

Creating new teaching contents with a design approach. How the use of design methodologies based on professional experiences can be used to create successful courses in a limited timeframe

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Abstract

The aim of this paper is to analyze and evaluate the effectiveness of the use of design thinking and other design methodologies to address the creation and implementation of a new subject in the Design Engineering and Product Development degree at the Polytechnic University of Valencia (UPV).

The main teaching objective for this subject is to improve the understanding and perception that students have of themselves, the degree, the profession and their future professional options.

Keywords: Thinking; design; methodology; education; subject.

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1. Introduction and Aims

We, the authors of this article (Miguel Abarca and Kiko Gaspar) have worked in the industrial design field since the year 2000. We were fortunate enough to witness the creation and development of the current degree in design engineering as we both studied technical engineering in industrial design, in its second and third year respectively, which was the precursor to this. Years later, when we were already working, we updated our qualifications by taking the degree adaptation course offered by the School of Design Engineering (ETSID) at the UPV for former students of that, now extinct, three-year technical engineering course. Although our professional beginnings focused on the exclusive performance of the profession in design studios and companies, both our own and those of others, our career as active professionals spanning over twenty years has allowed us to have a direct and clear idea of the current situation of the profession at a national level and its impact on the industry.

Since 2008, we have combined our professional activity with teaching both in the UPV and in other private universities.

We believe that both our own experiences as students, as well as our experience as teachers, have placed us in a privileged position in terms of knowledge of this degree. Taking most of the subjects that are currently taught in the degree, and lecturing in almost all of the subjects that our department teaches, have provided us with knowledge that we believe can be oriented to improve the degree and our students' learning.

1.1. Main Aim

After years of thoughtful analysis as well as conversing with students, we found a recurring situation in many cases: the students' lack of motivation. We consider that motivation is a key aspect when enabling students to make the most of the opportunities provided during their time at university.

However, we believe that student motivation should not be something imposed from outside, but rather, to be truly valuable, it must come from the individuals themselves. In this sense, our main objective as teachers is to help each student find their own motivation, based on their own interests,

abilities and potential. After all, “a society makes sense when it understands that its fundamental wealth resides precisely in the abilities of the young” (Goodman, 1971).

1.2. Specific Aim

We firmly believe that it is difficult to find the motivation required to acquire knowledge that is not perceived as necessary to achieve a personal goal. In this sense, we consider that the main problem resides in the fact that students are not clear about what that goal is. Our role as teachers can be to help "awaken and clarify individual purposes, as well as the more general aims of the group, [trusting] that the student really wants to achieve these significant goals for themselves, this being the underlying motivational force in all meaningful learning” (Rogers, 1975).

On the other hand, the students recognize how lost they are regarding the degree and its possibilities, according to the results of their research “the need for better information of the regulations that affect them is appreciated” (Peña-Martín et al, 2016).

In this regard and as specific objectives of the actions and methodologies that we will describe below, we would like to help students to be fully aware of the structure, organization, options and possibilities that the degree in which they have enrolled offers them, as well as the purpose and reason behind both the degree subjects and their methodology.

In addition to the future professional options which, by obtaining this degree, they have the possibility to access, as well as the sectors or professional fields they can enter.

And, finally, to help newly enrolled students reflect on the real motivation that has led them to study this degree, where they intend to go with it and what is the path, in this regard, which best suits their possibilities or preferences of reaching it.

2. Methodology

Nobel laureate Herbert Simon (as cited in Brown, 2020) said that "whoever conceives an action plan aimed at changing existing situations for preferred ones, designs."

Based on the concept that design should be conceived as a problem-solving tool, we decided to address this challenge using the design methodologies we are most familiar with: Design Thinking.

"Design Thinking", more than a methodology, is understood as an approach or mindset that finds its background in human-centered design, in which the users' interests and needs of the users, along with the feasibility of the proposals, will guide the entire design process. "Design thinking begins with the skills that designers have learned over many decades in their quest to match human needs with the technical resources available within the practical limitations of companies" (Brown, T. 2020).

There are many interpretations and theories about the phases into which to divide a project. Albeit with great similarities, each school of thought divides and names the phases of the project in a different way. For instance, the British Design Council model uses what they designated "the double diamond" as a frame of reference, as explained by Juan Gasca and Rafa Zaragoza (2014):

"It is not a linear and watertight process, but four stints or moments through which we have to move quickly in the identification and construction of ideas and concepts. It is, therefore, an iterative process in which each work phase constitutes the input of the next one and throughout which we can move both forwards and backward according to the results achieved."

