



**State of the Art of Issues related to
Engineering Education in Europe
(European Workshop on Higher Education)**

The Innovation Program in Education at the Polytechnic University of Madrid (UPM)



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WG6

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THE CONTEXT

Of 42 million people who live in Spain, 5,7 million live in the region of Madrid

Of 70 universities with 1.5 million students in Spain, 13 universities with a total of a quarter of a million students are located in Madrid. Seven of them are private

UPM is the only exclusively technical university in Madrid and the largest and oldest technical University in Spain



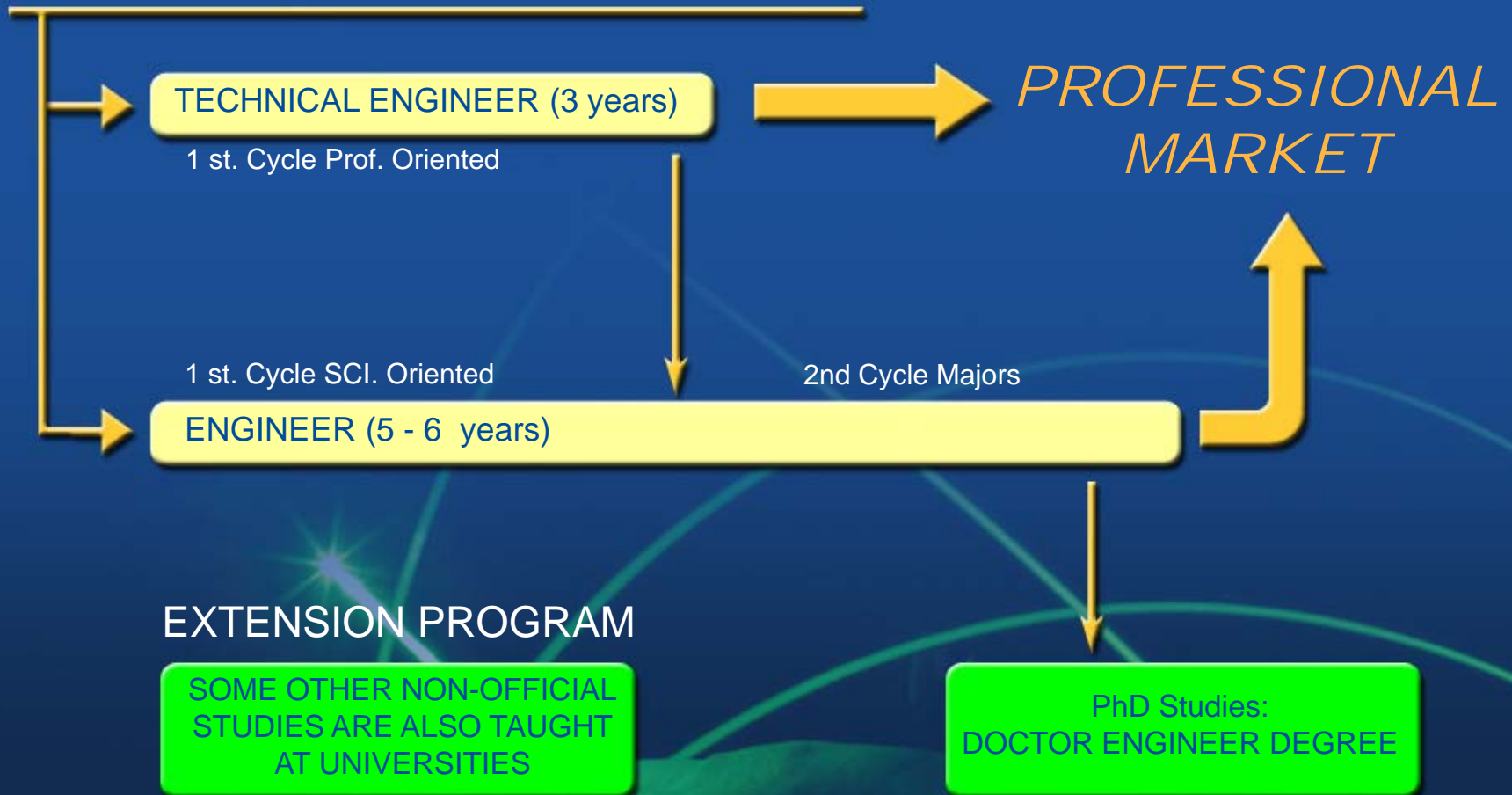
UNIVERSITY RANKING

BY NUMBER OF STUDENTS (2005)

