

Universitat d'Alacant
Universidad de Alicante



Color & Vision Group
http://web.ua.es/en/gvc

Designing a b-Learning MSc in Color Engineering for the Automotive Sector

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iated EDULEARN14

Outline

- **Academic "product" design**
  - Colour Technology for special-effect pigments
  - Intended audience
- **Context & Impact**
  - Automotive Sector and related
  - University – Business Cooperation
  - Employability of (under)graduates and professionals
- **Feasibility**
  - Instrumental and Human Resources
  - Teaching strategy: adaptive Moodle
- **Conclusions**

Academic “product” design: ColTAS



MASTER in COLOR TECHNOLOGY
for the AUTOMOTIVE SECTOR

UNIVERSITY OF ALICANTE

Academic “product” design: ColTAS

GENERAL INFORMATION AND REGISTRATION

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E-mail: escuela.negocios@ua.es , dofa@ua.es

For any general information regarding registration, legalisation of documents, foreign students, scholarships, insurance and issuance of degree certificates it is convenient to contact with the Continuing Education Centre (CEC-UA: http://web.ua.es/en/continua/continuous.html).

Pre-registration and fees:

Anyone interested in registering should complete a pre-registration form before 30th June 2014. This form is available from the course Secretary and must be handed in with a photocopy of the student's National Identity card or passport, as well as any academic transcripts and degree certificate/s. During the first half of July 2014, the Head of Studies will publish the list of admissions, which will be formalized once payment of the course deposit fee (€420, equating to 10% of the total course fee) has been confirmed in the CEDIP's Sabadell Bank account. This payment constitutes part of the first installment of the fee and will be deducted from the first installment in September.

Generally, those accepted onto the course will be required to pay course fees to the CEC-UA in three installments, the first in September 2014 (50%), the second in November 2014 (25%) and the final installment in April 2015 (25%).

Management and coordination:

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Escuela de Negocios

BYK Additives & Instruments
BASF The Chemical Company
Mercedes Benz
PPG Industries Bringing innovation to the surface
AkzoNobel Tomorrow's Answers Today
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Office Color Science
PLASTIC OMNIUM

AUDI
TOYOTA
SEAT
RENAULT
VOLVO
OPEL
AXALTA COATING SYSTEMS
GRUPO ANTOLÍN

Department of Optics – University of Granada
Sensors, Instrumentation and Systems Development Center – Technical University of Catalonia

Department of Paper and Textile Chemistry – Technical University of Valencia
Institute of Optics – High Council of Scientific Research (CSIC)

(logos constantly updated)

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MASTER in COLOR TECHNOLOGY for the AUTOMOTIVE SECTOR

UNIVERSITY OF ALICANTE

Color Technology:
study of theories and techniques used to design, manufacture and measure colored objects

Academic year 2014-15

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UA UNIVERSITAT D'ALACANT
Color and Vision Group
Department of Optics, Pharmacology and Anatomy
Faculty of Science

Academic "product" design: ColTAS

Master's Degree in Color Technology for the Automotive Sector

A PROFESSIONAL PROFILE WITH A FUTURE

Color Technology focuses on the study of theories and techniques related to the design, manufacture and measurement of colored materials. A wide range of different industrial sectors are involved in color technology (colorants, coatings, textiles, ceramics, plastics, printing, multimedia, etc.). Unfortunately, in many cases, color experts within these sectors have not received any specific training in color science. Therefore, their knowledge about colors, which is critical to developing their work, has been obtained through practical, possibly self-taught, experience.

For this reason, companies involved in these productive sectors often invest considerable resources in specific color training to improve their employees' skills. In the same way, the limited number of graduates who do have advanced color training are highly sought after by many companies.

Over recent decades, color measurement and color quality control of gonio-apparent materials have become key areas for the automotive industry and also for other sectors such as cosmetics, coatings, plastics, printing, textiles, architecture, etc. Therefore, it is necessary to count on in-depth knowledge of complex instrumentation techniques and visual evaluation procedures as regards differences in color and texture (sparkle and graininess); and even color formulation with solid and special effect pigments.