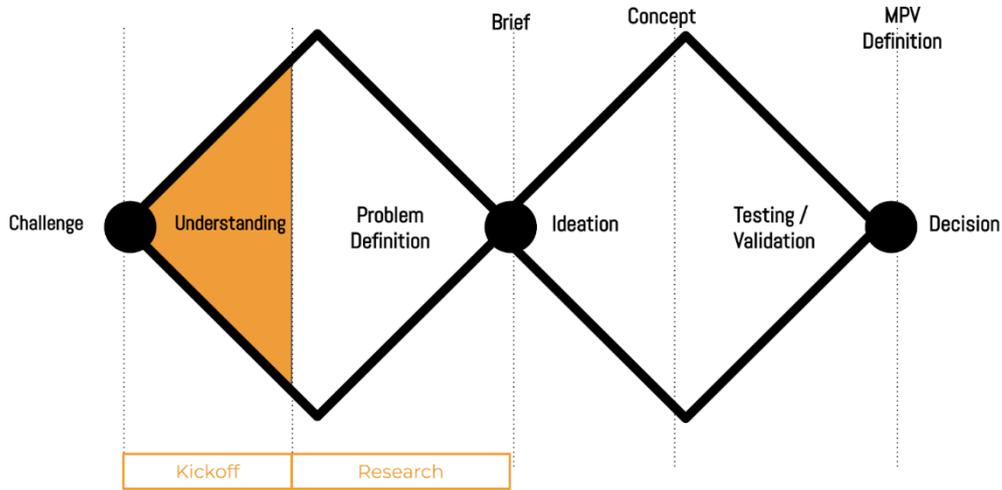


Figure 1. Reinterpretation of the British Design Council double diamond model made by Spanish Innovation Consultancy ThinkersCo.

In contrast, the Design Thinking model from the Stanford d.School, which we will use as a reference, divides the process into five phases:

- 1- Empathize
- 2- Define
- 3- Ideate
- 4- Prototype
- 5-Test

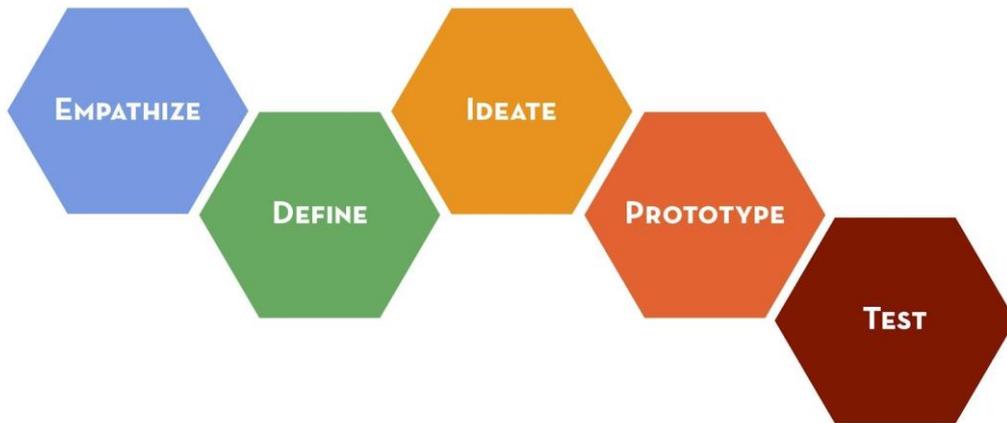


Figure 2. Design Thinking phases according to the Stanford d.School.

These phases find their equivalence with the development phases into which we have divided the projects on which we have worked professionally since our beginnings (almost 20 years ago) and throughout our experience as consultants in our own studio "Discoh Design" as well as the projects in which we have participated as researchers at the UPV:



Figure 3. Project stages used by Discoh Design consultancy: Research, analysis, ideation, development and prototyping.

The common principle of the different ways of breaking down the design process resides precisely in the fact that the phases never end, so we are constantly reiterating and going back to previous phases if we consider that it may be beneficial to the project. It could be said that, in some

way, the use of the design thinking methodology is based on the premise that there is not a single and perfect solution to the design challenge that we are tackling, but that the projects are open to possible improvements that involve a new iteration in the process. Similarly, in some projects, it can be difficult to determine, not only when it is finished, but even when the design work has started.

In order to clarify the design challenge we were facing and how we got to it, we followed the five phases of Design Thinking listed above that we went through even before having this specific project in mind:

- 1. Empathize: After years of conversations with classmates and students about the evolution of their degrees and their perception of them. (suggestions, changes, evaluation, teaching staff, management...).
- 2. Define: We have detected common patterns regarding their needs (lack of knowledge about professional possibilities, little contact with the industry and active professionals, absence of a clear professional objective...)
- 3. Ideate: Constantly devising proposals for improvement in the subjects we teach, both in content and structure, exercises, project themes, evaluation methods, etc.
- 4. Prototype: Introducing innovations in the subjects we teach, such as visits to companies and fairs, inviting active designers to speak, implementing self-awareness exercises, research exercises and analysis of designers, among many others.
- 5. Test: We draw conclusions regarding the interventions described by surveying students. These data are contrasted with others of a qualitative nature from meetings with former students who provide us with their reflections and experiences as active professionals, once they have finished their degrees.