UNIVERSIDAD NACIONAL DE EDUCACIÓN A DISTANCIA (UNED)	118 960
UNIVERSIDAD COMPLUTENSE DE MADRID	98 142
UNIVERSIDAD DE SEVILLA	61 418
UNIVERSIDAD DE BARCELONA	61 418
UNIVERSIDAD DE GRANADA	58 456
UNIVERSIDAD DE VALENCIA (ESTUDI GENERAL)	51 164
UNIVERSIDAD DEL PAÍS VASCO	48 300
<i>UNIVERSIDAD POLITÉCNICA DE MADRID</i>	45 655
UNIVERSIDAD AUTÓNOMA DE BARCELONA	38 480

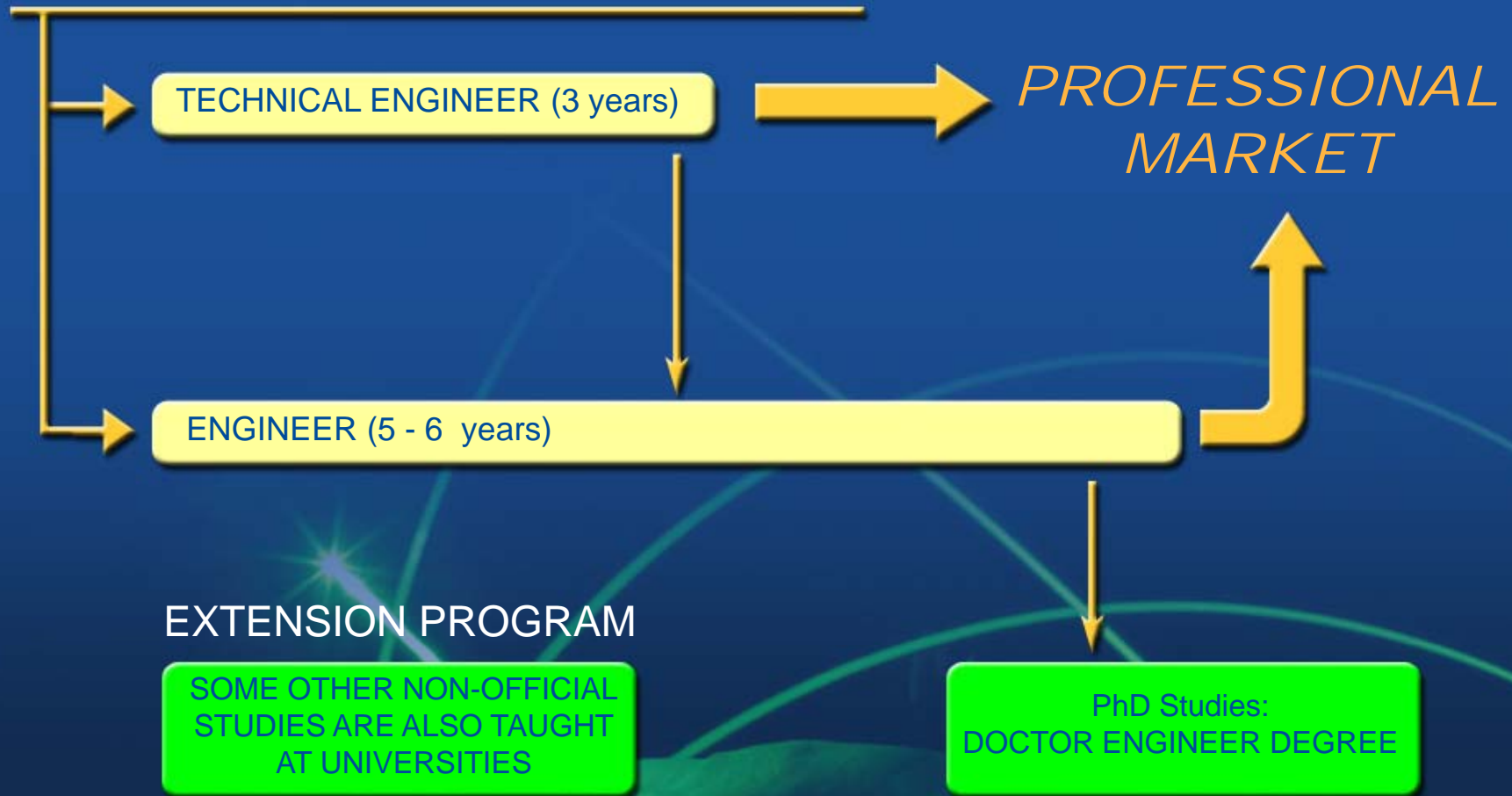
OFFICIAL ENGINEERING STUDIES IN SPAIN

After High School (18 years old)



