia de alcance de efecto ⟶ hasta donde llega el efecto del artefacto que el operario está manejando.

Mecanismos de acción (controles)

Instrumento o dispositivo ⟶ posible la acción, ⟶ poner en marcha, manejar, gobernar, regular y detener un aparato o una máquina.

Sistemas laborales y el análisis de tareas

Sistema es un término genérico que da la idea de agrupación de dispositivos, objetos, elementos, etc.

El sistema laboral queda definido por una relación de elementos que tiene por finalidad el cumplimiento de las tareas laborales.

Modelo de sistema laboral

Simulación. Sistema de evaluación de un modelo ⟶ caso de comprobación de las hipótesis de las reacciones del funcionamiento de un sistema productivo, ⟶ reproducir las condiciones mediante una simulación teórica del modelo. La idea ⟶ información en un sistema sea la adecuada ⟶ estabilidad del mismo, posibilitó el diseño de medios de elaboración más complejos, ⟶ control de errores y la conducción de su accionar hacia determinados objetivos previamente fijados.

El concepto de la regulación de sistemas por medio de la realimentación o retroalimentación, la cual puede ser positiva o negativa. En el caso de la realimentación positiva ⟶ información de salida del sistema actúa en la entrada ⟶ aumentar la desviación de la salida, en tanto que la realimentación negativa se utiliza ⟶ esta desviación disminuya caracterizando el estado estable del sistema.

Modelos de simulación suelen emplearse ⟶ elaborar pautas de diseño del elemento a controlar ⟶ análisis de comportamiento en accidentes. También considera la seguridad del sistema productivo ante rotura y fuera de funcionamiento del medio de elaboración.

Con este tipo de imagen y la consideración de las características de rendimiento ofrecido por el operador humano, ⟶ la experiencia y el adiestramiento, se envían las señales de control a las manos y pies ⟶ acción de los controles del medio de elaboración.

Estas señales de control, ⟶ surgen desde el momento que se establece la condición de observación de los estímulos hasta la toma de acción, tienen un cierto retardo conocido ⟶ tiempo de reacción ⟶ analizado desde la óptica de la psicología aplicada a los diseños industriales, ⟶ elementos que suministra criterios de configuración ergonómica del sistema laboral.

Psicología aplicable a sistemas de ingeniería ⟶ rol substancial ⟶ ideas que proyectan un nuevo diseño ⟶ intervienen en la modificación del medio de elaboración, ⟶ diseño correctivo.

Perturbaciones que intervienen pueden ser de distinto origen, por ejemplo: estado de las guías donde se desplaza el medio de elaboración, obstáculo imprevisto, condiciones climáticas, variación fisiológica diaria, falta de sueño, exceso en las comidas, conflictos personales, etc.

Cada acto humano constituye básicamente una oportunidad de equivocación, siendo la cantidad de errores que se producen dependientes ⟶ límites de la tolerancia prefijada.

El análisis teórico de los sistemas laborales mediante simulación, ⟶ pronosticar configuraciones de trabajo adecuadas a la concepción de determinados productos. Los resultados ⟶ cualitativos o cuantitativos, ⟶ primer lugar considerar los resultados cualitativos, los que posteriormente permiten establecer aquellos puntos débiles de la investigación y desarrollo ⟶ necesita una cuantificación.

Existen basados en el principio cibernético[1], simuladores de vuelo o de conducción de automóviles como los que se utilizan en los videojuegos, ⟶ usan normalmente como entrenadores, ⟶ pueden modificar los grados de dificultad de operación. El ajuste de estos grados de dificultad sirve, además, ⟶ analizar comportamientos ante situaciones críticas y para investigar fenómenos accidentológicos.

[1] La cibernética es la ciencia de la regulación y transmisión de datos en los seres vivos y en las máquinas. Ciencia que estudia las analogías entre los sistemas de control y comunicación de los seres vivos y los de lasmáquinas.

Tendencia en diseños de avanzada ⟶ inclina al uso de sistemas de simulación computarizada, los que permiten la cuantificación de resultados mediante el empleo de algoritmos matemáticos ⟶ combinación con el uso de sistemas expertos del área de la inteligencia artificial.

Elementos del sistema laboral

Tarea: unidad que caracteriza la finalidad del sistema laboral. Ejemplos: registrar documentos, embalar productos, transportar una carga.

Proceso de trabajo: relación espacial y temporal del hombre y medio de elaboración en indeterminado entorno de trabajo, que abarca:
- ¿Dónde? ⟶ hace referencia al lugar físico donde se desarrolla la actividad.
- ¿Cuándo? ⟶ en qué momento y con qué duración se lleva a cabo determinada actividad.
- ¿Con qué? ⟶ tiene en cuenta los recursos humanos y los medios de elaboración.

- Entrada ⟶ consiste en objetos a elaborar, personas, informaciones y energía, cuyo estado, forma o situación, ⟶ modificarse o aplicarse en determinada forma dando cumplimiento a la tarea.
- Salida ⟶ resultado de la interacción entre el hombre y el medio de elaboración, ⟶ objetos, personas, informaciones.
- Influencias del entorno ⟶ condiciones de entorno físicas, químicas, psicológicas, organizaciones económicas y sociales ⟶ interactúan en el sistema laboral influyendo en la ejecución de la tarea.
- Medio de elaboración ⟶ herramientas, máquinas o elementos que forman parte o se ponen a disposición del sistema laboral, ⟶ cumplimiento a la tarea.
- Hombre ⟶ parte de las denominadas capacidades del sistema de trabajo ⟶ cumplimiento a la tarea.

Condiciones de trabajo ⟶ innumerables definiciones, ⟶ condiciones de trabajo de un sistema laboral ⟶ abarcan la totalidad de las propiedades de los elementos del sistema productivo, las influencias de entorno, técnicas y económicas que pueden afectar al hombre en la ejecución de su tarea.

Los análisis con criterio ergonómico más comunes llevados a cabo desde el punto de vista sistémico son los siguientes:

- Análisis de la tarea ⟶ análisis de actividades basado en informaciones ⟶ tipos de requerimientos tanto de las capacidades físicas como mentales ⟶ exigidos para el cumplimiento de la tarea.

- Análisis del entorno: ⟶ registro de las influencias físicas (ruido, vibraciones, radiaciones electromagnéticas de distinto tipo, iluminación, clima, etc.), químicas (sustancias tóxicas, vapores, gases, etc.) y sociales (relación de los grupos, condiciones jerárquicas, etc.).

- Análisis de interacción entre el hombre y el medio de elaboración ⟶ proceso dinámico y complejo ⟶ interface del hombre con el medio de elaboración ⟶ aspectos biomecánicos y antropométricos, también la optimización del flujo de información.

Tipos de sistemas

Las funciones que hacen más efectivo a un sistema ⟶ observabilidad y la controlabilidad ⟶ flujo de información. Observabilidad ⟶ verificación o supervisión del sistema, y controlabilidad ⟶ acción de efectuar cambios en la tarea y el guiado del sistema.

Objetivo de la optimización ⟶ sistema desde el punto de vista ergonómico está caracterizado ⟶ mayor efectividad del sistema y una mejora en su confiabilidad. Efectividad ⟶ mejor calidad en la ejecución de la tarea, ⟶ necesario para su estudio fundamentos matemáticos aplicables a la ingeniería de control.

El funcionamiento del hombre ⟶ resultado de una secuencia que considera: la observación, percepción, decisión y acción, en relación intrínseca con la memoria. Tres tipos de sistemas: manual, mecánico y automático.

- **Sistema manual**. El hombre actúa como fuente de energía o motor, observando y controlando su tarea.
- **Sistema semiautomático**. La acción motora es llevada a cabo por componentes mecánicos mientras que el hombre observa y controla su tarea
- **Sistema automático**. La observación de instrumentos y monitores es efectuada por el hombre, en tanto que la controlabilidad es llevada a cabo por el sistema

Diseño ergonómico

Los ingenieros de diseño ⟶ entender el problema ⟶ proceso de análisis, los diseñadores ⟶ solución óptima de muchas soluciones posibles ⟶ proceso de síntesis. Diseño ergonómico ⟶ yuxtaposición de ambas formas de pensar. El procedimiento ergonómico básico de diseño de un sistema laboral u objeto ⟶ teoría de sistemas en el más amplio sentido ⟶ herramientas creativas biónicas o sinécticas con la intuición.

- Incremento de la complejidad de los medios de elaboración, productos y su operación.
- Incremento de los costos en recursos humanos y materiales.
- Velocidad creciente en las innovaciones tecnológicas.
- Incremento de los requerimientos del trabajador y del usuario en cuanto a salud, satisfacción y confort.
- Necesidad de reducción de los tiempos de desarrollo.

Los principales pasos en el diseño ergonómico del sistema laboral son:

Objetivos o requerimientos ⟶ misión a ser llevada a cabo por el sistema laboral.

Decisión ⟶ funciones realizadas por el medio de elaboración.

La percepción de la información: Introducción y aspectos teóricos y tecnológicos de la teoría de la Gestalt. Trata del diseño del medio de elaboración, ⟶ dispersión poblacional de cada característica de rendimiento que ofrece el usuario, ⟶ requerimientos que exige la tarea por parte del hombre.

Diseño de la interface entre los medios de elaboración y el hombre, en los procedimientos ⟶ amigabilidad en la interacción máquina-hombre.

Mayor empleo de las técnicas de laboratorio para simulación del sistema mediante el uso de algoritmos, sistemas informatizados de ayuda de diseño, sistemas de simulación videosomatográfica, etc. En tanto que, en el caso de las verificaciones reales, se trata fundamentalmente de ponderar además del cumplimiento de la función principal del producto.

Planificación, programación y control de la confección del sistema, que dé cumplimiento a los requerimientos del diseño dentro de los plazos y costos previstos.

Considera el cumplimiento de aseguramiento de la calidad del sistema en funcionamiento.

Criterios de valoración del trabajo

Criterios de evaluación del trabajo ⟶ reconocimiento científico-práctico ⟶ aprobación de la sociedad. Los niveles se ordenan secuencialmente desde el más bajo hasta el más alto:

Factibilidad ⟶ posibilidad de ejecución en el corto plazo.

