ACTIVE PARTICIPATION OF THE STUDENTS IN THE FORMAL EDUCATION IN THE DEGREE IN ENGINEERING IN INDUSTRIAL DESIGN THROUGH THE DESIGN STUDENT ASSOCIATION "ETSIDI-DESIGN"

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Abstract

New ways of life and the increasing of technologies make necessary redefining higher education. Dealing with students who are prepared to look up information all around the meanings, a distinct way of teaching, collaborating with them, is a necessary challenge for teachers. The creative capacity they show, and our background in art and art education are enabling new ways of learning and teaching.

Four years ago, in the ETSIDI (School of Engineering in Industrial Design of the Polytechnic University of Madrid - SPAIN), an association called "ETSIDI - Design" was born. Since then, it has been able to mobilise hundreds of students, encouraging them to participate in active projects from different fields. They are highly alive even in their spare time and have created a community that is willing to share and help each other.

The origin was an Innovation Project set in our Engineering School in 2013. Jaime Garcia Vaquero, a scholarship student, took care of the management and implementation of the Etsidi Design Blog. Later on, working with DRO, Student Association created by Javier Jiménez Rueda and Javier Pérez Arranz, they founded the current Etsidi Design Association. It's an association not only focused on design, but also on engineering, technology, culture, art and other events related to the human behaviour and interest.

Since then we have been collaborating together in the way of promoting an horizontal learning, cooperating with creative and artistic projects, facilitating the means of our School and hearing them in order to know their interests so as to integrate them in our education plans. We have involved them to participate with proposals in our classes.

Our teaching methodologies are anchored in the XIX century and we think that a new vision in the higher education is mandatory, involving students in their learning and collaborating with them bringing new proposals into classes, as the blog, conferences, tutorials, art and design exhibition visits, classes à la carte, design fairs organized by them. They will be able to transmit later on in the blog and to other students or teachers all new contributions. Communication with their mates is essential to make this project works.

Teachers have to facilitate this way of learning that approaches students to reality and to their preferences in learning. We base our proposal on the sense of taking advantage of all the knowledge students have with the only intention of helping them to extract it in collaboration of our institution so they will be better prepared to their professional career.

Keywords: Horizontal learning, Art and Design Education, Student Association, collaborative work, Long Life Learning.

1 INTRODUCTION

In a world where we have the best tools of communication we find a university very isolated from the professional, social and educational environment. Many contents are outdated, subjects and disciplines appear totally separated, obsolete educational practices and an educational structure that hinders innovation outside the pre-established.

In contrast to these aspects, we think that communication at different levels and between the different entities involved in the educational environment can generate some interesting changes. Due to the magnitude of this approach, we decided to take part in our immediate university scenario, specifically in the most imminent relationship, and possibly the less worked, like communication and the
teacher/student relationship. That is, we want to quit the nineteenth-century educational model, anchored in the figure of the teacher as the only active agent of education, and to integrate the student as the main actor, endowing him with roles traditionally given to the teacher.

On the one hand, due to our experience in different areas of training, we want to reinforce the need to re-establish communication between different disciplines, and especially the connection between art and science, which we pointed very useful to overcome the barriers in more technological careers, such as Engineering in Industrial Design. And likewise, we want to look for a connection with real projects, with a high collaborative character in which the practical approach is present.

In this article, we will first examine the methodological background of this proposal, with a special emphasis on art and science connections. We will then analyze the educational values of the collaborative, experiential and practical learning processes, among others, and then, describe the results harvested. On the one hand we describe the birth of this collaboration between teachers and students, and on the other hand we review the current collaborations and the work of the student ETSIDI design association.

To finish this introduction, we would like to highlight the collaborative nature of this article, in which Jaime García-Vaquero, president of the ETSIDI Design Student Association and Engineering Student in Industrial Design, Raúl Díaz-Obregón and Silvia Nuere, teachers of Graphic Expression in Engineering area, in which they take part.

2 METHODOLOGY

2.1 Methodological background

We could establish several antecedents to our methodological commitment that integrates the interdisciplinary development, the horizontal development of the teaching, the collaborative work, the connection with the professional world, or the connection with the real world, among other things. That is to say, we are reflected both in the interdisciplinary connections of Leonardo Da Vinci, as in the renovating vanguard of the Bauhaus, the most revolutionary expressions of the art of Joseph Beuys, or as in the recent and indisputable MIT proposals, in the connection of art and science. In all of them art appears as a conducting nexus, although it still has great difficulties to be integrated in the educational environments. But if we had to argue the real reason for defending our bases, we must confess, that it is the practice of many years as teachers in contact with students in different artistic environments, such as art, design, architecture, industrial engineering and the art education, that has led us to go deeper into a new methodological proposal. Above all these experiences, we highlight the need to connect all disciplines and to break educational barriers to cohesion.

