

Developing Learning Strategies Based on Research Projects

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Research projects are a very important part of any professor life sheet. Through these projects, they use their knowledge to solve real problems within professional area. Besides being an advance in research area, they can essentially contribute to improving teaching process. This work originates from the idea that the experienced gotten from those projects should be exhaustively exposed in the class and not mentioned as a simple anecdote. Thus, it proposes the application of two research projects for developing learning strategies related to industrial graphic designs in graduate and postgraduate subjects. Starting up from the phases developed in the research project, work is divided into different parts that should be carried out by each student. Each part should synchronize with a theoretical explanation of those concepts that are necessary to solve it, and class work is combined with individual and team work. The final goal is to motivate students for studying the subject and show them the real application of those theoretical concepts that has been explained in class.

Keywords: graphic design, higher education, research projects, case method, PBL (problem-based learning)

Introduction

Spanish University Legislation (Article 83, Act 6/2001, December 21, Universities) rules that companies and other institution can have access to knowledge and results gotten by universities, and makes it possible for professors to do scientific, technical and artistic projects for others, such as particulars, universities and public institutions or private companies. In this way, universities contribute to economic and social development and innovation (Technology Transfer Centre of UPV (Universitat Politècnica de València), n. d.).

Technology Transfer Centre of UPV (n. d.) mentioned the following kinds of research projects:

(1) Collaborative R + D: Companies and universities elaborate a research, development and innovation project together sharing risks and benefits. This kind of projects generates a frequent and direct interaction between university and company with an addition of work and knowledge to both institutions;

(2) Custom built R + D: An expert team of the university is asked by a company to do a research and development work, which makes it possible to obtain a new result based on a research work that solves technological demands of the company and not only gives it innovative solutions, product, service and process improvement, but also an independent solution free of other commercial interests;

(3) Technical support: An expert analysis based on previous knowledge in order to find solutions to those demands was requested by companies. The result of this work can be a report or the scheme of a new

product. This kind of project makes technical innovation projects within the company easier and gives independent advice;

(4) Licences/patents/software/know-how: Transference of economical use and exploration rights of intellectual or industrial property of those results were obtained through made-to-order research projects for a company by UPV. This kind of project gives solutions that have been developed already for technical needs and sometimes it is necessary for advice in the use and production of required technology.

The development of these projects is positive for companies and universities as well. From companies' point of view, these projects contribute to the incorporation of technological innovation into their activities. From university's point of view, they are opportunities to direct its investigative lines and make them profitable.

In the professor's opinion, these research projects are one of the most important stages within their investigative activity and constitute essential evaluation criteria of their efficiency within research area (Article 40, Act 6/2001, December 21, Universities). The importance of these projects is even higher in certain fields, such as engineering.

The experience and results of these projects are usually compiled in scientific media, such as papers in congress, articles in scientific journals or any chapter within a book from a specialized publishing house.

Nevertheless, the projects could have other utilities, besides research. From an educational point of view, they could be helpful for leading teaching-learning process towards real professional life and present concepts applied in a real situation. This could increase students' motivation and their participation rate in class.

Regarding to this point, this paper pretends to move the experiences gotten from these projects towards classes not only as a simple anecdote, but also as a support for creating learning strategies for students. Two possible applications of project experiences in graduate and postgraduate subjects in industrial design area are presented. Aspects considered in both projects are similar: subject and research project description, educational objectives, methodology and evaluation.

Learning Strategy I

The Subject

This strategy is developed for a subject called "Graphic Design and Communication". The subject belongs to the third stage in "Engineering Design and Product Development" grade that began to be taught in the Higher Technical School of Design Engineering of Universitat Politècnica de València in 2009/2010.

The objective of these graduate studies is to train professionals scientifically and technologically, so that they can be able to direct and manage the whole process of a product from the generation of ideas (market analysis, marketing, basic design, etc.), planning, production and launching to environmental impact study at the end of its cycle.

This theme is part of a subject called "design basis" within design special field (see Table 1). It is taught during the third stage and has six ECTS (European Credit Transfer System) credits. Its content is related to graphic design themes, such as typography, color, page setup and structure, relations between image and text, basic layout and digital graphic design.

Short Description of the Research Project

Research project applied in this subject was called "Comparative analysis of the name, graphic mark, shop and advertising of two opticians" and was developed by professors of this subject along the year of 2009. The main objective of this project was comparing two opticians' logos in order to determine if they had similar

characteristics that could produce any confusion to consumers.