Soportabilidad ⟶ relacionada con la actividad a largo plazo.

Admisibilidad ⟶ problemática social, ⟶ observar los límites de soportabilidad del ser humano.

Satisfacción ⟶ problema psicológico, al considerarse la satisfacción individual ⟶ psicología social como personal.

El análisis ergonómico de tareas (AET).

Actividades socioproductivas ⟶ exigencias jurídicas y política social ⟶ humanización del trabajo. El tema a tratar en este caso particular se circunscribe al reconocimiento de los riesgos y la implementación de medidas de prevención basado en el procedimiento ergonómico de análisis de actividades (Procedimiento AET) desarrollado a partir de mediados de la década del 70 en el Instituto de Ciencia del Trabajo de la Universidad de Darmstadt.

El desarrollo de sistemas científicos de análisis de actividades se llevó a cabo a partir de 1973, cuando el Gobierno de Alemania Federal, ⟶ peritaje para la determinación de la carga de trabajo a la que estaban sometidas las mujeres, ⟶ negociar entre las partes que intervienen en las Convenciones Colectivas de Trabajo.

Nuevas tareas que afectan al hombre ⟶ los esfuerzos musculares localizados, consideraciones de atención, concentración, monotonía, etc.

Universalidad, ⟶ diferencias se tornan más pequeñas, haciendo a los sistemas de trabajo muy semejantes entre sí independientemente de su complejidad y especificidad. Entre la gran cantidad de áreas en las cuales estos métodos encuentran aplicación, se consideran:

- Análisis de los requerimientos y configuración del trabajo.
  - Documentación del puesto de trabajo.
  - Configuración del puesto de trabajo.
  - Diseño del medio de elaboración.
  - Disminución de las cargas.
- Organización de la producción.
  - Organización de modificaciones organizativas.
  - Configuración del proceso laboral.
  - Distribución de pausas y turnos.
  - Determinación de tiempos de descanso.
- Administración de personal.
  - Asimilación de personal.
  - Selección y promoción de personal.
  - Administración grupal.
  - Capacitación.
  - Valoración del trabajo y remuneración.
- Higiene y seguridad industrial.
  - Estado de salud de los distintos grupos.
  - Clasificación personal de acuerdo a los requerimientos.
  - Asesoramiento profesional en la disminución de riesgos.

El análisis del trabajo

Procedimientos tradicionales ⟶ orientados a los modelos de estructuración de personal y remuneración, el análisis ergonómico es útil ⟶ estudio de una determinada tarea desempeñada por el hombre, ⟶ evaluada de acuerdo al contenido de trabajo que le corresponda.

Mayor relevancia ⟶ introducen tecnologías más avanzadas, ⟶ desplazamiento del trabajo muscular efectuado por el hombre en forma masiva en dirección a un trabajo individual y predominantemente informativo, ⟶ incrementan los requerimientos referidos a las características sensoriales, combinatorias y de decisión. El análisis científico del trabajo ⟶ profesionales de distintas disciplinas, contándose entre las más relevantes las correspondientes al estudio científico del trabajo: medicina del trabajo, ergonomía, sociología y psicología laboral entre otras. Estas disciplinas diferencian el procedimiento de acuerdo a:

- Finalidad del análisis.
- Objeto a considerar en el análisis.
- Método de análisis.
- Formulación de modelos teóricos.

Análisis de trabajo ⟶ clasificación o desglose sistemático de un sistema laboral en sus componentes ⟶ investigación de un trabajo con anotaciones por escrito de los resultados, clasificándolos por finalidad, proceso, medios de elaboración, conocimientos, habilidades y responsabilidades. Conocimiento, ⟶ requerido y lo existente en relación con el objeto laboral, medio de elaboración y ambiente laboral.

La clasificación científico-analítica

a. Sistema laboral.

- Objeto de trabajo (OdT).
  - Material.
  - Energía.
  - Información.
  - Hombre, animales y plantas.
- Medio de elaboración (ME).
  - ME que modifican la naturaleza del OdT.
  - Medios de transporte.
  - Mesas, sillas y espacios de trabajo.
  - Dispositivos auxiliares.
- Ambiente laboral.
  - Influencias físicas del ambiente laboral.
    - Riesgo de la actividad laboral.
    - Riesgo de enfermedad profesional.
  - Medio social y organizativo.
    - Organización temporal del trabajo.
    - Situación de la actividad en estudio en la organización del proceso.
    - Situación de la actividad en estudio, en la organización estructural (organigrama).
    - Situación de la actividad en estudio en el sistema de comunicaciones.
  - Bases y métodos de remuneración.
    - Establecimiento de bases de remuneración.
    - Establecimiento de métodos de remuneración.

b. Análisis de tareas.

1. Tareas referidas a objetos de trabajo concretos.
2. Tareas referidas a objetos de trabajo abstractos.

c. Análisis de requerimientos.

1. Toma de información.

- Magnitudes de reconocimiento.
  - Información visual.
  - Información auditiva.
  - Información táctil y térmica de piel.
  - Información olfativa y gustativa.
  - Información propioceptiva.
- Tipos de reconocimiento.
- Exactitud en la toma de información.

2. Decisión.

- Complejidad de la decisión.
- Flexibilidad en la decisión temporal.
- Conocimientos.

3. Manipulación osteomuscular.

- Carga por postura corporal.
- Carga por sostenimiento estático.
- Carga por trabajo muscular dinámico pesado.
- Carga por trabajo muscular dinámico localizado.

La clasificación científico-analítica

De igual forma se puede visualizar el análisis tipo de los requerimientos, diferenciándose los mismos en cuanto a la toma de información, la toma de decisiones y la manipulación física.

Organizar la actividad en la empresa ⟶ conocer el contenido de actividades desarrolladas por cada puesto de trabajo, como ser: prevención de los riesgos que la actividad implica, asignación de la persona idónea y asignación de remuneración acorde.

Evaluación de los requerimientos ⟶ método sistemático de evaluar comparativamente las dificultades que presenta una tarea dada. En este tipo de análisis ergonómico ⟶ el sistema laboral, la descripción de la tarea y la especificación de los requerimientos.

a. **Sistema laboral** ⟶ identificación del puesto de trabajo, donde se diferencia cada puesto de todos aquellos que no tengan las mismas características, por medio de:

- Nombre de la empresa.
- Área de la actividad.
- Nombre del analista.
- Fecha del análisis.
- Nombre del puesto. El nombre debe expresar el contenido del trabajo.
- Departamento a que pertenece.
- Sección a que pertenece.
- Código mediante números y letras que clasifican lo arriba mencionado.

b. **Análisis de la tarea** ⟶ ordenar y explicitar por orden de importancia cada una de las tareas de acuerdo a su finalidad. Por ejemplo: determinar que utilidad tiene cada fase del proceso de fabricación. Especificar los materiales y medios de elaboración que se emplean.

c. **Análisis de los requerimientos**. ⟶ exigencias al hombre:

- Experiencia.
- Conocimientos.
- Iniciativa.
- Responsabilidad.
- Esfuerzo físico.
- Esfuerzo mental.
- Condiciones del medio ambiente.

Del análisis de las características del trabajo ⟶ determinar que peligro acarrea un desempeño incorrecto, ⟶ cuáles son los riesgos de enfermedades profesionales y que actividades efectuadas por un puesto de trabajo afectan la seguridad de otras personas.

Evaluación

En los procedimientos científicos de análisis de trabajo ⟶ evaluación del ser humano ⟶ tarea, bajo condiciones internas y externas.

Las condiciones internas como son la fuerza muscular, el riego sanguíneo, los tiempos de reacción, la aptitud para trabajar en grupo, etc. Están dadas por medio de las características físicas y psíquicas del operador humano.

Bajo condiciones externas se entiende, por ejemplo, el tiempo trabajado en relación al día, la semana, el mes, el año, la duración y distribución de las pausas, y el tipo de medio de elaboración, el clima, el polvo, los contaminantes tóxicos, el ruido, las vibraciones, la iluminación, perteneciendo también a este tipo de condiciones la interrelación personal con los compañeros y superiores.

Aplicaciones

- Prevención de riesgos.   • Planificación del personal.   • Planificación de la producción.   • Otros fines.

En el análisis del trabajo los objetivos básicos que se deben tener en cuenta para la prevención de accidentes, son entre otros:

- Movimientos o actitudes posturales que impliquen lesión.
- Determinación de los medios de elaboración necesarios para efectuar una actividad sin riesgos.
- Determinación de los requerimientos necesarios para un desempeño seguro de la actividad laboral (aptitudes, actitudes).

Las condiciones ⟶ sometido el hombre en distintas regiones y países influyen ⟶ implementaciones de estudios realizados en otras latitudes ⟶ inaplicables sin una previa adaptación. El éxito de la utilización del procedimiento AET depende fundamentalmente de una planificación detallada y una ejecución minuciosa.

Los efectos de rentabilidad ⟶ mayor flexibilización de las actividades, las cuales apuntan a una mayor productividad y una reducción del número de accidentes, ausencias, etc.

De un análisis que surgió de la lista de participantes a los seminarios sobre el procedimiento AET surgen las especialidades o áreas de trabajo cuyo interés más gravitante se centra en:

- Departamento de estudio de trabajo.
- Organización y elaboración de datos.
- Grupos de proyecto para la conformación de trabajo.
- Administración de personal.
- Departamentos de seguridad industrial.
- Servicio médico de empresas.

Este grupo de usuarios se ordena jerárquicamente de la siguiente forma:

- Niveles de apoyo a los mandos superiores (por ejemplo, servicio de medicina del trabajo, departamento de ergonomía).
- Niveles de conducción de mandos medios (por ejemplo: conductor de grupos, jefe de departamento de preparación de trabajo).
- Pertenecientes a institutos de investigación del trabajo y asesores de empresa independientes.

La importancia de la configuración del grado o nivel de la actividad laboral ⟶ incremento de la complejidad en los sistemas de fabricación y administración ⟶ mayor el número de las diferenciaciones o calificaciones de los puestos de trabajo. La discriminación de las diferencias ⟶ establecer compensaciones justas. Los efectos de rentabilidad ⟶ mejor flexibilización de las actividades ⟶ mayor productividad, reducción del número de accidentes, ausencias, etc.