In response to this socioeconomic demand, the Color and Vision Group of the Department of Optics, Pharmacology and Anatomy at the University of Alicante, in collaboration with other academic institutions (UGR, UPC, UPV and CSIC) and different companies (AUDI, SEAT, BASF Coatings, BYK-Gardner, Mercedes Benz, Volvo, Toyota Motor Europe, PPG, Merck, Valspar, Plastic Omnium, Nubiola, etc), is offering the Master's Degree in Color Technology for the Automotive Sector (acronym: ColTAS) as a postgraduate course with 60 ECTS or credits.

A DEFINED OBJECTIVE

The purpose of the ColTAS Master is to provide comprehensive training in the multidisciplinary study of Color Science and Technology from a global perspective. Students will examine the physicochemical and visual laws and solve real or simulated problems that often arise when using special effect pigments in different industrial sectors, particularly within the automotive sector.

This course includes an industry-based internship of up to 300 hours and provides a great opportunity to achieve basic and advanced color control skills at an industrial level, particularly in the automotive sector, but also in other industries using special-effect pigments as cosmetics, plastics, inks, etc.

For color experts with, or not, a university degree, this new postgraduate course is a great chance to enhance training and professional qualifications. Meanwhile, recent graduates, even undergraduates as it will be shown below, who choose to undertake this specialist postgraduate course will find it easier to obtain highly specialized jobs, which are therefore more highly valued (and better paid).

SYLLABUS

For undergraduate students (with less than 18 ECTS for finishing her/his graduate) and/or professionals without University degree, the ColTAS Master enables to obtain two sub-degrees (Expert = 20 ECTS + Specialist = 30 ECTS) before obtaining the final MSc degree, even in different academic years.

DEGREE DISTRIBUTION	SEMESTER	SUBJECT	ECTS
Expert in Color Science	1	Basic Colorimetry	6
	1	Colour Perception	6
	1	Colour Physics and Chemistry	6
	1	Bibliographic Resources	2
Specialist in Color Engineering for the Automotive Sector	1	Advanced Colorimetry	4
	1	Visual Appearance	6
	1	Visual Harmony Management	5
	1	Coatings and Plastics	3
	1	Colour Reproduction	7
	2	Internships I	5
MSc in Color Technology for the Automotive Sector	2	Internships II	4
	2	MSc Thesis	6

TEACHING STRATEGY

Blended learning methodology (b-learning) using the Moodle platform (http://sl.ua.es/moodle), with individual and collective learning activities, with a weekly continuous and effective communication and tutoring between student and professor.

However, taking into account the applied profile of this Master, when the first semester will be finishing, and before starting the internships, there will be an intensive period of mandatory laboratory practices and invited technical conferences (workshop).

EVALUATION METHOD

Classroom attendance is not mandatory, except the mandatory attendance for laboratory sessions and workshop finishing the first semester. But the virtual learning activities will be diverse and demanding. These activities will be evaluated to guarantee the assimilation of general, transversal, cognitive and procedural skills. If students do not fulfill the established requirements, they will simply receive a certificate of attendance.

The Master's thesis will involve drawing up, presenting and defending a report on the activities undertaken during the industrial internship (car manufacturers, coatings and plastic suppliers, etc.) or at a research institution.

ENTRY REQUIREMENTS

Spanish or foreign graduates in chemistry, physics, material engineering, industrial engineering, computer engineering, multimedia, architecture or psychology, etc. B1 in English. But, obviously, it is possible to access to this Master as undergraduate student, or professional without University degree, provided that the „Expert" + „Specialist" combination is done, even though in different academic years.

COURSE INFORMATION

Number of hours: 1500 (60 ECTS)

Type and duration:
Semester 1 (Blended learning from September to February, Monday to Thursday)
Semester 2 (Industrial Internship from March to May; Master's Thesis in June)