Table 1

Themes That Are Part of Main Subject “Design Basis” Within Engineering Design and Products Development Grade in the Higher Technical School of Design Engineering (Universitat Politècnica de València)

Theme	Type	Stage	Semester	ECTS
Basic design and creativity	Compulsory	1	B	7.5
History and esthetic of design	Compulsory	2	B	6
Graphic design and communication	Compulsory	3	A	6
Ergonomics	Compulsory	3	B	4.5
Packaging	Compulsory	4	A	4.5

Note. The shade row indicates the subject where learning strategy I has been developed.

Both opticians belong to retail distribution and sell sector of optical products (sun glasses, glasses, contact lenses, etc.), audiology products and optician professional services. Therefore, analyzing their logo included not only their logos, but also their shops and advertising graphic aspects (leaflets, flyers, printed and TV advertisements).

The study was divided into the following stages: (1) Logo analysis: name, logotype, colors and symbol; (2) Logo applications to shops and advertising; (3) Comparing both logos and their different applications to get similarities and differences between them; and (4) Determination of association or confusion risks in consumers.

Objectives of Teaching-Learning Experience

The following objectives were posed as the first step for planning teaching-learning experience that will guide the choice of methodology and evaluation later on. They will also orient students on what is expected from them and how to direct their work in order to reach these goals (Mager, 1984).

Considering Bloom’s taxonomy (Bloom, Hastings, & Madaus, 1973) and trying to get objectives from the different levels proposed by this author, the following were raised in this case:

- (1) To describe a logo (name, logotype, symbol and colour) using specific vocabulary of graphic design;
- (2) To describe corporate identity elements applied in shops and advertising using specific vocabulary of graphic design;
- (3) To use concepts related to industrial and copy right appropriately;
- (4) To compare several designs to determine their similarities and differences;
- (5) Teamwork;
- (6) To synthesize ideas in order to do a clear exposition of arguments;
- (7) To defend own perspectives from others.

Methodology: Case Method

Methodology chosen to develop this experience was case method. This technique has the following advantages (Merseth, 1996):

- (1) Educating students in skills of analysis, decision-making and problem-solving in the classroom;
- (2) Establishing demonstrations of theoretical principles and illustrating exemplary practice;
- (3) Stimulating personal reflection in order to develop habits of reflection and skills of self-analysis.

It is divided into five stages listed in Table 2.

Table 2

Summary of Learning Strategy I

Stage	Activity	Session	Methodology	Timing	Delivery
1	Case presentation Dividing students into two groups: logo A or B	1st	Expositive class	20 minutes	-
2	Exercise 1: Logo description	2nd	Individual work	20 minutes	No. 1.1
	Comparing and solving exercise 1 in groups	2nd	Work in group (four people)	10 minutes	No. 1.2
	Exercise 2: Describing logo application into their shops	3rd	Individual work	20 minutes	No. 2.1
	Comparing and solving exercise 2 in groups	3rd	Work in group (four people)	10 minutes	No. 2.2
	Exercise 3: Describing logo application in its advertising	4th	Individual work	20 minutes	No. 3.1
	Comparing and solving exercise 3 in groups	4th	Work in group (four people)	10 minutes	No. 3.2
3	Writing a report	5th	Work in group (four people)	60 minutes	No. 4
		5th	Work in group (four people)	30 minutes	
4	Discussion	6th	-	one hour	-
5	Exposing real case solving	6th	Expositive class	10 minutes	-

Note. Shade rows indicate that activity is done out of class (non-presence).

(1) Stage 1: Professor exposes the original problem: “Opticians A has demanded Opticians B, because of similar elements in their logos that create confusion in consumer”. Then, steps to be followed to get a solution are explained, as well as how to elaborate a report about differences and similarities between both logos, including conclusions that determine if there are enough differences to avoid confusion between each other.

Students are divided into two groups: one has to analyze logo A and the other logo B.

(2) Stage 2: This task is about describing both logos and analyzing applications into their shops and advertisement. Students are asked to solve three 20 minutes exercises along three sessions. They have to do the exercise about the logos assigned to their group and according to the steps they proposed during stage 1.

These exercises have the following tasks: (a) Exercise 1: Logo description; (b) Exercise 2: Description of logo application into its shops; and (c) Exercise 3: Description of logo application to its advertising.

Exercises should be done outside the classroom and its results should be given next class. This is a non-presence teaching modality, so students have to do their work independently (De Miguel Díaz, 2006) and with teacher’s absence.