Diseño sostenible

Línea de tiempo

WILLIAM MORRIS - Arts&Crafts

BUCKMINSTER FULLER- Nave espacial Tierra

70 CRISIS PETROLERA

VICTOR PAPANEK- Design for the Real World

90´s ECODISEÑO

2000 - ODM & ODS

MÉTODOS PARA CONOCER AL USUARIO

DCU/DCP/UCD

TREND ANALYSIS

- El método Trend Analysis ayuda a identificar y analizar las necesidades del usuario y las oportunidades de la empresa para desarrollar estrategias para la empresa, visiones de diseño y nuevas ideas de producto.
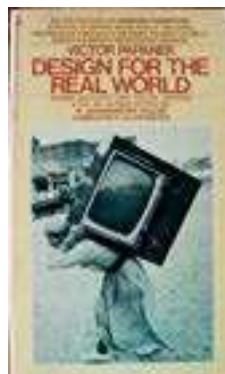
Cuándo?

- Las tendencias son cambios en la sociedad que se dan en periodos largos de tiempo, entre 3 y 10 años. No está relacionado únicamente a la evolución de las preferencias de las personas como la moda o la música, sino al desarrollo de la economía, política y tecnología.
- Se utiliza en el inicio de un proyecto de diseño o en la etapa de desarrollo estratégico.
- No solo puede ser una fuente de inspiración, también ayuda a identificar los riesgos envueltos en la introducción de nuevos productos.

TREND ANALYSIS

Cómo?

- Con este método se busca encontrar respuestas a las siguientes preguntas: Qué desarrollo en los campos de la sociedad, mercado y tecnología se puede esperar en los próximos 3 a 10 años? Cómo estos se relacionan entre ellos? En qué puntos se estimulan y en qué puntos se bloquean? Cómo las tendencias influencian en el desarrollo de estrategias de una organización? Cuales son las amenazas y las oportunidades? Cuántas ideas de nuevos productos y servicios podemos desarrollar conociendo lo básico de las tendencias?
- Para el análisis, una pirámide de tendencias puede ser usada. Las tendencias pueden ser analizadas en cuatro niveles:
  - Una micro-tendencia está al nivel de un producto y tiene un horizonte de un año.
  - Una midi-tendencia está a nivel del mercado y tiene un horizonte de uno a cinco años.
  -

TREND ANALYSIS

- ○ Una maxi-tendencia está a nivel del consumidor y tiene un horizonte de cinco a 10 años.
- ○ Una mega-tendencia está a nivel de sociedad y tiene un horizonte de 10 a 30 años.

Posible proceso

1. Enlistar una gran cantidad de tendencias posible. Identificar las tendencias a partir de diferentes variedades de fuentes como periódicos, revistas e internet.
2. Usar checklist as DEPEST, que te ayudará a realizar preguntas relevantes y estructuras los hallazgos. D= Demográfico, E= Ecológico, P= Político, E= Económico, S= Social, T= Tecnológico.
3. Remover las tendencias que son similares e identificar las jerarquías. Identificar cuales tendencias están relacionadas y definir relaciones.

TREND ANALYSIS

4. Colocar las tendencias en una pirámide de tendencias, hacer varias tendencias de acuerdo a la estructura DEPEST.
5. Identificar direcciones interesantes para nuevos productos o servicios basados en las tendencias. Combinar tendencias, esto puede ayudar a inspirar nuevas propuestas de productos o servicios.
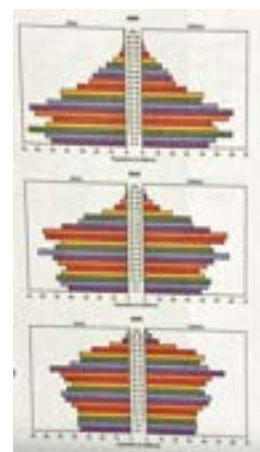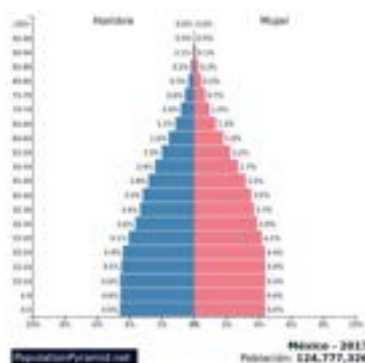
TREND ANALYSIS

Tips

- En el primer paso, enlistar cuantas más tendencias se puedan, no poner atención a redundantes o similares.
- Examinar tendencias es útil por dos razones: provee de una herramienta que ayuda a procesar una gran cantidad de información generada. Y ayuda a evaluar las consecuencias de las tendencias.
- Se puede utilizar para identificar preferencias del grupo objetivo.
- Utiliza la mayor cantidad de fuentes posibles.

MÉTODOS PARA CONOCER AL USUARIO

DCU/DCP/UCD

ETAPAS

- Descubrir
- Definir
- Desarrollar
- Evaluar y decidir
- Articular y simular
- Aprender
- Observar
- Preguntar
- Probar

Descubrir/Observar

Tiene métodos que pueden ayudar a descubrir elementos/información y crear conocimiento/entendimiento mientras se diseña.

Observar a las personas para descubrir qué hacen, más bien de que digan/cuenten qué es lo que hacen

FOCUS GROUP/GRUPOS FOCALES

- Grupo en el cual se trataran diferentes temas referente a un producto o a un tema de discusión.
- Por lo general está conformado por personas del grupo objetivo, del producto que se está desarrollando. (Recomendado de 6 a 10 participantes)

Cuándo?

- Puede ser utilizada en las diferentes fases del proceso de desarrollo de producto.
- **Investigación**: Información contextual sobre productos, uso y opiniones del usuario sobre productos existente.
- **Comprobación**: Probando conceptos, para la retroalimentación correspondiente o para escoger los conceptos propuestos.
- Para conocer la opiniones y necesidades de los usuarios sobre el tema/objeto.

FOCUS GROUP/GRUPOS FOCALES

Cómo?

- Por lo menos 3 sesiones con el grupo objetivo.
- Participantes (6-10), un moderador, uno para recolección de la información. Moderador (persona con experiencia y carisma para conducir)
- Hacer una prueba, para moderar o verificar la lista de temas.
- El focus group puede ser combinado con collages.
- También se puede hacer grupos en línea.
- Los resultados dependen de los objetivos: necesidades de los usuarios, ideas para nuevos productos, aceptación del producto, percepción de desventajas o problemas con productos existentes.

FOCUS GROUP/GRUPOS FOCALES

Tips

- Empezar con temas generales del tema a tratar. Ejemplos de usabilidad de productos o conceptos de productos, para que los participantes entiendan el contexto.
- Cuando se está probando conceptos, la explicación y presentación de los mismos es crucial.
- Conceptos claros, y siempre preguntar a los participantes si es claro.
- Distribuir el tiempo en los temas (organización)
- Ilustrar los descubrimientos con frases de los participantes.

FOCUS GROUP/GRUPOS FOCALES

Posible proceso

- Hacer una lista de temas (guía de temas), problemáticas, ejemplos o preguntas particulares.
- Testear los temas en una prueba piloto y si es necesario cambiar.
- Invitar a los participantes,del grupo objetivo (escoger las características del usuario)
- Hacer el grupo focal, lleva entre 1:30 a 2 horas. Por lo general documentado (video, fotos, apuntes), luego se realiza transcripción y análisis.
- Analizar y reportar los resultados, mostrar las opiniones más importantes, ilustrar por temas el marco de opiniones.

FOCUS GROUP/GRUPOS FOCALES

Limitaciones

- Si los participantes no tienen experiencia con el producto, no hay grandes resultados.
- Los resultados depende de los participantes y sus personalidades. Depende del manejo del moderador.

MÉTODOS PARA CONOCER AL USUARIO

DCU/DCP/UCD

ENTREVISTAS

Son consultas cara a cara que pueden ser útiles para entender la percepción de los consumidores, opiniones, motivaciones y preocupación con el desempeño de productos y servicios, o también el conocimiento de un experto en el campo.

Cuándo?

- Provee de conocimiento y ayuda a comprender mejor un determinado fenómeno/contexto/problema
- Puede ser utilizada en las diferentes fases del proceso de desarrollo de producto.
- **Investigación**: Información contextual sobre productos o sobre problemas
- **Comprobación**: Probando conceptos, para la retroalimentación correspondiente.
- Cuando el desarrollo del producto, no es completamente nuevo para los usuarios.

ENTREVISTAS

Cómo?

- Hacer una guía del tema. Que abarque todos los temas relevante.
- Relacionar las respuestas y retroalimentación del entrevistado.

Tips

- Atmósfera relajada sin distractores y proveer de refrescos/café/caramelos/etc.
- Empezar con temas generales del tema a tratar.
- Distribuir los temas durante el tiempo concedido
- Si se utiliza apoyo, que sea de buena calidad.

ENTREVISTAS

Posible proceso

- Hacer una guía, incluir una lista de temas, basado en la investigación previa.
- Invitar los correctos entrevistados, Dependiendo del objetivo, entre 3 y 8 personas.
- Realizar las entrevistas, por lo menos una hora de entrevista, y se debe grabar (solicitar permiso para hacerlo).
- Hacer la transcripción o hacer un sumario de notas
- Analizar la transcripción o el sumario de notas y realizar las conclusiones.

ENTREVISTAS

Limitaciones

- Los entrevistados sólo pueden responder cosas del tema que conocen a consciencia.
- Los resultados dependen de las habilidades del entrevistador.
- Los resultados son cualitativos no cuantitativos.

ENTREVISTAS

https://www.youtube.com/watch?v=uTzQEfPr7L0&t=14s

https://www.youtube.com/watch?v=tOEJToVU_I0

MÉTODOS PARA CONOCER AL USUARIO

DCU/DCP/UCD

CUSTOMER JOURNEY/DIARIO DEL CONSUMIDOR

- El Diario del consumidor ayuda a tener percepciones en todas las etapas que atraviesa el consumidor mientras experimenta el uso de un producto o servicio.