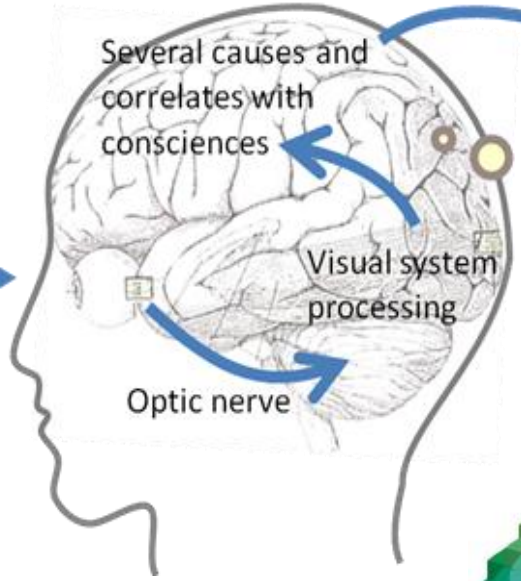
Registration fee: 4200 € to be paid by installments (corporate registration available)

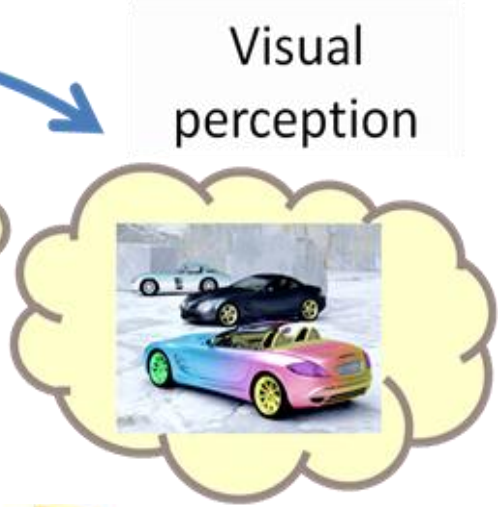
Qualification awarded: Expert in Color Science, Specialist in Color Engineering for the Automotive Sector, and, Master's Degree in Color Technology for the Automotive Sector, signed by the University of Alicante President.

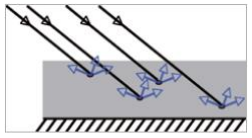
Colour Science & Technology

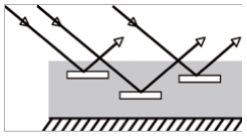
- Pigments with goniochromatic effect
  - Light–Matter–Eye Interaction
  - Nano/micro (structural) ⇒ macroscopic scales