At the beginning of each session (2nd, 3rd and 4th), students should make groups of four with others that are analyzing the same logo. They will try to solve in group those doubts that could have appeared while doing the exercise and expose and compare their conclusions too. They will expose a group solution and conclusions in class at the end.

Professor collects individual work and evaluates their delivery. Regarding group works, the professor corrects them, evaluates them and gives his/her comments to students. In case he/she finds a mistake common to a high percentage of the class, he/she exposes its corrections during next session.

These exercises have three main functions: (a) to control students assistance; (b) to ensure students understand and know how to apply those concepts that have been explained during the class; and (c) to split work in different stages so that students keep working continuously.

(3) Stage 3: As soon as all exercises have been completed, students expose their work in groups of four.

Group composition on this stage is different from the one in previous stage, because this time each group should have two students working on logo A and two students working on logo B.

After two sessions (one in class and the other out of class), students have to present a report of maximum five pages about differences and similarities they found between both logos. Professor corrects the works and returns them to students, so that they can prepare next stage.

(4) Stage 4: This last stage consists in a discussion during the class where students are split in two groups: one defends similarities between logos and the other defends their differences. Professor acts as discussion's moderator and suggests those aspects that neither have been considered nor included. One group of students does not participate in the discussion, but collaborates with the teacher in the evaluation of the others.

(5) Stage 5: At the end, professor presents the real solution.

Evaluation

An educational evaluation is done in order to give a periodic feedback of students' learning evolution.

All exercises are corrected by the professor weekly and are returned to students in the next session. The professor comments most common mistakes in class and gives the possibility to repeat the exercises to those students who have gotten a mark below six.

Report is also corrected and returned to students. In case the mark obtained is below seven, group has the possibility to do it again.

Finally, professor and a group of students evaluated discussion. To make evaluation easier for students, they get a card with all aspects that they should consider.

Learning Strategy II

The Subject

This strategy is developed for a subject called "Packaging" that is included in the second course of the official master in design engineering in the Higher Technical School of Design Engineering of Universitat Politècnica de València, Spain.

This official master has two orientations: professional and investigative. Its main objectives focus on training over graduates and researchers specialized in the following subjects: design and innovation, managing new products, updating marketing analysis techniques, making decisions, quick development of products and optimization of corporative communication technique for companies.

The subject is included in the Specialization Block "Design and technology of graphic products" (see Table 3). Being taught during the second stage, it has five ECTS credits, and its contents are related to graphic design of packages.

Those students that take this subject have previously learned other subjects related to graphic design, such as "New concepts of graphic corporative communication" during the first year or "Design and typography" and "Graphic products design" during the second year. Therefore, they do know basic concepts of design, use of color and typography.

Short Description of the Research Project

The research project "Comparative analysis of structural and graphic elements of two margarine packages" was developed in order to determine if there were enough differences to avoid confusion for consumers.

Table 3

Subjects Included in the Specialization Block “Design and Technology of Graphic Products” of Official Master in Design Engineering in the Higher Technical School of Design Engineering (Universitat Politècnica de València)

Subject	Stage	Semester	ECTS
Design and typography	1st	A	5
Graphic products design	1st	A	5
Managing color process	1st	A	5
Packaging	2nd	B	5
Graphic technology	2nd	B	5

Note. The shade row indicates the subject where learning strategy II has been developed.

Two packaging were analyzed along the project in order to determine the differences and similarities between each other. Other packaging of the same product was compared in a second stage to establish those characteristics that belong to the aesthetic of that product area. At the end, differences and similarities founded are commented and considering common aesthetics in that sector, risk of confusion can be determined.

Objectives of Teaching-Learning Experience

Considering taxonomy proposed by Bloom et al. (1973), following objectives were raised for these experiences:

- (1) To describe graphical aspect of a packaging;
- (2) To compare two packaging and to determine differences and similarities between each other;
- (3) To use legal vocabulary related to industrial and copy right appropriately;
- (4) To plane stages and time for elaborating each work;
- (5) To promote team work.

Methodology: Problem-Based Learning

Methodology chosen for this experience was PBL (problem-based learning). From all the advantages, this methodology has the following application in this case better (Vicerrectoría Académica del Instituto Tecnológico y de Estudios Superiores de Monterrey, n. d.):

- (1) To promote students responsibility of their own learning;
- (2) To develop critical evaluation abilities and the acquisition of new knowledge with an everlasting learning compromise;
- (3) To involve students in a challenge (problem, situation or task) with initiative and enthusiasm;
- (4) To develop efficient and creative thinking according to integrated and flexible knowledge basis;
- (5) To stimulate collaborative sense as part of a team for reaching common goals.