2.1. Description of the possible proposal.

After years of applying different contents, activities and methodologies to the subjects in which we have participated, we proposed the hypothesis that a promising solution to this could be the

creation of a new first-year subject that would serve as an introduction to the Degree in Product Design and Development Engineering.

The aim of this would not be focused solely on informing students of the professional possibilities of the degree, but on helping to reflect on and investigate about their interests, abilities, objectives and future possibilities.

2.2. Rollout of the plan and methodology

To address this "design project phase" we once again use the tools and methodologies explained previously, this time to prepare an implementation plan and a curriculum consistent with the objectives and the degree of maturity of the students:

- 1. Empathize: Conduct qualitative interviews with students from each year of the degree.
- 2. Define: clarify the objectives of the course based on the first interviews.
- 3. Ideate: Brainstorm possible topics of interest that could be addressed as part of the subject. In this phase, more ideas were generated than could actually be implemented, so a potential teaching schedule could be created by selecting and classifying this raw material.
- 4. Prototype: The first prototype of the subject could be said to be an outline of the program in which the different teaching units, with their corresponding theoretical material and possible related activities, were already being considered. Having defined different ideas for activities and agendas, we decided to use the successive conversations with students and ex alumni as "initial prototypes."

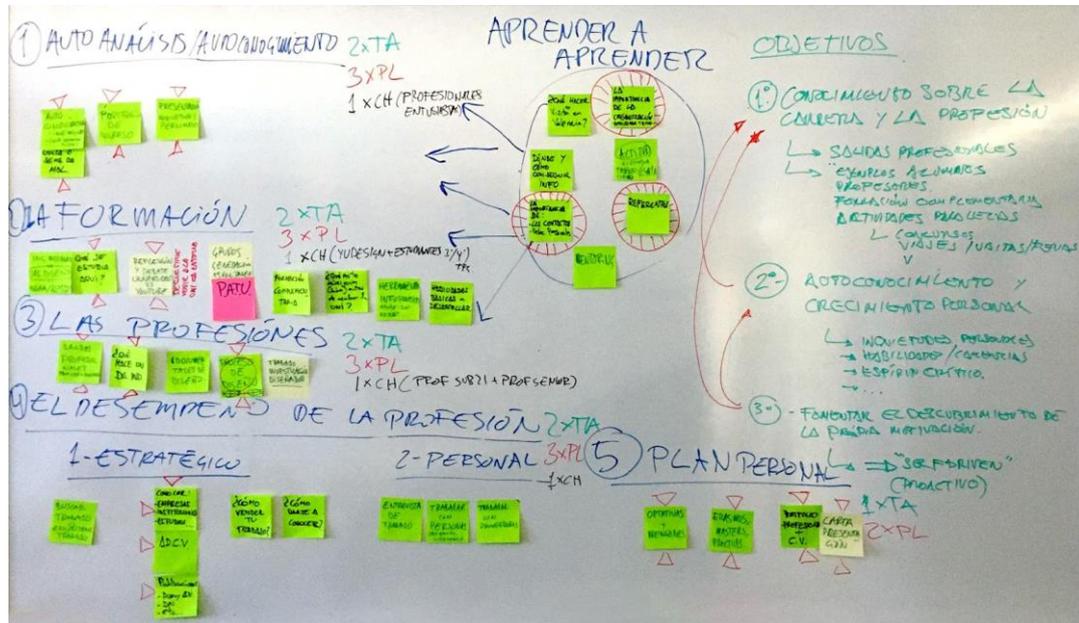


Figure 4. First draft divided into different teaching units.

- 5. Test: We commented on the proposed and filtered ideas with the students we met to draw conclusions after observing and analyzing their reaction. In this way, these conversations served both to gather information and to test the possible interest aroused by the ideas already proposed.

At a teaching level, it is important to note that during those interviews and conversations, we could see a great concern among the students derived from the lack of their own personal planning and future objectives. A clearer view of personal goals would have made it easier for them to set, early on, an objective to follow that could have helped them to give meaning, not only to their studies but also to the way of understanding them, guiding them and, ultimately, making the most of them.

We have also perceived the students' lack of know-how, due to the continuous and rapid changes in both the labor market and the way of managing the start of a professional career, in how to tackle

their first challenges as professionals with confidence, as well as the promotion and communication of these first projects and their personal brand.

This is why we have identified the importance of addressing these concerns and shortcomings at an educational level, analyzing different points in which we try, in addition to providing the student with tools or skills that give them personal abilities at a general level that minimize the problems and detected weaknesses.