Our base is supported on the brilliant work of Leonardo da Vinci in the 15th century, a clear example where art, design and engineering advanced hand in hand. He was a brilliant artist, scientist, engineer and admirable inventor whose talent shone in disciplines like art, music, mathematics, engineering or architecture. His talent is overwhelming and he demonstrated a great capacity to combine different areas of knowledge [1]

But this is not the only model of reference, if we look back, we find another antecedent in which not only art and design went together, but also a model of learning based on the interrelation of both disciplines. We refer to the Bauhaus. It can be considered to have been the School of creation with more success and with more consequences, based on propaedeutical teaching, "preceded by a vision: the idea of resurrecting a new man from the catastrophe of First World War, a gifted creature of all the senses and formed by the best artists and architects of the time to create the present and the future of a modern century". Art and crafts came together to generate a creative design for industrial production.

"The political hopes of renewal after the First World War were preceded by a whole generation of artistic and aesthetic projects, fundamentally with the common idea of mixing art and life" [2]. It is from this idea that very diverse projects arise to reform the production and artistic education, preserving the artistic exaltation of productive work.

It is important to point out certain achievements of the Bauhaus in terms of didactic concept, since in the beginning with its preliminary course (Vorkurs), they proposed the internal interpenetration of work and theoretical learning of a clearly oriented curriculum towards the practice. We could consider it as the basis of project-based learning, with its workshop model. We must not forget the interest they
showed in relating the School to the life and daily life of the artists of the Bauhaus, being able to adapt continuously to the external changes of political and social reality. That connection with reality seems to us a key element to consider in our proposal. In 1923, Gropius provoked a turn of direction of the Bauhaus with the motto "art and technique: a new unit" [2].

Joseph Beuys was an artist who found in art the necessary structure to articulate thought, the motor of true social change, in which education occupied a fundamental space. In its texts appears a very refreshing, interdisciplinary, based on the self-management and with a horizontal relationship educational vision:

But this educational process, once again, would not have to be authoritarian, but should happen in an oscillating way between people, that is, as a universal teacher-student relationship, among human beings. So universal, deep down, that you can say that language is the teacher. That is, at the moment I speak, I am currently the teacher and as soon as I listen, the student. So when I hear you I am the student. So universal should be understood [3].

Relationships at the same level in the educational hierarchy have been dealt with by various authors in the field of art, from Camnitzer, who spoke of the structuring of a curriculum in which students played a fundamental role, until Reshaw, who suggested the creation of horizontal structures as a way of organizing a school. This author already pointed out that large companies were replacing the empirical-rational model of leadership by fostering creativity and teamwork. [4]

But with no need to look back, we find the recent interest of the Massachusetts Institute of Technology to introduce art into its current STEM (Science, Technology, Engineering and Math) becoming today STEAM.

Leila Kinney is a member of the executive committee of a2ru and executive director of arts initiatives at MIT, which include the MIT Center for Art, Science & Technology (CAST). In the 1970s, during the presidency of Jerome H. Wiesner, MIT incorporated the arts as a conduit of innovation, believing them to be essential to the creative environment of a research institution renowned for science and engineering. In Kinney's own words: “Although we sometimes have to remind ourselves of that fact here at MIT, it is gratifying to join forces with an organization dedicated to integrating the arts into research universities nationwide and recognizing their powerful role in fostering flexible thinking, disciplined collaboration, and creative departures from the norm.” [5]

A2ru is a group of universities that includes MIT, Stanford, Virginia Tech, University of Michigan, and twenty-five others. The Alliance, founded in 2011, addresses the concern that universities are suffering from “a kind of mass amnesia for the heuristic power of art-making, and for the many functional similarities between art-making and scientific modes of inquiry,” according to a2ru’s founding proposal. A2ru was created to “fuel an investigation of the unique qualities of art-making as a mode of discovery and learning in post-secondary education,” i.e., to facilitate discussion among universities on the arts and creative thinking. [6]

In our proposal we rely on methodologies close to design and in particular on design thinking, which proposes an analysis and resolution of problems collectively. This transfer to the academic field becomes a collaborative work between teachers and students, in which the student is one of the team. In this way we break the classic paradigms of our educational model in which the student is passive and has a lower status to the teacher.