Experience is structured in four stages summarized in Table 4.

Stage 1: During the first class, the problem to be solved is presented: A company is demanding B company, because A considers that the packaging B using for its margarine is very similar to A's, and thus, consumer get confused. After that, task to be developed along the subject in order to solve the problem is indicated to elaborate a report containing differences and similarities between both packaging in order to determine whether there are enough differences to avoid confusion or not.

Then, students form four groups and are asked to do a work planning. Each student has to dedicate 20 hours working partly individually (out of class) and partly in group (in class).

Table 4

Summary of Learning Strategy II

Stage	Activity	Session	Methodology	Timing
1	Problem presentation	1st	Expositive class	10 minutes
	Planning setting	1st	Work in group	30 minutes
2	Working out	2nd-6th	Individual work	18 hours
	Working out		Work in group	5 hours
	Tutorials		Tutorial	2 hours
	Oral exposition		Expositive class	20 minutes
3	Final presentation	7th	Oral presentation	2 hours and 30 minutes
4	Exposition of the real solution	7th	Expositive class	10 minutes

The teacher gives students the following pads to guide their planning:

- (1) To establish tasks to be done;
- (2) To make a difference between those tasks to be done individually and those to be done in group;
- (3) Tasks timing;
- (4) To assign each group member a task;
- (5) To fill a planning table (elaborate by the teacher) with information about tasks, timing and deadlines.

At the end of the session, each group has to expose its planning and corrections that are made either by the teacher or by the rest of the class. This way they avoid overlaps and add important issues could be forgotten.

The following stages could be set as a student's guide:

- (1) To determine those parts of the packaging to be analyzed;
- (2) To analyze A company packaging;
- (3) To analyze B company packaging;
- (4) To find out similarities and differences between both packagings;
- (5) To analyze several packaging in the same industry;
- (6) To find out common graphical elements in packaging of this industry;
- (7) Second evaluation regarding to similarities and differences between packagings A and B;
- (8) Final conclusions.

Stage 2: Students work out this stage following their own planning. Teacher corrects works and solves possible doubts during class.

For doing this work, students may use those themes explained in class and some complementary readings suggested by the professor or available in the library, Internet or an on-line database. The teacher gives a short orientation about them too.

Besides, each group must set two dates for the work review out of class. These tutorials last approximately one hour and students can expose the progress of their work, the problems that they have had or the doubts that have come up. The teacher corrects it, solves those doubts and checks if they are fulfilling the planning set during the first session.

In order to obtain an interrelation between all groups and to prepare the final exposition, each group has to do two short speeches (ten minutes each), in which they explain what they have done so far. The rest of the class can participate by adding new aspects, expressing their opinion or disagreeing with the information exposed. This system makes oral presentations more dynamic, helps students to work continuously and makes evaluation easier because of comments from professor and students as well.

Stage 3: Finally, a public defend of each work may be done. Each group should explain the conclusions of

their work and relate them to those presented by the others groups. Thus attention of all class during the presentations is fomented.

Stage 4: At the end, the teacher exposes the conclusions of the real project.

Evaluation

An educational evaluation is done. Even tutorials or observations after oral presentations are a feedback for students about their learning performance.

Evaluation may be done regarding to different aspects or rubrics (Mager, 1984), each one has a certain value in the final evaluation. They are as follows:

- (1) The work process has adjusted to planning (5%);
- (2) The student prepares and exposes oral presentations appropriately (5%);
- (3) The student prepares tutorials (10%);
- (4) The student prepares and exposes final presentation correctly (10%);
- (5) The student elaborates the work correctly (60%);
- (6) Teamwork (10%).

Conclusions

We can mention the following conclusions from the experiences explained before:

Results, methodologies and experiences developed within the research projects can be moved to the class and not remain only in scientific communication area (congress, journals, publishing companies, etc.).

Adapting research projects to a learning strategy can be useful to approach contents discussed in class towards a real application area close to professional development. This could increase students' motivation, because they could understand and keep in mind the theory concepts.

Being more focused on professional development, grade subjects are easier for preparing an application, such as the one explained here.

Doing this experience does not mean to add work to students, but to adapt all their work to that problem posed within the research project.

Finally, none of the experiences explained in this report has been totally put into practice. Therefore, the information exposed should be completed with the results gotten from its application and with the opinion of students about required improvements.

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