Cuándo?

- Se puede utilizar durante todo el proceso del proyecto.
- En el inicio del proyecto a través de la investigación que te guía hacia el diario del consumidor; una representación gráfica de las etapas que el consumidor atraviesa.
- Durante las fases posteriores del proyecto el diario del consumidor ayuda a encontrar información faltante.

CUSTOMER JOURNEY/DIARIO DEL CONSUMIDOR

Cómo?

- Con el diario del consumidor se gana un entendimiento profundo del proceso que los usuarios atraviesan cuando utilizan productos o servicios para alcanzar su objetivo.
- Una de las fallas comunes de los diseñadores es que se desarrollan puntos de diseño, es decir elementos puntuales que muchas veces trabajan bien individualmente pero en conjunto tiene fallas, este método ayuda para que esto no suceda, y no exista experiencias indeseadas entre el producto o servicio y el usuario.
- El diario del consumidor ayuda a considerar experiencias complejas y proponer diseño de productos o servicios que generen valor al usuario y a la empresa que provee este tipo de servicios.

CUSTOMER JOURNEY/DIARIO DEL CONSUMIDOR

Posible proceso

1. Determinar el tipo de consumidor/usuario y justificar las razones por la cual se eligió. Describirlo de la manera más precisa posible y explicar como se conoce esta información (investigación).
2. Mapear las etapas que atraviesa el consumidor en un axis horizontal. Tomar el punto de vista del usuario, mapear las actividades.
3. Realizar preguntas en el eje vertical: cuáles son los objetivos de los usuarios? Qué hace el usuario? Desde el punto de vista del usuario, qué funciona? Qué no funciona? Qué emociones experimenta a través de las actividades?
4. Adicionar cualquier pregunta que sea necesaria para el desarrollo del proyecto, por ejemplo: qué tipo de objetos está utilizando el usuario? Cuáles son los elementos puntuales que el usuario encuentra?

CUSTOMER JOURNEY/DIARIO DEL CONSUMIDOR

5. Contesta todas las preguntas de cada etapa, preferiblemente desde un acercamiento interdisciplinario.

Tips
- Deja para el final del ejercicio el mapeo de elementos puntuales. No enfocarse demasiado en las necesidades de uso, sino como les gustaría utilizar.
- Utilizar el eje vertical de manera flexible.
- Usar diferentes formatos visuales.
- Pedir a los usuarios que mapeen su propia jornada, que ellos definan las etapas, pregúntales cómo perciben su experiencia de uso?, pero no limitarse al lado emocional.
- Combinar en la investigación datos cuantitativos y cualitativos.
- Utilizar el método en diferentes etapas del proyecto.

MÉTODOS PARA CONOCER AL USUARIO

DCU/DCP/UCD

MAPA PERCEPTUAL

- Son representaciones visuales sobre lo que piensan los consumidores acerca de productos y marcas.
- Ayuda a evaluar cómo el consumidor/usuario percibe tu producto o marca en relación con la de los competidores.

Cuándo?

- Es una herramienta útil para construir una estrategia de marketing efectiva.
- Se puede utilizar para productos existentes y para nuevos productos.
  - Para los existentes, ayuda a la evaluación de fortalezas y debilidades respecto a la competencia. Se puede encontrar fuentes y ventajas para la competitividad de la compañía.
  - Para los nuevos productos o marcas, esta herramienta nos ayuda a identificar oportunidades de mercado.

MAPA PERCEPTUAL

Cómo?

- Para desarrollar esta herramienta no se requiere mucha experticia ni experiencia.
- Se requiere objetividad al colocar la información.

Tips

- Si la disposición es cercana es indicador de una intensa competitividad, por el contrario si se encuentran lejos, la competencia entre ellos es menor.
- Lugares en el mapa donde no hay marcas ni productos, demuestra una brecha de competencia, lo que se traduce en oportunidades para la propuesta, si es que los consumidores están interesados.

MAPA PERCEPTUAL

Posible proceso

1. Identificar los atributos, por ejemplo precio e innovación .
2. Identificar los productos/marcas competidoras.
3. Preguntar a los posibles usuarios/consumidores calificar cada producto/marca con respecto a los atributos.
4. Consultar a los posibles usuarios/consumidores cuan importante son estos atributos.
5. Comenzar con los atributos más importantes y colocar los resultados de los pasos 3 y 4 en el mapa. Repetir con otro par de atributos.

MAPA PERCEPTUAL

Limitaciones

- Solo se pueden representar dos atributos por vez en el mapa, si existen más atributos se deben realizar algunos mapas.
- Un mapa perceptual representa la percepción de una marca/producto en un específico punto en el tiempo. Tienen que ser actualizados regularmente, particularmente si el mercado es cambiante.
- Esta herramienta puede indicar oportunidades, pero no muestra por cuánto tiempo esa oportunidad permanecerá o si la organización está en la capacidad de desarrollarla.

MAPA PERCEPTUAL

Esquema ejemplo
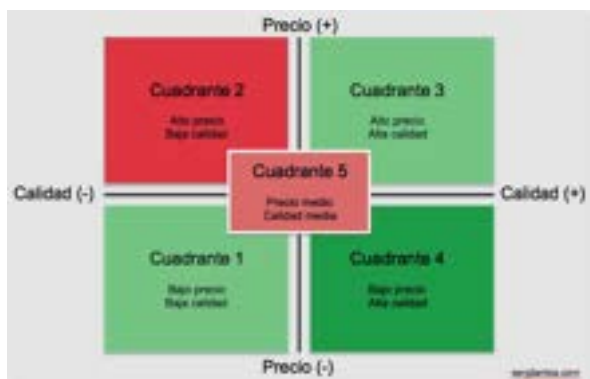
MÉTODOS PARA CONOCER AL USUARIO

DCU/DCP/UCD

CONTEXTMAPPING/MAPA DE CONTEXTO

Es un acercamiento desde el diseño centrado en el usuario que envuelve al usuario como "experto en su experiencia". Proveyendo al usuario de herramientas, el o ella pueden expresar su experiencia personal en donde un producto o un servicio juega un rol.

Cuándo?

- Es mejor usar este método en la etapa de de pre-concepto, donde hay la posibilidad de encontrar nuevas oportunidades.
- A parte de los insights sobre el proyecto, hay varios resultados, incluyendo personas, estrategias de innovación, nuevas percepciones sobre segmentos de mercado, entre otros.

CONTEXTMAPPING/MAPA DE CONTEXTO

- Se utiliza herramientas para que los usuarios puedan expresar sus experiencias de manera lúdica y de la misma manera puedan estar más conscientes de su experiencia.
- Se les pide que hagan un mapa del contexto en el que utilizan el objeto o servicio , esto les permite expresar los objetivos, motivaciones, significados, necesidades y prácticas.

Cómo?

- Antes de empezar, es mejor conocer o participar de una sesión, para entender que envuelve este método.
- Al haber hecho una previa te permite empatizar con tus participantes cuando realices tu sesión,
- También es necesario planificar con anticipación tu mapa de contexto, porque puede ser difícil encontrar participantes, tiempo y un espacio para desarrollarlo.

CONTEXTMAPPING/MAPA DE CONTEXTO

Posible proceso

1. Preparación
    1.1. Definir el tema y planificar las actividades
    1.2. Capturar tus pre-conceptos en un mapa mental.
    1.3. Realizar una investigación previa.
    1.4. Puedes entregar información previa a los participantes para que se sensibilicen ante el tema planteado. Esto permite que analisen y reflexionen sobre sus experiencias alrededor del tema.
2. Durante la sesión
    2.1. Grabar la sesión en video o audio
    2.2. Hacer varios ejercicios. Es posible también entablar una conversación en base a los materiales de estímulo.
    2.3. Hacer preguntas como: Cómo te sientes con esto? Que significado tiene para ti?
    2.4. Escribe lo que percibiste inmediatamente después de la sesión.

CONTEXTMAPPING/MAPA DE CONTEXTO

3. Análisis
    3.1. Después de la sesión, analiza los hallazgos para encontrar patrones y posibles direcciones para el diseño. Para este fin selecciona frases de las transcripciones . Debes crear un entorno visual muy rico de interpretaciones y categorías para analizar.
4. Comunicación
    4.1. Los hallazgos o resultados tienen que ser comunicados a los miembros del equipo, o al comitente.
    4.2. La buena comunicación de los resultados es necesaria, porque ayuda a la generación de ideas, desarrollo de concepto y el desarrollo del proyecto.

CONTEXTMAPPING/MAPA DE CONTEXTO

Tips

- El término contexto es definido como la situación en la cual un producto o servicio es utilizado.
- Todos los aspectos que influencian la experiencia del uso del producto o servicio son considerados valiosos. Pueden ser aspectos sociales, culturales o físicos asi como el estado interno de los usuarios, sentimientos, estado mental y más.
- Este método permite a través de la información adquirida, generar una guía para el equipo de diseño. Permite al equipo generar una estructura, reconocer barreras y oportunidades.
- Es inspiración no validación.

MÉTODOS PARA CONOCER AL USUARIO

DCU/DCP/UCD

ANÁLISIS SWOT/FODA

- Es un método que ayuda a analizar sistemáticamente la posición de una compañía/propuesta.
- Fomenta el desarrollo de un plan estratégico para la propuesta.

Cuándo?

- Se lo realiza en etapas tempranas del proceso de innovación.
- (FODA) Fortalezas y Debilidades, representan factores internos de la compañía/proyecto
- Oportunidades y Amenazas, representan factores externos que influencian a la propuesta. (competencia)
- Se construyen bloques de información que generan áreas de investigación.

ANÁLISIS SWOT/FODA

Cómo?

- Depende de un buen entendimiento de los distintos factores que influyen en el compañía/proyecto.
- Se realiza con un equipo multidisciplinario.
- Análisis externo, comprende el entendimiento del mercado actual, los usuarios, los competidores, productos y servicios similares. Buscar amenazas y oportunidades de la compañía/proyecto.
- Análisis interno, realizarlo objetivamente y con conocimiento a profundidad de la compañía/proyecto. Comprensión de las fortalezas y debilidades que tiene la compañía/proyecto.