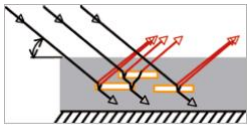







Absorption pigments

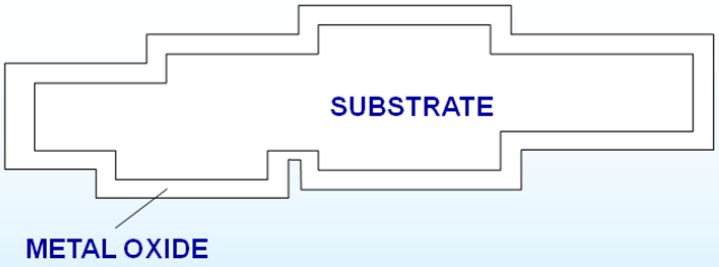

Metallic pigments


Interference pigments



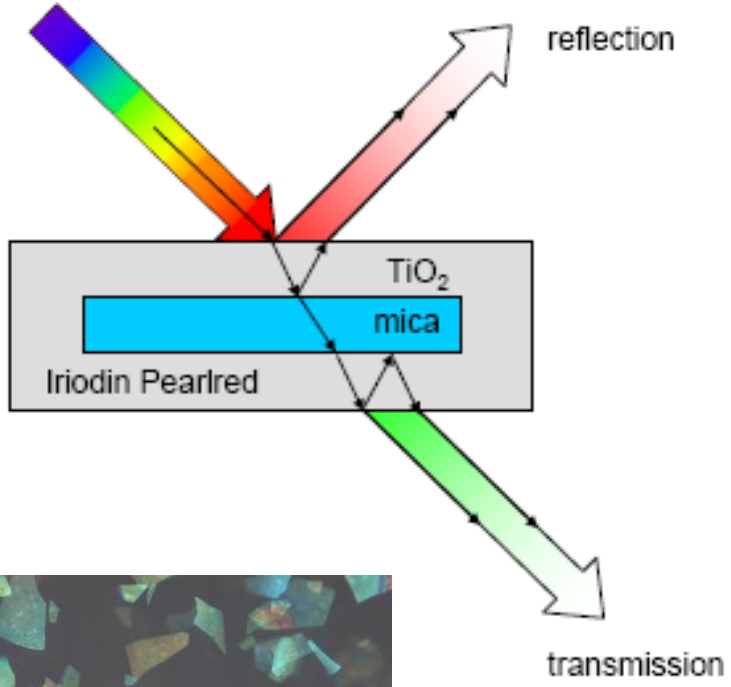
Color Science & Technology

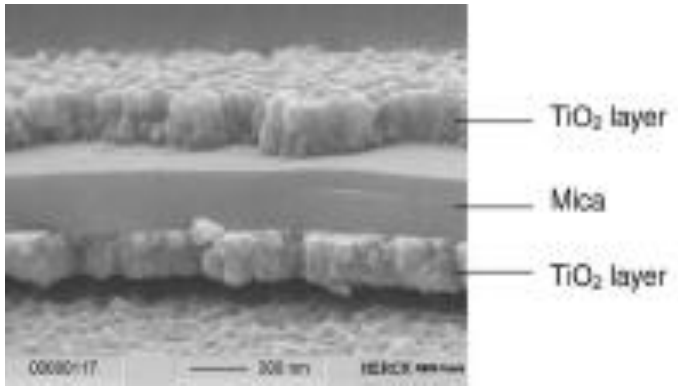
- **Special-Effect Pigments**

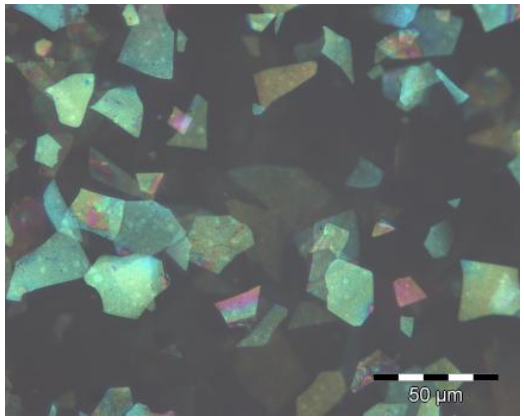


SUBSTRATE
Mica
Silicium Oxide (synthetic)
Aluminium
Aluminium Oxide (synthetic)
plated Iron Oxide (synthetic)

METAL OXIDE
TiO_2 (Rutil)
$FeTiO_3$
$CoTiO_3$
Fe_2O_3
Cr_2O_3
multiple layer







Social Context

- **Industrial sectors:**
  - Pearlescent or metallic pigments
  - Cars: exterior & interior parts
  - Plastics for consumer electronics
  - Cosmetics
  - Security inks
  - Building materials
  - Computer Graphics
    - Virtual Reality
  - Etc