As Tim Brown [7] puts it, "all the elements of the world around us, from the world made by man, have been designed by man." It is not a question of hiring designers but applying their techniques, understanding how they plan an approach and the methodology they apply to creatively solving problems and widening the horizon.

As Víctor Lombardi proposes, [7] design thinking is a way of thinking based on collaboration between people with different and complementary experiences. We rely on an experimental method for being new proposals, posing hypotheses, putting them to the test, but always taking into account the particular context of each problem and the people involved. Perceiving the particular characteristics of each participating agent enriches the model. Therefore we are based on a technique of inquiry and discovery, i.e. a heuristic model, considering that the path to innovation lies between art with its concepts of imagining and discovering; design visualizes and conceives, and science invents and transcends. Design is a behavior.

Following the above considerations, we believe that there is a need to create a more vital training proposal in which students feel that their passage through university classrooms is closely connected
with the experiences they may feel in real life. In all these years of teaching, both in the role of teachers and students, we consider that teaching lives far from reality with which they will face when they finish their studies.

After our experience in the Degree in Engineering in Industrial Design and Product Development, we have been able to verify how the students are interested in the advances in design that are developed in the day to day. The connection the student seeks with his environment is spontaneous and fresh and his personal concerns motivate them to be up to date and look abroad for their future professional worries. This natural connection of the student should be used to enrich the teaching-learning environment.

2.2 Educational connections

*Tell me and I forget, teach me and I may remember, involve me and I learn - Benjamin Franklin*

The Degree in Engineering in Industrial Design and Product Development has been taught at the High Technical School of Engineering and Industrial Design of the Technical University of Madrid since 2011. We have to situate these studies in a school with a strong tradition of engineering in a university where traditional teaching excels. Through the new framework of Higher Education, this Technical Education School has had to readapt to the new times introducing subjects with a strongly creative nature and of a clearly differentiated methodological conception. We are looking forward to leave away the classic master's degree lessons with a final evaluation test and introduce a concept related to the creation of projects, where diversity has a significant role [8].

Teaching is based on the constructivist model by considering the learning as a cognitive process by which the student actively constructs systems of understanding and knowledge of reality from the experience previously possessed, and the interactions between this experience possessed and the new experience [9]. Piaget [10] suggests that thinking involves two complementary cognitive processes: the assimilation process and the accommodation process. The first, refers to the acquisition of new knowledge produced by the manipulation of new information obtained through experience and filtered through schemas (structures of prior knowledge). The second process refers to the transformation of the previous scheme that is modified by the new knowledge. As Perkins comments [11], "in essence, understanding something is the ability to think and act flexibly about what one knows". In short, the student has to be an active subject in the construction of his own knowledge, therefore he should emphasize the term "understanding" in such a way that, what he will be doing is learning to learn.

The student will come to the understanding of a meaning if he can explain it, interpret it, apply it, have perspective on it, emphasize it and finally develop an own knowledge about that meaning [8].

On the other hand, we propose a collaborative and Problem-Based Learning challenge, working together with students, so as to deal with personal problems they will have to face. It is a constant feedback between students and teachers in an environment where all the proposals are heard. The connection students have with reality has to be take into consideration to renew didactic models, to face new challenges where relationship between both members of the process.

Among the most important changes referring to the new European Higher Education Area, and starting from the basis of meaningful learning, where the students assimilate knowledge once they have experienced the actions, they should be helped to train in skills that later serve them in any field and not exclusively in the academic one. As Manuel Riesco comments [12], a competence is more than knowledge and skills, and must include the ability to face complex demands where skills and attitudes come into play. Competence is therefore considered to be an effective capacity to successfully carry out a work activity by combining it with parameters of professional activity such as production and employment. Thus, imitating the practice of competences in the professional field, students are sought to perform tasks, to solve concrete but contextualized problems, to adapt to each situation, because students will hardly internalize the knowledge that has not been put into practice.

Framed in these main concepts, it is proposed learning based on the student. Learning has to be able to adapt to its environment, its new challenges, its needs, its concerns, where one of the fundamental tools will be directly related to learning by doing. The student is competent to generate and transmit knowledge.

In this way a horizontal development, similar to that described by Díaz-Obregón [13], is created. It will be a place where teachers and students interact at the same level, raising without fear, suggestions,
proposals and discussions that develop their critical capacity against others defending their position with solid arguments.