To do this, we not only address aspects such as broadening and facilitating knowledge about the degree in which they are immersed or merely guide them in the organization of their subjects, such as itineraries, training complements or scholarships, but also show the importance of the figure of the mentor as a useful tool and resource during the student's education.

2.3. Iteration of the process during the course.

One of the challenges we faced was the fact that we started the subject without having prepared all the necessary theoretical content. However, far from experiencing it as a limitation, we decided to embrace it as an opportunity, asking the students enrolled in the subject themselves to share with us the topics or activities that they thought could be interesting. To our surprise, several of them put special emphasis on issues that had gone unnoticed by us even in the interviews with students of other courses.

This allowed us to make modifications to the already prepared theoretical contents to adjust the agenda to some of the topics that were important to them.

In fact, these exercises were defined thanks to qualitative interviews carried out with third and fourth year students who gave us their opinion.

3. Results

The challenge when testing and evaluating the effectiveness of any prototyped idea resides in the method used for data collection and interpretation. To obtain conclusions from the evaluation of the results, we used two complementary methodologies. On the one hand, we used the "student opinion surveys on teachers", a UPV results measurement system that, although is mainly used to provide data on the opinion that students have of teachers and not so much of the subject, we can confirm that there is usually a direct relationship with the degree of satisfaction with said subject. In these surveys, the average degree of satisfaction with the teaching staff was (9.20/10.00) exceeding, in the case of both teachers, the average for our department (8.77/10.00). We consider this a relevant indication, since it is more typical for student satisfaction in newly created subjects to be low, initially, and increase as the subjects evolve and consolidate.

On the other hand, in order to be able to draw more specific conclusions about which units and activities had best met their objectives and which could be improved for successive courses, we decided to carry out a specific survey in which students could evaluate the contents in detail. This survey was mandatory and was conducted anonymously.

The Design Thinking model focuses on knowing the needs, concerns and difficulties of users in depth, which is why it prioritizes qualitative interviews with open questions. In this sense, "Design Thinking" and quantitative research significantly differ in their methodology and tools used, as well as in their applications and deliveries. Nevertheless, if used correctly, they can complement each other." (MJV Innovation, 2018).

For this reason, the survey was designed by contemplating it both quantitatively and qualitatively. In the first part, the students gave a numerical score to each of the activities (mean: 7.6/10.0), theoretical classes (mean: 8.1/10.0) and talks (mean: 9.0/ 10.0), as well as general satisfaction with the subject (average 8.1/10.0), and other questions related to the pace, amount of information, or difficulty (average 8.8/10.0).

At the end of the survey, in the open-ended section, the students answered questions such as: "What would you change about the subject?" or "What did you like about the subject?", and an open

space was left for them for general and/or specific observations, as well as for suggestions or complaints.

We believe that it was very useful to complement the qualitative responses with the quantitative ones as erroneous conclusions may have been reached otherwise. For instance, based on the quantitative response data, we might erroneously conclude that students preferred the theoretical content to the practical sessions. However, in the open answers there was a broad consensus in the sense that the students would like there to be more practical content than is currently included. After a thorough reading, we were able to draw the conclusion that the theoretical content was in a state of greater maturity than most of the dynamics of a practical nature.

Immediately after completion of the subject and thanks to the impressions and opinions of the students, the possible changes and modifications for the following course were documented. Such modifications included for example, schedule changes to avoid activities overlapping with each other, or the modification and replacement of some of the work or evaluative acts from which we did not obtain the expected answers, as the students did not understand, did not do them as they were expected to or were not motivated to do them.

4. Conclusions

We based our solution proposal to the proposed objectives on the creation of a subject that would respond to several key aspects: on the one hand, the analysis and knowledge of the degree and future professional options. And on the other, in the preparation of a personal plan that would make it easier for students to create, early on, an objective to follow that means something not only to their studies but also to the way of understanding them, guiding them and, ultimately, taking advantage of them.

From our point of view, the most relevant points in the application of this methodology can be found in:

- 1. Empathize: Emphasizing the importance of listening to students and making decisions, assessing not only what we consider interesting for them to learn, but also what they expect and consider important.
- 4. Prototype: At this point, it is worth highlighting the importance of assuming the challenge of implementing activities or dynamics at an early stage of development.
- 5. Test: Using a successful methodology to evaluate the results, we were able to validate the decisions implemented and propose changes to improve future editions of the subject.

After this analysis and reflection, we can qualify the use of Design Thinking, as a technique to improve teaching through the creation of a new subject, as successful. We managed to prepare a complete syllabus for a non-existent subject in a few months, and implement it with room for tweaks and adaptations, obtaining above average ratings in surveys for our department. Finally, we consider that this methodology could be extrapolated to the creation of other subjects for different degrees.

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