ANÁLISIS SWOT/FODA

Tips

- Formular las amenazas como oportunidades, proyectando hacia la innovación.
- Las oportunidades se crean, no se encuentran fácilmente.

Limitaciones

- El FODA ayuda a un análisis previo, que genera áreas de investigación y profundización en algunos puntos.

ANÁLISIS SWOT/FODA

Posible proceso

1. Determinar el alcance del entorno competitivo de la compañía/proyecto. Determinar en qué lugar y tipo se la encuentra.
2. Realizar el análisis externo con preguntas como: Cuáles son las tendencias en el mercado actual? Cuáles son las necesidades y frustraciones de las personas con los productos actuales? Cuáles son las tendencias económicas y socioculturales que prevalecen? Utilizar temas como: demografía, económico, político, ecológico, sociocultural, desarrollo tecnológico.
3. Comparar las fortalezas y debilidades de la compañía/proyecto con los competidores. Centrarse en las fortalezas, no prestar mucha atención a las debilidades; se busca oportunidades y no obstáculos.
4. Sistematizar en la matriz SWOT/FODA.

ANÁLISIS SWOT/FODA

Matriz

Métodos para conocer al usuario

PERSONAS

PERSONAS

Es un método que representa un arquetipo de un usuario, describiendo y visualizando su comportamiento, valores y necesidades. Este método ayuda a entender y comunicar este comportamiento, valores y necesidades de la vida real en el proyecto de Diseño.

Cuándo?

- La investigación sobre el usuario está terminada, se utiliza para resumir y comunicar lo que se ha encontrado.
- Se puede utilizar durante la conceptualización, o cuando se realiza la evaluación con los miembros del equipo y los grupos objetivos que envuelven al proyecto.
- Se utiliza para tener un entendimiento consistente de los usuarios, sus valores y necesidades.

PERSONAS

Cómo?

- Recoger información acerca de los probables usuarios, haciendo investigación cualitativa, usando técnicas de mapas de contexto, entrevistas y observación.
- En base a esta información se construye el conocimiento sobre los posibles usuarios: patrones de comportamiento, puntos en común, particularidades y diferencias; se debe incluir todo tipo de detalles.
- Se agrupan los usuarios en base a sus similitudes y así se construye los arquetipos de usuarios que representa un grupo específico.
- Cuando las características de los representantes están claras, se pueden visualizar, nombrar y describir.
- Usualmente un número limitado de Personas por proyecto, cerca de tres o cinco es suficiente.

PERSONAS

Posible proceso

1. Recolectar a una gran cantidad de información y detalles acerca de los posibles usuarios.
2. Seleccionar las características que son las más representativas del grupo objetivo y las más relevantes para el proyecto.
3. Crear de 3 a 5 Personas:
   a. Dar a cada una un nombre
   b. Escoger un formato por Persona para asegurar una buena visión global de cada una.
   c. Utilizar texto y la foto de una persona que representa el arquetipo de usuario, además de imágenes de su contexto material, además de frases relevantes de usuario.
   d. Incluir algunos datos demográficos como la edad, educación, trabajo, etnia, religión y status de familia.
   e. Incluir sus responsabilidades y objetivos.

PERSONAS

Limitaciones

No puede ser utilizada independiente. Se necesita personas reales para testear y evaluar el diseño.

Tips

- Se pueden utilizar las personas para hacer storyboards.
- Ayuda para enfocarse en un usuario específico.

USUARIO

—

TIPOS DE USUARIOS

DEFINICIÓN

—

Según la RAE:

1. adj. Que usa algo. U. m. c. s.

2. adj. *Der.* Dicho de una persona: Que tiene derecho de usar de una cosa ajena con cierta limitación. U. m. c. s.

3. adj. *Der.* Dicho de una persona: Que, por concesión gubernativa o por otro título legítimo, goza un aprovechamiento de aguas derivadas de corriente pública. U. t. c. s.

VS.

1. adj. Que consume.

2. m. y f. Persona que adquiere productos de consumo o utiliza ciertos servicios.

USUARIO DIRECTO

—

PERSONA QUE
VA A INTERACTUAR
DIRECTAMENTE CON
EL OBJETO O SERVICIO.

USUARIO INDIRECTO

PERSONA QUE **NO** VA A INTERACTUAR DIRECTAMENTE CON EL OBJETO O SERVICIO.

USUARIO EXPERTO

PERSONA QUE CONOCE DE LA ACTIVIDAD DESDE VARIOS ASPECTOS, A VECES TÉCNICOS, CONOCEN COMO DEBE FUNCIONAR UN OBJETO.

USUARIO EXTREMO

AQUELLAS PERSONAS QUE TIENEN UN COMPORTAMIENTO POCO COMÚN RESPECTO AL CONSUMO O USO DE UN SERVICIO Y SE ALEJAN DE UN USUARIO COMÚN.

LISTA DE REQUERIMIENTOS

- Una lista de requerimientos muestra las características importantes que la propuesta de diseño debe alcanzar para ser exitosa.
- Describe concretamente los objetivos de diseño y puede ser utilizado para escoger las ideas de las propuestas.

Cuándo?

- La lista de requerimientos es redactada en base al análisis de toda la información revisada sobre el problema de diseño.
- Un producto es "bueno" en la medida en que cumple con la lista de requerimientos.
- La lista de requerimientos va evolucionando durante el proceso de desarrollo del producto mientras que la propuesta se va volviendo más concreta y detallada.

LISTA DE REQUERIMIENTOS

Cómo?

- Es necesario crear una estructura que te ayude a encontrar la solución.
- Al principio servirá como una check list.
- Se debe buscar más información para asegurar requerimientos válidos y concretos.
- En el proceso nuevas perspectivas sobre el problema de diseño van generando nuevos requerimientos. Por esto los requerimientos deben ser revisados, actualizados o cambiados si fuera necesario.

LISTA DE REQUERIMIENTOS

Tips

- Definir en términos numéricos, cuantificables.
- Mencionar las fuentes de donde se saca la información.
- Darle una estructura numérica para poder referenciarlos.
- Usar más de una check list para complementarlas.

Limitaciones

- Pasar mucho tiempo en la lista de requerimientos puede perjudicar la fase creativa.
- Proceso iterativo.

LISTA DE REQUERIMIENTOS

Posible proceso

1. Realizar una estructura basada una check list para generar los requerimientos.
2. Definir tantos requerimientos como fuera posible.
3. Identificar la carencia de conocimiento, que necesita ser reunida mediante investigación.
   - Determinar valores en términos de características observables o cuantificables.
   - Hacer una distinción entre demandas (deben ser alcanzadas) y deseos (ideas o propuestas).
4. Eliminar requerimientos que son parecidos o que no ayudan a escoger entre propuestas. Definir si existe una jerarquía en los requerimientos.
5. Procurar que:
   - Cada requerimiento debe ser válido
   - No ser redundante
   - Debe ser concisa
   - Sean factibles y operativos

DEFINICIÓN DEL PROBLEMA

- Para empezar a trabajar es necesario asegurarse que se va a trabajar sobre el problema correcto.

Cuándo?

- Al final de la fase de análisis del problema.
- Son definidos de acuerdo al dueño del problema.
- Es la descripción del estado actual de una situación, sumándole todas las causas que lo provocan y la situación deseable.

Cómo?

- Definiendo correctamente el problema.

DEFINICIÓN DEL PROBLEMA

Tips

- Hacer una jerarquia de problemas . Empezar con un grande y dividirlo en pequeños pensando en causas y efecto.
- El problema puede ser reformulado como una oportunidad, para motivar al equipo.

Limitaciones

Definir el problema no lo resuelve.

DEFINICIÓN DEL PROBLEMA

Posible proceso

- Responder las siguientes preguntas puede ayudar de definir el problema.
  - Cuál es el problema?
  - Quien tiene el problema?
  - Cuáles son los factores relevantes del contexto?
  - Cuáles son los objetivos?
  - Cuáles son los efectos secundarios a ser evitados?
  - Qué acciones son admisibles?
- El resultado es una descripción estructurada del problema de diseño. Con una clara descripción de la situación deseada y la posible dirección.

CONCEPTO DE DISEÑO

CONCEPTO?

- Idea, representación mental de una realidad, un objeto o algo similar.
- Opinión, juicio, idea que se tiene sobre algo.
- Aspecto, calidad, título.
- Idea que concibe o forma el entendimiento
- Determinar algo en la mente después de examinadas las circunstancias

CONCEPTO DE DISEÑO

FORMA

- Características formales (accidentes y cualidades).
- Características connotativas del objeto.
- Materialidad.
- Principios de configuración de diseño (Leyes de la Gestal, elementos de ordenamiento).

FUNCIÓN

- Características denotativas del objeto.
- Características formales: Arquetipo (modelo mental), (calidad).

Denotación

Connotación

SCAMPER

Es un método creativo que puede ayudar a crear ideas a través de la aplicación de siete heurísticas (conjunto de métodos o técnicas para resolver problemas): **s**ustituir, **c**ombinar, **a**daptar, **modificar**, **poner en otro uso**, **e**liminar y **reservar**.

Cuándo?

- SCAMPER se utiliza en una etapa tardía de la generación de ideas, cuando las ideas iniciales o los conceptos ya existen.
- Este método se utiliza cuando se han agotado las ideas.
- Se van creando posibilidades con SCAMPER, sin considerar factibilidad o relevancia, se pueden crear ideas inesperadas, o pasos para nuevas ideas.
- Este método se utiliza como complemento a la lluvia de ideas.

SCAMPER

Cómo?

- Cuando se utiliza este método, se va a confrontar cada idea de producto o concepto con los 7 heurísticos, preguntando un número de preguntas por método.
- Después de generar un número satisfactorio de nuevas ideas se puede proceder a agrupar las ideas, para seleccionar las más prometedoras y proceder a detallarlas.
- **S**ustituir (S)

  - Qué puede ser sustituido en la idea o concepto para mejorarlo?
  - Qué materiales o recursos pueden ser sustituidos o cambiados?
  - Qué otro producto o proceso puede ser utilizado para alcanzar el mismo objetivo?