All this structure of interactions reaffirms the self-learning capacities of the student and make a condition of an updating of teachers. Confronting real problems, forces teachers to continually renew content and move away from the comfort zone. The student is often more informed than teachers, is fresh, dynamic and in touch with reality. His activity helps the teacher to stay up-to-date, to be renewed, to be updated, to be more permeable, to better connect with their needs and to communicate with the professional world. That is to say, with these dynamics, both teachers and students carry out a permanent formation.

Proof of these dynamics we find them into the association the creation of Student Associations, willing to participate actively in their teaching-learning process. Their proposals acquire a salient educational value parallel to the academic curricula, which implies an educational potential of a magnitude as important, or more, than that offered in the official curriculum. This is what we will discuss in the next section.

3 PROPOSED EDUCATIONAL FRAMEWORK

3.1 Student Associations and Educational Innovation Project

Two ways have allowed us to propose teaching based on teacher-student collaboration. On the one hand the activity of the student organizations that sought formative collaborations, and on the other hand the creation of an educational innovation project to create a blog of Industrial Design managed by the students.

In the first place the students organized themselves in associations to collaborate among themselves and to fill the gaps found in their formation has made us reflect on the advantage of being able to collaborate. In 2013, Javier Pérez and Javier Jiménez, both students of the School, created the Junior Company Creart Designers. Among other objectives, they intended to collaborate in the training of their peers. In 2014 they launched several courses aimed at students and peers. It is at that moment when the first collaboration arises by enabling, through contact with the School’s management, the publicity of one of its courses in the hall of the School. It is not only the training proposals offered we are interested in, but also, the beginning of a stage where personal initiatives and actions that the students themselves want to introduce in the academic framework.

![Figure 1. Add of the course from Creart Designers. November 2014](image)

Later Javier Jiménez created DRO, as a student association that develops design projects applying what they learn in the university and applying what they know in the real world.

Secondly, and following the need to create structures that allow collaboration between teachers and students, an Educational Innovation Project, awarded in 2013 with the title "Creation of an Educational Web of reference for students" is proposed. It was developed over two academic years. The need to create a platform where updated information on industrial design could be obtained was the trigger for
this initiative. In his second year, Jaime García-Vaquero took over as a grant holder, giving an unprecedented boost to the project and being the initiator of a closer relationship between teachers and students. This educational website ends up being known as ETSIDI Design Blog and is entirely managed by students of the School. In the year 2015, Jaime created the Etsidi Design Association, taking over the DRO and proposing various activities in some of which have participated with teaching duties.

Today, we perceive that the university offers very few alternatives to introduce the dynamics that we are working, forcing them to act with a lot of flexibility in a structure, put on a corset, bureaucratic and rigid. However, we believe in the necessity of continuing working on these lines for the fantastic results they are giving us.

3.2 Collaborations with ETSIDI DESIGN

ETSIDI DESIGN is a student Association of the High School of Engineering and Industrial Design (ETSIDI) from Polytechnic University of Madrid. It was founded on September, 2016, it has more than 120 members and this is the management team: Jaime García-Vaquero Mateo (President), Olga García Martínez (Vice-president), Myriam Barnés Guevara (Administrator), Valentina Jiménez Londoño (Treasurer), Mauro Médici and Ángela Pérez (Co-founders).

The association has two defined parts, one dedicated to the creation and maintenance of a blog and the other devoted to the management of the student association. Both of them maintain a direct collaboration with degree’s subjects and all the students involved have improved their transversal capabilities and competences. This collaborative work started on February 15 when we gain an Educational innovation project to set the blog etsididesign.com.

Since its creation the ETSIDI Design Association has worked side by side with the Design Department in many activities due to a significant point of view from the current education system. The students involved in this group they normally present a great active attitude, are self-initiated in different projects, very well connected with the external reality and they have a cordial relationship with their teachers.

Due to the growth of the organization in the last year, many profiles have been created

- Publishers and mentoring. Composed by a team of seven people in charge of editing the articles written by his team and published on the blog. In addition, the mentor in design has been created with the intention that each editor can guide his team by supervising their articles, design training exercises, exhibition visits and mentoring in general.
- Editors. In charge of carrying out the research and development of various themes related to design, culture and technology.
- Trend hunters. The main purpose of this team is to investigate the latest trends in the field of engineering in industrial design so that the drafters can complement their articles.
- Communication and events. They are responsible for the dissemination of articles in social networks.
The development of these profiles leads to a continuous movement of the activities and articles of the association. Following the steps initially marked in the Project of Educational Innovation, we observe that this seed has been growing to the point of maturing into a solid project with a significant number of students involved. This development has been possible thanks to the close relationship between students and teachers, a relationship that is revealed in a more horizontal model where teachers and students exchange experiences and points of view with the aim of reaching the same goal.