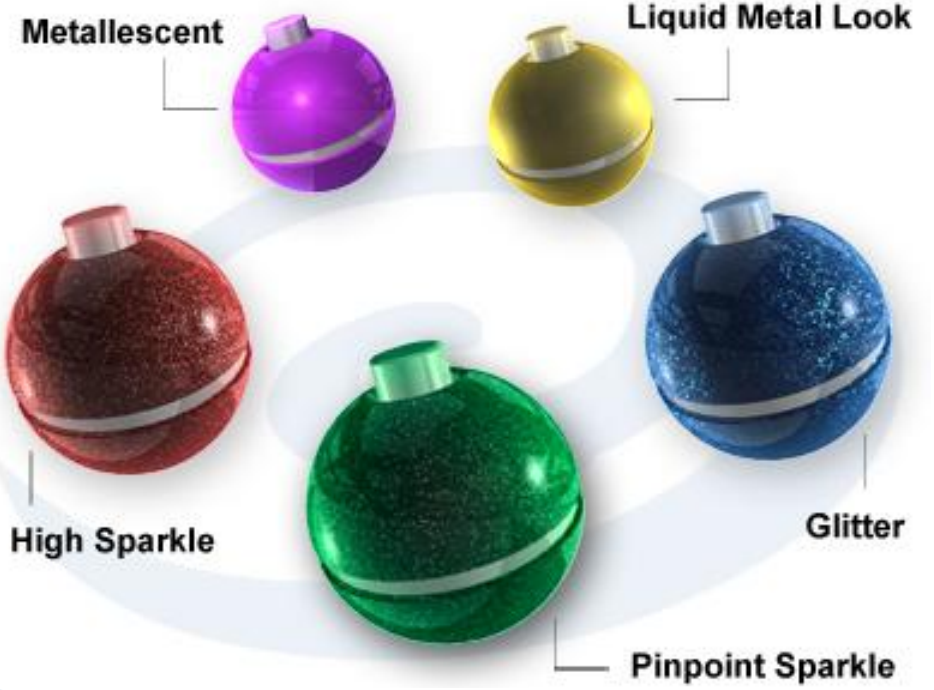




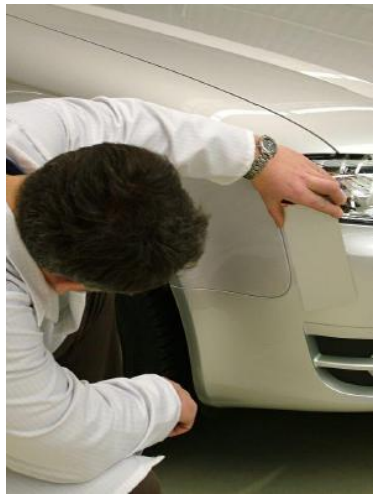
Context: challenges

- Colored materials with **different** pigments to obtain the **same** visual effect of color & texture



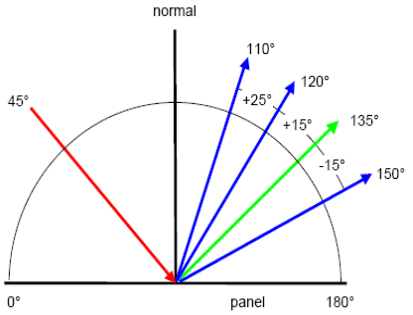






Context: challenges

- **New topics:**
  - **Metrology: calibration and standardization**
  - **Normative (CIE, ISO, DIN, ASTM, etc):**
    - **Measurement geometries**
    - **Visual scales for detection and discrimination**
      - **Color and texture (sparkle, etc) differences**



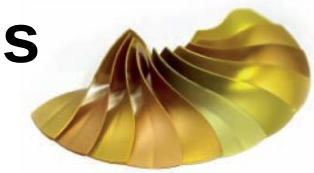


- **Reproducibility and visual quality control of many commercial products**





- **R&D in new visual effects with new special-effect pigments or sophisticated surface finishes**



ColTAS Syllabus

- Semester 1 (semi-attendance by Moodle): October – January
- Semester 2 (virtual): February – June
  - Internships in companies / institutions
  - MSc Thesis: Performance report related to the internship

DEGREE DISTRIBUTION	TOPICS	ECTS
EXPERT in COLOUR SCIENCE	Basic	20
SPECIALIST in COLOUR ENGINEERING for the AUTOMOTIVE SECTOR	Advanced	30
MSc in COLOUR TECHNOLOGY for the AUTOMOTIVE SECTOR	Internships MSc Thesis	10