SCAMPER

Cómo?

- **C**ombinar

  - Qué puede ser combinado para mejorar la idea o concepto?
  - Que puede pasar si se combina un producto con otro para crear algo nuevo?
  - Qué pasa si se combina los propósitos u objetivos de la idea o concepto?

- **A**daptar

  - Qué aspectos de la idea o concepto se pueden adaptar para mejorar la idea o concepto?
  - Cómo se podría adaptar o ajustar el producto para que sirva para otro propósito?
  - Qué otra cosa es cómo tu producto que se podría adaptar?

SCAMPER

Cómo?

- **M**odificar

    - Cómo podrías modificar la idea o concepto mejorarla?
    - Cómo podrías cambiar la forma, apariencia de tu idea o concepto?
    - Qué podría pasar si se magnifica o minimiza el tamaño?

- **P**oner en otro uso

    - Cómo la idea o concepto se podría poner en otro uso?
    - Se podría utilizar esta idea o concepto en otro lugar, tal vez en otra industria?
    - Cómo se comportará de diferente el producto en otro entorno?
    - Se podrá reciclar la basura para realizar algo nuevo?

SCAMPER

Cómo?

- **E**liminar

    - Qué aspectos de la idea o concepto pueden ser eliminados?
    - Cómo se puede simplificar la idea o concepto?
    - Qué características, partes o reglas se podrían eliminar?

- **R**eservar

    - Qué aspectos de la idea o concepto pueden ser reservados?
    - Qué pasaría si se reserva el proceso de uso? O si se cambia la secuencia de uso?
    - Qué pasaría si deberías hacer lo exactamente opuesto a lo que se pretende con la idea o concepto?

SCAMPER

Limitaciones

- Este método es efectivo dependiendo de la disposición del diseñador.

Tips

- Este método debería estar constantemente en el pensamiento creativo, este tipo de preguntas deberían pasar todo el tiempo en la cabeza del diseñador.
- El éxito de este método está en lo desafiante de las preguntas, el desafío a la creatividad del diseñador.
- Evitar las críticas a los resultados obtenidos, y a la sideas ireales.
- Cambiar de actitud para la etapa de elección de alternativas, fase de evaluación y selección.

ANALOGÍAS Y METÁFORAS

Podemos usar las analogías y las metáforas para buscar inspiración .

Cuándo?

- Durante la generación de ideas.
- Las analogías son utilizadas para la conceptualización, empezando por la clara definición de un problema.
- Se pueden utilizar analogías cercanas o lejanas al problema.
- Las metáforas son utilizadas para encuadrar el problema y analizar.
- Son utilizadas para comunicar mensajes particulares a los usuarios.
- Al utilizar metáforas la inspiración debería ser posible relacionar.

ANALOGÍAS Y METÁFORAS

Cómo?

- Buscar material que nos inspire.
- Si queremos más creatividad, podemos buscar en dominios lejanos.
- Cuando se encuentre el material, cuestionarse porque se asocia este recurso de inspiración con la propuesta de diseño.
- Luego se decide cual se va a implementar, analogía o metáfora en la nueva solución de diseño.
- Cuando se realice analogías tener cuidado en no copiar o trasladar los atributos a la solución de diseño.
- Buscar cambiar y potenciar las soluciones a través de la abstracción y transformación.

ANALOGÍAS Y METÁFORAS

Posible proceso

- Encuadre
    - Analogía: el problema de diseño a ser resuelto.
    - Metáfora: cualidades de la experiencia que se quiere brindar al usuario a través de la solución del problema de diseño.
- Búsqueda
    - Analogía: situaciones o ejemplos donde el problema haya sido resuelto exitosamente.
    - Metáfora: concreta de una entidad que tenga las cualidades que se quiere transmitir.
- Aplicación
    - Analogía: Recuperar y procesar los recursos del campo de inspiración. Abstraer, transformar y transferir a la solución del problema de diseño.
    - Metáfora: Recuperar los recursos del campo de inspiración. Abstraer la esencia de las propiedades. Transformarlas para la aplicación en la solución del problema.

ANALOGÍAS Y METÁFORAS

Limitaciones

- Puede llevar mucho tiempo encontrar e identificar las fuentes adecuadas de inspiración e información.
- Identificar si este recurso puede ser utilizado en el proyecto de diseño.

Tips

- Utilizar analogías cercanas y lejanas, el exito esta en la abstracción y transformación.
- Buscar las cualidades que se quiere enfatizar en el objeto para el uso de las metáforas. Trabajar en las referencias, hacerlas sutiles y no tan obvias.

ANALOGÍAS Y METÁFORAS

ANALOGÍAS Y METÁFORAS
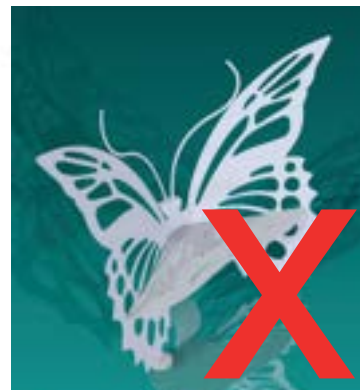
BRAINWRITING AND BRAIN DRAWING

Es una alternativa a la lluvia de ideas, y se dibuja o escribe en un papel. Este papel se lo pasa varias veces a los miembros del equipo para que se construyan ideas o se aporten a las ideas del grupo. Como en la lluvia de ideas se asume que la cantidad lleva a la calidad. (Mientras más se aporte y se trabaje, mejor es el resultado)

Cuándo?

- Estos métodos son útiles para la construcción y generación de ideas.
- Se debe evitar las críticas prematuras.
- La lista de requerimientos puede ser temporalmente olvidada.

BRAINWRITING AND BRAIN DRAWING

Cómo?

- Las críticas deben ser pospuestas: se trata de no pensar en la utilidad ni en la factibilidad.
- Esto ayudará a tener respuestas inesperadas.
- Mediar para que los participantes no se sientan ni atacados ni olvidados.
- Expresar cualquier idea que se nos presente, mientras más descabellada mejor.
- Busca combinar y mejoras a las ideas.
- Generar un ambiente seguro para los participantes.
- Proponer la mayor cantidad de ideas para que el equipo pueda trabajar. En este caso la cantidad genera calidad.

BRAINWRITING AND BRAIN DRAWING

Posible proceso

- Definir el problema.
- Divergir del problema.
- Brainwriting
    - 6x3x5 (3) participantes, (6 ideas), (5 minutos) 18 ideas en 30 min.
    - Cada participante escribe la idea en 5 minutos y se la va pasando al siguiente participante.
- Brain drawing
    - Cada participante dibuja la idea durante 3 minutos y se pasa a sus compañeros de equipo para que aporten o aumenten ideas al dibujo inicial. Este proceso se puede hacer varias veces.
- Hacer un inventario, evaluar y agrupar las ideas. Escoger con criterio las mejores.
- Escoger ideas o grupos de ideas para la siguiente fase del proceso de diseño.

BRAINWRITING AND BRAIN DRAWING

Limitaciones

- Utilizados para problemas relativamente simples.
- Expresar y comunicar las ideas a través del dibujo

Tips

- No criticar los resultados obtenidos.
- Hacer un break entre sesiones.
- Cambiar de actitud para la etapa de elección de alternativas, fase de evaluación y selección.

Diseño

Wucius Wong "El diseño es un proceso de creación visual con un propósito. A diferencia de la pintura y de la escultura, que son la realización de las visiones personales y los sueños de un artista, el diseño cubre exigencias prácticas."

"Un buen diseño es la mejor expresión visual de la esencia de "algo" ya sea esto un mensaje o un producto, el diseñador debe buscar la mejor manera de que ese "algo" sea conformado, fabricado distribuido, usado y relacionado con su ambiente. Estética y funcional."

Hay que dominar el lenguaje visual, este es la base de la creación del diseño, existen reglas, conceptos y principios para la organización visual.

Diseño bi-dimensional

elementos de relación → Son elementos gobierna la ubicación y la interrelación de las formas en un diseño.

Dirección. → La dirección de una forma depende de cómo está relacionada con el observador, con el marco que la contiene o con otras formas cercanas.

Posición → La posición de una forma es juzgada por su relación respecto al cuadro o la estructura.
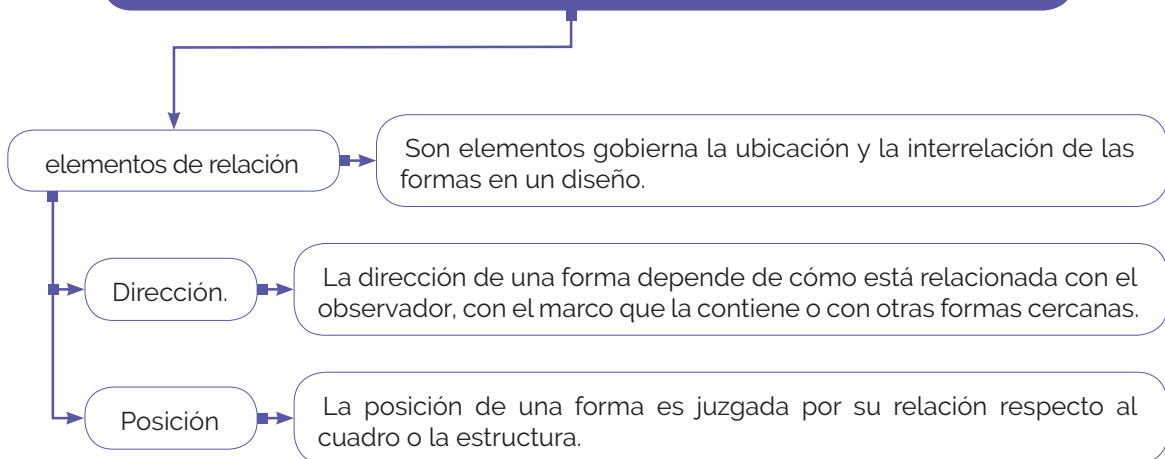
Diseño bi-dimensional

El diseño bi-dimensional, concierne a la creación de un mundo bi-dimensional mediante esfuerzos conscientes de organización de los diversos elementos, su principal objetivo es establece una armonía y un orden visual o generar una excitación visual dotada de un propósito.

elementos conceptuales ▸ No son visibles, no existen, de hecho solo parecen estar presentes.