OFFICIAL ENGINEERING STUDIES IN SPAIN

After High School (18 years old)



UPM CREATED IN 1971: MERGING OF CENTENARY ENGINEERING SCHOOLS



CIVIL, INDUSTRIAL, ARCHITECTURE, AERONAUTICAL, FORESTRY, AGRICULTURE, MINING, NAVAL, TELECOM., COMPUTER SCIENCE AND OTHER



FIRST TECHNICAL UNIVERSITY IN SPAIN

UPM FIGURES AT 2006:

11 ADVANCED ENGINEERING SCHOOLS (5 TO 6 YEARS ENG. AND PhD DEGREES)

9 ENGINEERING SCHOOLS (3 YEARS ENGINEER DEGREE)

37.000 UNDERGR. STUDENTS
6.800 MASTER STUDENTS
2.500 PhD STUDENTS

3.300 FACULTY MEMBERS
2.100 SUPPORTING STAFF
1.000 PROFESSIONAL STAFF

30 ENGINEER DEGREE
> 50 PhD PROGRAMS

SOME FIGURES WORTH MENTIONING

SCHOOLS AND COLLEGES 20

ACADEMIC DEPARTMENTS 111

RESEARCH INSTITUTES & CENTERS 9

TEST LABORATORIES 3

DISTANCE LEARNING CENTER

START-UP INCUBATOR FACILITY

TECHNOLOGY TRANSFER & PATENT OFFICE



ENGINEERING CENTERS AT UPM

ADVANCED CENTERS

(5/6 year degree)

AERONAUTICAL ENGINEERING

ARCHITECTURES

AGRICULTURAL ENGINEERING

CIVIL ENGINEERING

INDUSTRIAL ENGINEERING

MINING ENGINEERING

FORESTRY ENGINEERING

NAVAL ENGINEERING

TELECOMMUNICATIONS ENGINEERING

SURVEYING ENGINEERING

COMPUTER SCIENCE

SPORTS & PHYSICAL ACTIVITIES

TECHNICAL SCHOOLS

(3 year degree)

AERONAUTICAL ENGINEERING

TECHNICAL ARCHITECTURE

AGRICULTURAL ENGINEERING

PUBLIC WORKS ENGINEERING

INDUSTRIAL ENGINEERING

FORESTRY ENGINEERING

TELECOMMUNICATIONS ENGINEERING

COMPUTER ENGINEERING

LAST NEW DEGREES

(IN ALREADY EXISTING CENTERS)

- > Environmental Sciences (Two cycles)
- > Chemical Engineering (Two cycles)
- > Geology Engineering (Two cycles)
- > Geodesy and Cartography Eng. (2nd cycle)
- > Materials Engineering (2nd cycle)
- > Energy Engineering (2nd cycle)

UPM'S STRATEGY FOR THE SHORT TERM

“UPM is arranging its study programs to comply with the Bologna Declaration in order to facilitate the combination of studies among UPM and any international network of leading universities”.

UPM is working towards a 240-ECTS engineering degree as the Bologna Declaration suggests”.



UPM LOCATIONS IN MADRID



UPM is spread around 3 Campuses
The main one in downtown Madrid



The other two Campuses count with
Technological Parks (North & South of Madrid)