ECTS: European Credit Transfer and Accumulation System

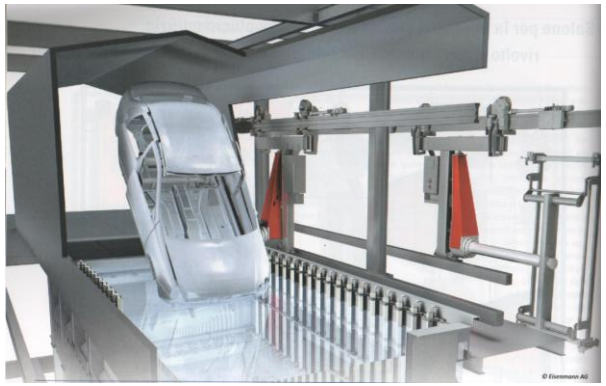
Intended Audience

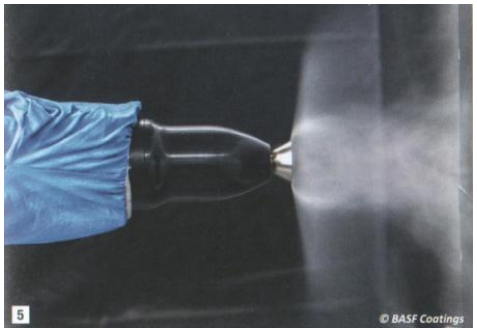
- **ColTAS Mission:**
  - **Training of color engineers in special-effect pigments (goniochromatic, functional, etc)**
- **Transversal & General Key Competences**
- **Procedural & Cognitive Key Objectives**
- **Blended learning using adaptive Moodle**

- **For (under)graduates and professionals in Chemistry, Materials, Industrial Engineering, Physics, Optics, Imaging & Computer Science, etc,**
  - **Or any discipline related to the quantitative description of colored materials**
  - **From Europe, America, Asia, Africa, etc.**
  - **Intermediate level of English**

Context & Impact

- **Automotive Sector and related:**
  - **Car body: composition metal & plastic components**
  - **Interior: dashboard, seats, lighting, etc**













Context & Impact

- **University – Business Cooperation:**
  - **Financial and budgetary sustainability**
    - **New revenues from private sources**
  - **Postgraduate with professional specialization**
    - **Differential (singular) quality at global level**
  - **Ensuring the employability of graduates**
    - **Not only local or national level, but also internationally**
    - **New professional profiles and ways of working**

- **University of Alicante, reinforcing the ColTAS, could be placed in the global vanguard of the training of new inter and multi-disciplinary professions in the XXI century**

Context & Impact

- **Promoting employability:**
  - **Sectors: automotive, cosmetics, plastics for consumer electronics, inks, etc**
- **(Under) Graduates:**
  - **ColTAS can provide an easier access to a highly specialized and valued job**
    - **~ 300 hours for internships**
- **Professionals:**
  - **Only attendance for laboratory practices and invited seminars in January 2015**
  - **Internships in their own companies**
  - **ColTAS can offer an appreciation in their professional training and qualifications**

Feasibility

- **Basic teaching group: GVC-UA**
  - **Doctors in Physics, Materials Engineering, Industrial Engineering, etc**
  - **Research group with more than 10 years of experience in R&D and technology transfer projects**
  - **Complete laboratory:**

















Feasibility

- **Supplementary teaching group:**
  - **Doctors and professional experts from:**
    - **Research institutions: UGR, UPC, UPV, CSIC from Spain**
    - **National and multinational companies**