Punto ▸ Es el elemento geométrico que indica posición, no tiene dimensión (largo, ancho o profundidad), no tiene un lugar espacialmente. Es el inicio y final de una línea y es el encuentro de dos líneas. Su posición se determina por un conjunto ordenado de coordenadas.

Es el bloque de construcción fundamental de todos los elementos y principios de comunicación visual. Es el más puro y simple de los elementos geométricos del vocabulario del diseño, componente esencial de la geometría, la física, los gráficos vectorriales y otros campos análogos.

Fenómeno abstracto que no puede verse ni tocarse. Puede aparecer solo, identificado por su propia presencia o como una serie de puntos crea una línea; una masa de puntos crea un volumen.

Diseño bi-dimensional

elementos visuales ▸ Cuando los elementos conceptuales se hacen visibles, tienen forma, medida, color y textura. Los elementos visuales forman la parte más prominente de un diseño, porque son lo que realmente vemos.

Medida ▸ Todas las formas tienen un tamaño. El tamaño es relativo si lo describimos en términos de magnitud y de pequeñez, pero asimismo es físicamente mensurable.

Forma ▸ Todo lo que pueda ser visto posee una forma que aporta la identificación principal en nuestra percepción.

Forma y punto ▸ Una forma es reconocida como un punto porque es pequeña.

La pequeñez, desde luego, es relativa. Una forma puede parecer bastante grande cuando está contenida dentro de un marco pequeño, pero la misma forma puede parecer muy pequeña si es colocada dentro de un marco mucho mayor.

La forma más común de un punto es la de un círculo simple, compacto, carente de ángulos y de dirección. Sin embargo, un punto puede ser cuadrado, triangular, oval o incluso de una forma irregular, por lo general simple.

Diseño bi-dimensional

elementos conceptuales → No son visibles, no existen, de hecho solo parecen estar presentes.

Plano → Es el recorrido de una línea en movimiento se convierte en plano. Tiene largo y ancho, pero no grosor, posee posición y dirección, limitado por líneas, define los limites extremos de un volumen.

→ Se define por límite y área

→ Contorno o aspecto espacial, o la configuración superficial características de una cosa; silueta o contorno.

→ Es bidimensional, y se define por una línea de contorno que lo encierra .

→ Tiene largo y ancho pero nunca profundidad.

→ Los planos básicos son el triángulo, el cuadrado y el círculo, todas las demás formas que son complejas derivan de estas tres.

Diseño bi-dimensional

elementos relación → Gobierna la ubicación y la interacción de las formas en un diseño:

Gravedad → Es psicológica, podemos atribuir pesantes o liviandad, estabilidad o inestabilidad, a formas o grupos de formas.

Forma → Todo lo que pueda ser visto posee una forma que aporta la identificación principal en nuestra percepción.

Forma y plano / módulo →
Geométricas
Orgánicas
Rectilíneas
Irregulares

→ Las formas más pequeñas, que son representadas, con variaciones, o sin ellas, para producir una forma mayor, se denominan módulo.

→ Un módulo puede estar compuesto de elementos más pequeños que se denomina submódulos

→ Una unidad mayor puede estar hecha por dos o más módulos en relación constante o aparecer frecuentemente en un diseño, se llama supermódulos.

Diseño bi-dimensional

elementos visuales → Cuando los elementos conceptuales se hacen visibles, tienen forma, medida, color y textura. Los elementos visuales forman la parte más prominente de un diseño, porque son lo que realmente vemos.

Textura → Se refiere a las cercanías de la superficie, de una forma.

Forma → Todo lo que pueda ser visto posee una forma que aporta la identificación principal en nuestra percepción.

Forma y línea →
- Sensación de delgadez es relativa
- Su ancho es estrecho
- Su longitud es prominente
- Hay línea conceptual, sucesión de puntos

La forma total. Apariencia general, recta curva, quebrada, irregular o trazada a mano.

El cuerpo. Tiene ancho, su cuerpo queda contenido entre ambos bordes. Las formas formas de los bordes y la relación entre ambos determinan la forma del cuerpo.

Las extremidades. Si la línea es ancha, la forma de sus extremos puede convertirse en prominente. Pueden ser cuadrados, redondos, puntiagudos o de cualquier otra forma simple.

Diseño bi-dimensional

elementos conceptuales → No son visibles, no existen, de hecho solo parecen estar presentes.

Línea → El movimiento de un punto se convierte en una línea, Una línea es una serie infinita de puntos. Forma los bordes de un plano y está limitada por puntos.

Desde el punto de vista de la geometría, una línea posee longitud, pero no anchura, posee dimensiones, tiene posición y dirección.

Una línea es la conexión entre dos puntos, o la trayectoria que recorre un punto en movimiento.

Las líneas aparecen en los bordes de los objetos y allí donde convergen dos planos.

Gráficamente, las líneas pueden tener muy distinto grosor; este, junto con la textura y la trayectoria del trazo, determina su presencia visual.

Pueden ser rectas o curvas, continuas o a trazos.

Una gráfica es una línea ascendente y descendente que describe los cambios a lo largo del tiempo, como sucede con las ondas que representan el latido de un corazón o una señal de audio.

Cuando una línea alcanza un cierto grosor, se convierte en un plano. Las líneas se multiplican para describir volúmenes, planos y texturas.

Métodos de comprobación

DCU/DCP/HCD

Evaluación del concepto de producto

Sirve para entender como los posibles usuarios o los grupos objetivos valoran tu concepto de diseño. Esto permitirá determinar que aspectos deberán ser optimizado.

Cuándo?

- Este método toma lugar a través del proceso de diseño.
- Frecuentemente se utiliza en el inicio del proceso cuando se tienen gran número de ideas y conceptos de producto.
- Optimización del concepto toma lugar cerca del final del proceso de diseño, cuando los aspectos del concepto necesitan ser mejorados.

Evaluación del concepto de producto

Cómo?

- Por lo general las evaluaciones se las realizan en entornos controlados, donde un panel de personas juzgan los conceptos en base a una lista predeterminado de requerimientos.
- Para la optimización de conceptos se toma en cuenta partes o elementos del producto. Para esto se puede utilizar: Conceptos textuales (escenarios, como las personas usarían el objeto, o enumerar los aspectos del producto) Conceptos pictográficos (representaciones gráficas de las ideas del producto), animaciones (representaciones del producto o el escenario), mock-ups (modelos 3D)

Evaluación del concepto de producto

Posible proceso

1. Describir el objetivo de la evaluación del concepto de producto
2. Determinar qué tipo de evaluación del concepto de producto se quiere realizar, por ejemplo entrevistas personales, focus groups o grupos de discusión.
3. Crear las representaciones adecuadas del concepto.
4. Concebir un plan: objetivos y tipo de evaluación, descripción de los participantes, aspectos del concepto que se quiere evaluar, descripción del entorno donde se realizará la evaluación, un plan de cómo se analizarán los resultados.
5. Buscar e invitar a los participantes.
6. Crear el ambiente de evaluación, incluir el equipo para recopilar información (camara, video).
7. Realizar la evaluación. Analizar los resultados, y mostrar los resultados.

Evaluación del concepto de producto

Tips

- Es importante la selección de los participantes, serán parte de los grupos de usuarios objetivos.
- Se pueden seleccionar basados en características socioculturales o demográficas.
- Se debe tomar en cuenta el conocimiento del usuario sobre la tipología del producto. Se puede preguntar experiencias previas con objetos similares.
- Tener en cuenta aspectos psicológicos relacionados a la innovación o tolerancia.
- Otro elemento que se debe analizar es el grado de conservador o innovador de los participantes.
- Proveer a los participantes con algún incentivo o compensación.

Métodos de comprobación

DCU/DCP/HCD

Medición de emoción (PREMO)

PREMO es un instrumento no-verbal y de auto-información que mide la respuesta emocional de los usuario hacia los productos.

Cuándo?

- PREMO ayuda a responder interrogantes: qué emociones son evocadas por estímulos como productos, packaging o fragancias?
- Se pueden utilizar en varias etapas para comprobar impacto emocional de productos existentes o nuevos conceptos de productos. Los participan utilizan personajes animados para expresar sus respuestas emocionales.
- PREMO mide 12 emociones, seis positivas y seis negativas, el resultado es un perfil emocional detallado.

Medición de emoción (PREMO)

Cómo?

- El método ha sido desarrollado para diseñadores que no tienen experiencia midiendo respuestas emocionales a productos o conceptos de productos.
- Esta funciona en una plataforma online que permite la generación de información cuantitativa
- Se requiere algo de experiencia y conocimiento para el análisis de esta información.
- Los resultados pueden ser utilizados para diferentes objetivos, como un input para el diseño de un nuevo producto, o para formular puntos de referencia emocionales, o para la selección de conceptos de diseño.
- Se utiliza como método de comunicación en equipos de diseño para alcanzar un conocimiento compartido del impacto emocional de determinado producto.

Medición de emoción (PREMO)

Posible proceso

1. Se puede diseñar plantillas para medir emociones en la plataforma online.
2. La plataforma incluye un módulo de diseño y uno de experimentación.
   a. Módulo de diseño
      i. Crea tu propia plantilla, cargando los estímulos (texto o imágenes) que se quiere medir.
      ii. Selecciona las emociones que se quiere medir.
      iii. Determina el lenguaje de la plantilla
      iv. Formular textos de introducción e instrucciones, estos estarán disponibles para los participantes en el módulo de experimentación.

Medición de emoción (PREMO)

Posible proceso

1. Módulo de experimentación.
   i. Prueba tu plantilla
   ii. Envía a los participantes el link para la participación individual.

Limitaciones

- Este solo puede medir emociones: atracción, facinación, aburrimiento e insatisfacción.
- Solo en relación a estímulos definidos como productos o fragancias.

Medición de emoción (PREMO)

Evaluación de usabilidad

Sirve para validar la usabilidad del producto, permite entender la calidad de tu diseño (ideas o conceptos) mediantes las condiciones de uso. Se puede modificar la propuesta en base a los resultados obtenidos por este método.