Here are a few benefits:

- We find a higher quality teaching thanks to the feedback between students and teachers.
- Implementation of new teaching procedures is set in the development of the academic course.
- Increased proactivity: The proposal of collaborative work among students in different projects such as Library of materials, Silk-screen printing, ETSIDI Interior design, Blog ETSIDIDESIGN, etc.
- Multidisciplinary concept: Development of projects by mixing different fields of knowledge.

Collaboration between students and teachers.

During the current academic year different activities have been carried out in which the responsible students of the Association and the faculty of the Design Department have been involved. We highlight the following:

- Basic Design. Exercise performed in mutual collaboration. The objective of the exercise is to write an article suitable for publication in the blog. To this end, meetings were organized between the editors of etsididesign.com and teachers. The proposal was carried out with a highly satisfactory result. Thanks to this collaboration, the student acquires research skills and is able to write a topic later on.

- Graphic design. Exercise performed in mutual collaboration with Jaime García-Vaquero and Raúl Díaz-Obregón. The objective of the exercise is the realization of a digital portfolio of the work that the students have been doing throughout their studies. The proposal was carried out with a highly satisfactory result. Thanks to this collaboration, the student acquires the ability to put into practice the knowledge of the subject in a more professional environment for his professional future.

- Sketching workshops. Due to the lack of knowledge in this area, the workshop was carried out with the aim of allowing students to know the basic techniques for sizing and sketching a product.
• Digital competence workshops. Exercise performed in mutual collaboration. The objective of this workshop is for the student to understand and manage the digital tools necessary to carry out his activity in the blog etsididesign.com

Figure 4. Sketching workshop taught between Jaime García-Vaquero and Raúl Díaz-Obregón

Figure 2. Etsidi Design teaching about its Association and benefits (Teachers participating as students). October 2016

4 RESULTS

At the beginning of this article we pointed to the need to establish different communication nodes within the university to search for a more real, current, close and living educational environment, made with the indispensable help of students. We demand the necessity of breaking the plots of highly specialized teaching, seeking the interesting interdisciplinary communion, with special interest in the art-science dialogue.

The work of Leonardo da Vinci and his studies that fused art, music, mathematics, engineering or architecture, are a good example of this, but the contributions of the Bauhaus, with the cohesion of art and craftsmanship, are especially significant through design. Its multidisciplinary conceptions aimed at a holistic action integrating art and life, in which social, political, economic and educational contexts were taken into account. His didactic contributions to the world of art and design are fundamental. We are interested in the special interest of the Bauhaus in the creation of workshops and in project-based learning.
Among the horizontal dynamics we emphasize the contributions of Beuys, Camnitzer or Reshaw, who find in these relationships a great potential of work, not only for the educational field, but also for the resolution of conflicts and the business management. Along the same lines is the methodology of collaborative work of design thinking, in which diversity is understood as an advantage, strength and wealth necessary to approach a project. Finally, we highlight the premises of the Massachusetts Institute of Technology, which conceives art as a form of innovation, or the group of universities A2ru, which attributes to art the same forms of inquiry of science.

Our methodological proposal is based on a learning based on practice, which seeks to solve real problems, adapting to the contextual needs, all carried out through collaborative processes in which the contact with teachers-students is continuous. This dynamic reinforces the idea of self-learning, of learning to learn and, above all, of lifelong learning, understood both for students and teachers.

These didactic proposals of teacher-student collaboration would not have occurred without the essential action of the students organized in associations and without the execution of the Educational Innovation Project. These associations began to cover the university's lack of training, to participate in academic life in a unique way and to create entrepreneurial projects to carry out academic content that is too theoretical. At the same time, an industrial design contents blog, as part of a teacher innovation project, was developed in which there was a close collaboration between teachers and students.

As a result of this collaboration, the student Jaime García-Vaquero, founded the association ETSIDI DESIGN, which establishes several collaborations. Students have access to highly useful transversal learning, which helps strengthen the content of the degree and increases motivation. They value the creation of their personal projects that connect more with the professional reality and also with their own interests. These workspaces contribute enormously to establish emotional ties, with their own colleagues and with the teachers, indispensable to face such a demanding training.

We sincerely believe that educational quality is acquired with aspects as basic and difficult to achieve in the university context, as the creation of real spaces of communication and work, in which hierarchies could be dissolved, working for the need to learn, in connection with different professionals and with the social reality.

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REFERENCES