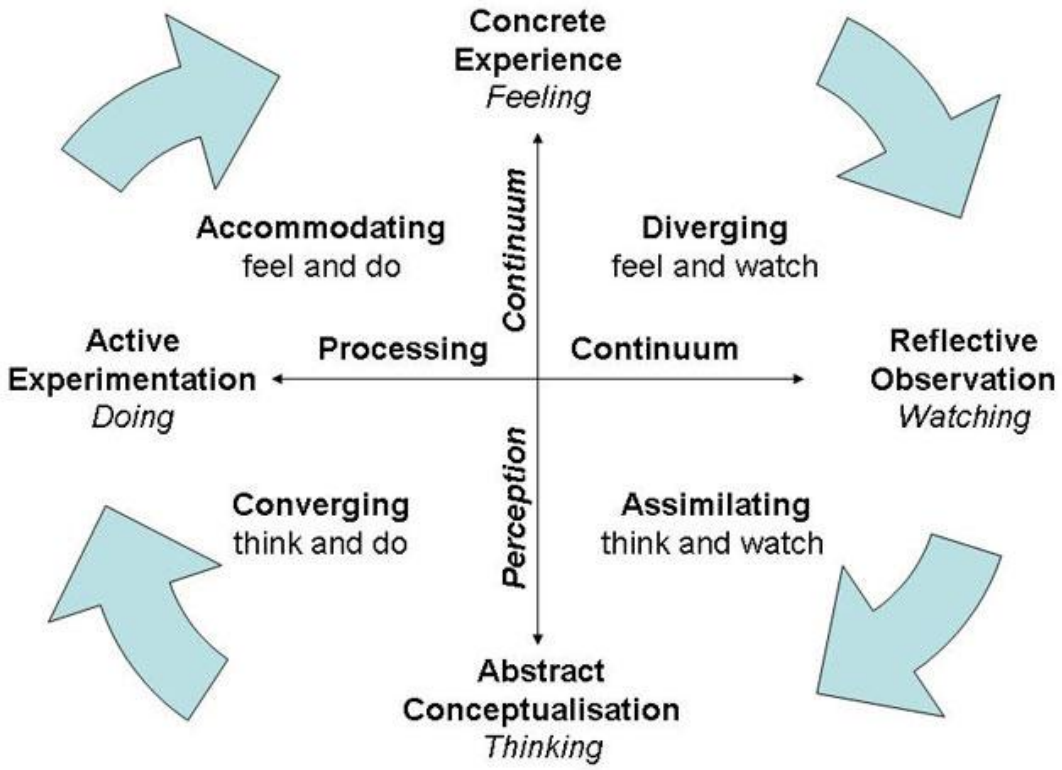


  - **Continuously updated with new free collaborations:**
    - **Renault, PSA Peugeot Citröen, Axalta Coatings, etc**
    - **Internships in or out of Spain**

Feasibility: teaching strategy

- **Adaptive Moodle platform**
  - **Learning styles:**
    - **Kolb, Felder, etc.**
  - **Thinking styles:**
    - **Stenberg, etc.**
  - **Combined:**
    - **Lamia & Tayeb**
    - **etc.**





Feasibility: teaching strategy

	Active	Reflective	Theoretical	Pragmatic
What **blocks** the student development	fear and ridicule, self-confidence, novelty causes anxiety, think much	enough time, impatient to begin, resistance for submitting written	based on first impressions, to be intuitive and subjective, take risk and show spontaneity	leave open issues, think that only one's ideas work, lost in the discussed topic
What **improves** the student development	make something new every week, read article with different opinion, force and sustain conversation with strangers	observation, monitor, keeping a personal journal, do files, controversial issues and develop arguments	read something dense, abstract theories and hypotheses, invent procedures to solve problems, do demanding questions	group dynamics, concept maps, interviews, research

Feasibility: teaching strategy

Table 2. Moodle suitability for adaptation

	Moodle activities							Collaboration methods
	Forum	Chat	Glossary	Workshop	Survey	Choice	Lesson	
Active	Concrete problems	Yes	Many terms	Experiment	No	Yes	Problems examples	Face-to-face
Reflexive	Topics for thinking	No	Concepts	Unexplored topics	Yes	Yes	Provided topics	Email
Visual	No	No	No	Yes	Yes	Yes	Illustration	Combined
Verbal	Yes	Yes	Yes	Yes	Yes	Yes	Written, multimedia	Combined
Sequen-tial	Yes	Frequent	Yes	Yes	No	Yes	Yes	Combined
Global	Global topics	No	No	Yes	Yes	Rarely	Rarely	Combined
Sensitive	Facts, examples	Yes	Yes	Practical examples	Yes	Yes	Facts, algorithm	Combined
Intuitive	Abstract topics	No	No	Unexplored topics	Yes	No	Rarely	Combined

Source: Despotović-Zrakić, et al., (2012): "Providing Adaptativity in Moodle LMS Courses". Educational Technology & Society 15(1), pp. 326-338.

Conclusions

- It has been shown the genesis and context of opportunity and logistic, organizational and technical feasibility, of a highly specialized one-year postgraduate course, with foreseeable impact at worldwide level for many industrial sectors, mainly automotive,

- and it would project, if successful in its first class, the University of Alicante in the global vanguard of new inter and multi-disciplinary professions in the XXI century

Acknowledgements

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GOBIERNO DE ESPAÑA
MINISTERIO DE ECONOMÍA Y COMPETITIVIDAD

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JRP – IND 52
xDReflect

- To the University of Alicante (CEC, DOFA, EN, etc) for their encouragement and confidence in this project.

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