Cuándo?

- La evaluación de usabilidad se puede realizar en diferentes puntos del proceso de diseño. En cada punto del proceso se van a evaluar diferentes elementos:
  - En el inicio se prueba y analiza el uso de productos similares ya existentes.
  - En una etapa temprana se pueden evaluar ideas y conceptos utilizando sketches, escenarios o storyboards para simulación.

Evaluación de usabilidad

- - Siempre, se evalúa el uso en el desarrollo de diseño intermedio o final, utilizando modelos en 3D que pueden simular específicamente forma y su funcionalidad.
  - Hacia el final se evalúa el uso de prototipos casi totalmente funcionales.
- Adicionalmente se descubren información útil como errores y malentendidos, posibles mejoras para solventar estos descubrimientos y oportunidades para perfeccionar la seguridad y la experiencia de uso del objeto por parte del usuario.
- Los resultados de las evaluaciones ayudan para generar requerimientos de eficiencia, efectividad y satisfacción.

Evaluación de usabilidad

Cómo?

- Usar una representación del objeto, observar a los usuarios en situaciones reales. Observar que señales de uso ellos perciben y encuentran durante el uso del objeto. Percepción y Cognición, como a través de estos elementos pueden alcanzar el objetivo.
- Observar el uso destinado y no del objeto.
- Se requiere una buena preparación con materiales y participantes. Para obtener una evaluación cualitativa se necesita por lo menos de 4 a 10 personas.
- El resultado es una lista de requerimientos para el rediseño . La evaluación puede ser grabada (video y voz) o fotografiada para análisis y comunicación.

Evaluación de usabilidad

Posible proceso

- Hacer un storyboard de los usuarios reales y deseados y el uso del objeto.
- Decidir qué parte del uso del producto se necesita evaluar, cómo o en qué contexto.
- Describir los supuestos en detalle: qué características del producto los usuarios percibirán, entenderán y operarán en una situación específica. (Características de uso= señales de uso)
- Formular preguntas abiertas de investigación, así como: Como las personas utilizan el producto y Qué elementos toman como señales de uso.
- Establecer la investigación: representaciones del producto (modelos, storyboards), el contexto o ambiente, instrucciones y preguntas para los participantes.

Evaluación de usabilidad

- Preparar a los participantes, manejar las expectativas de los participantes, así como temas de privacidad. Grabar las actividades. Observar el uso destinado y no del objeto.
- Analizar los resultados cualitativamente (problemas y oportunidades) y/o cuantitativamente (contando incidencias).
- Comunicar los resultados y el rediseño del producto de acuerdo a la información obtenida. Ideas de mejora por lo general emergen durante la evaluación.

Evaluación de usabilidad

Tips

- Pedir a alguien menos involucrado en el proyecto que conduzca la evaluación para evitar influenciar a los usuarios.
- La validez de los resultados mejorarán y se incrementarán mientras se gane experiencia en la investigación.
- No se necesita reclutamiento profesional ni espacios formales. Es necesario realizar evaluaciones del proyecto. Es mejor evaluar que nunca hacerlo.
- Manejar los temas de privacidad previamente.

Métodos de comprobación

DCU/DCP/HCD

Interacción, prototipado y evaluación

Es un método que ayuda a simular y probar cómo la gente experimenta futuras interacciones con el objeto diseñado. Ayuda a evaluar conceptos en estado temprano de desarrollo. Para ajustar y seguir con el proceso.

Cuándo?

- Se usa en el prototipado de baja fidelidad y desarrollo del concepto.
- Nos ayuda a comprobar el uso que las personas harán del objeto, confrontando la idea del diseñador.
- Aplicando este método, se puede conocer feedback del usuario que ayudará a validar, mejorar o cambiar conceptos e ideas en el producto.

Interacción, prototipado y evaluación

- Ayudará a crear escenarios de interacción, para probar formas y materiales, y modificar según la experiencia del usuario.

Cómo?

- Crear prototipos de interacción es una habilidad que se aprende y se desarrolla haciéndola.
- Se puede utilizar este método flexiblemente, para visualizar, chequear y comunicar aspectos del diseño que podrían afectar las futuras interacciones con él.
- Este nos ayuda a enfocarnos en elementos a resolver en base a la interacción.
- Se recomienda utilizarlo en pequeña escala.
- Aportará a decidir características físicas, de forma y el uso del producto, para identificar vacíos de conocimiento.

Interacción, prototipado y evaluación

Posible proceso

1. Hacer un sketch de escenario o storyboard de las interacciones esperadas.
2. Crear un prototipo de interacción, versión simple y cruda del objeto, enfocándonos en los aspectos de diseño que se quiere probar.
3. Usuarios y actores deben interactuar con él como si fuera el diseño final.
   Este proceso se debe repetir varias veces hasta depurar los detalles a cabalidad. Durante este paso enfocarse en las acciones que realiza el usuario y no en las palabras. Asegurarse de que los observadores están grabando las interacciones.
4. Evaluar las experiencias y sus cualidades de interacción durante el uso.

Interacción, prototipado y evaluación

Limitaciones

Los usuarios pueden confundir este método con evaluación de usabilidad, sin embargo este método genera información sobre la interacción, cualidades y conceptos del producto.

Tips

- Se deben explorar y desarrollar varios prototipos, la construcción de prototipos mejora con la aplicación continua de este método.
- Tratar de incluir personas que conozcan de improvisación y técnicas teatrales.

Ivonne Ortiz Sánchez PhD (C)

Is a PhD candidate of the programme IDAUP-International Doctorate Architecture and Urban Planning XXXV cycle, in the curricula of (1) Architecture in the research topic: (1.2) of Inclusive design, design for all, accessibility to spaces, products and services, sustainable design.

Graduated in Design with a mention in Product Design from the Faculty of Architecture, Design and Arts (FADA) of the Pontifical Catholic University of Ecuador (PUCE) in 2009. She studied at the University of Lisbon in the Faculty of Fine Arts (FBAUL) in the Máster of Equipment Design and obtained the title of Máster in Equipment Design with specialisation in Design Studies in 2014. In the professional field, she has been involved in different areas of design such as products, graphics, editorial, equipment and fashion.

Since 2015 is a full-time tenured professor in the Product Design Career at FADA-PUCE. Ivonne Ortiz has been responsible for different activities in the career such as: (1) academic programming between 2017 and 2019; (2) led the career redesign project in 2018 and was responsible for its implementation between 2018 and 2022; (3) Coordinator (Director) of the Product Design Career from June 2020 to June 2022; (4) leader of the theoretical area of the career, has developed and updated the chairs in this area. Her chairs are: User-centred Project, History of Product Design and Semiotics of Product Design.

Her research began in the FADA-PUCE with the final grade project "El Ecodiseño bajo un Pensamiento Latinoamericano, estado de la cuestión. And continue in FBAUL with the thesis for the Máster degree "Ethics and Design: Ethical Responsibilities of the Design Project", after these projects She researches on issues related to sustainability in design, ethics, philosophy, theory, methodology and design criticism.

During the IDAUP program, she has been involved in different research activities such as publications, lecturers, courses and workshops proposed by UNIFE and POLIS University, expanding her knowledge. Below them will be synthesised.

EDUCATIONAL ACTIVITIES	YEARS	DESCRIPTION
Interdisciplinary activities	1st year	1. English Lectureship 2. Italian Language for foreign students
	2nd year	1. Corso di Informatica avanzata eLinguaggio ¡R Modulo Base+Modulo specialistico di áreaScientifico-Tecnologica 2. EU Project MASCOT: Initial proposal, grant agreement and successive developments 3. European innovation Council 4. APRE Modulo 7 e 9 "General Annex & Valutazcione""MGA" 5. Terza Missione, Trasferimento tecnologico e Tutela della proprietà intellettuale"
	3rd year	1. Corso di Ética 2022 2. Certificazione linguística Cambridge ESOL - Livello CAE - C1
DA Teaching activities	1st year	6th Ferrara International PhD Workshop IDAUP II Edition 2019 *"The innovation race. Strategies for new research challenges"*.
	2nd year	7th Ferrara International PhD Workshop IDAUP III Edition 2021 *"Digital Transition in Research"*.
Polis Teaching activities	1st year	*"Rethinking Gjirokastra"*. Can architecture and city planning stimulate hope and growth for shrinking cities? - International PhD workshop

CONFERENCES ATTENDACE	YEARS	DESCRIPTION
Lecturer and publication in proceedings	1st year	Bienal Iberoamericana de Diseño (BID) 2019_Foro de Innovación Docente: *Diseño por los refugiados*. Madrid, España.
	2nd year	XVIII Congreso Latinoamericano de Enseñanza y Diseño. Innovation in teaching and design: *El Taller de Diseño Centrado en el Usuario*. Buenos Aires, Argentina.
	3rd year	1. Bienal Iberoamericana de Diseño (BID) 2021_Foro de Innovación Docente: *La Historia de Diseño como reflexión sobre la practica*. Madrid, España. 2. Investigación en Diseño 2023, 2da edición_Red de Investigadores en Diseño: *Perspectivas de Enseñanza en Diseño*. Buenos Aires, Argentina.

PUBLICATIONS	YEARS	DESCRIPTION
PhD Candidate Publications	1st year	*Diseño por los refugiados* (ISBN 978-84-09-21554-6) Madrid, España.
	2nd year	1. *Del Mullu a Ianamullu:desarrollando un envase para chocolates basado en la historia del cacao y de la Spondylus.* (co-author) (ISBN:9789978774618) Ecuador 2. *El Taller de Diseño Centrado en el Usuario.* (Año 24 Número 135 2021/2022 ISSN 1668-0227) Argentina 3. *The city of design and culture.* (ISNN: 978-9928-4459-8-8 (OMB series)/ 978-9928-347-04-6 (V.7). Cap. 4.8 (pp. 350-359) Albania 4. *Healthy City* (coauthor) (ISNN: 978-9928-4459-8-8 (OMB series)/ 978-9928-347-04-6 (V.7). Cap. 4.4 (pp. 298-303) Albania