In addition, 2 of the oldest Schools are in
downtown independent locations

INSTITUTES & RESEARCH CENTERS

Most of them are Multidisciplinary

Automotive Industry

Genomics for Plants

Microgravity

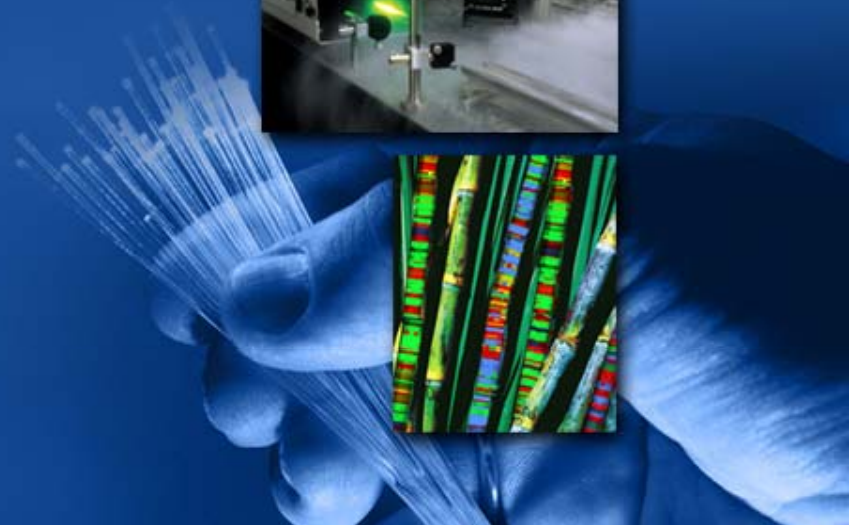
Solar Energy

Lasers

Opto & Microelectronics

Intelligent Transport Systems

Smart Homes



PhD PROGRAMS

DEPARTMENTAL PROGRAMS

- > **One year of courses**
- > **Another year of directed Research**
- > **Thesis (2 – 3 additional years)**

25% Int'l Students

POSTGRADUATE PROGRAMS: STUDENT'S DISTRIBUTION

Distribution for 100 students:



52% of Master's Students in Madrid are with UPM
24% Master's Students in Spain are with UPM

PROFESSIONAL POST-GRADUATE PROGRAMS

Masters Programs



At least two semesters

Specialization Programs



One semester

Continuing Education Courses

35% Foreign Students

INTERNATIONAL RELATIONS

UNDERGRADUATE STUDENT EXCHANGES

- DIPLOMA PROJECT
- ONE ACADEMIC SEMESTER
- ONE ACADEMIC YEAR
- DOUBLE DEGREE

**OVER 1400 STUDENTS ANNUALLY
50 DOUBLE DEGREE AGREEMENTS**

INTERNATIONAL RELATIONS

DOCTORAL STUDENTS

- **Short stays (3 months a year)**
- **Research oriented**
- **Funded by Research Agencies (up to 3 years)**



INTERNATIONAL RELATIONS

Faculty Staff (peer to peer relations)

FINANCED BY UPM:

- *SHORT STAYS*
(several weeks)
- *SABBATICAL PERIOD*
(up to one year)



RELATIONS WITH LATIN AMERICA

INTER-UNIVERSITY DOCTORATES (25 PROGRAMMES)

Cooperation with Latin American Universities

Courses and Thesis pursued Part-time in a LA University

JOINT RESEARCH IN DIVERSE DISCIPLINES

> 40 RESEARCH PROJECTS FUNDED BY UPM

SUPPORT FOR ACCREDITATION



RESEARCH AT UPM



- **Around 2000 own Scientific Staff, 1500 PhD students and 500 Support Personnel**
- **Extensive Cooperation with Industry in Spain and internationally**
- **App. 80% of the Research Performed at UPM is financed by External private sources**
- **From Basic Research to Technology Transfer**

SOME R&D FIGURES AT UPM

BUDGET: FROM COMPETITIVE RESEARCH

<i>PER YEAR</i>	}	TOTAL INCOME	100 M euros
		EUROPEAN PROGRAMS	12 M euros
		R&D SPANISH PROGRAMS	12 M euros

RESEARCH RESULTS

INT. JOURNAL PAPERS	1200
RESEARCH REPORTS	300
INT. CONFERENCE PAPERS	2300
DOCTORAL THESES	250

*THE INSTITUTIONAL
QUALITY PROGRAMME
AT UPM*

A hand holding a glowing blue fiber optic cable against a dark blue background with abstract light patterns.

THE INSTITUTIONAL QUALITY PROGRAMME AT UPM

The general lines of the Institutional Quality Programme, as passed by the Governing Council at its meeting on the 26th of May 2005, made a series of points regarding Quality of Teaching, including the following:

- **Promote the methodological innovation necessary for the subsequent implementation of the European Space for Higher Education**
- **Improve awareness of students' profiles, their academic and professional progress and entry into the labour market**
- **Encourage the participation of teaching staff in projects related to quality of teaching within the UPM**

EDUCATIONAL INNOVATION WITHIN THE UPM

(Aspects of the previous current situation)

- a) There was a significant number of teachers who have voluntarily joined forces in order to work on an idea or project with a view to improving teaching quality
- b) In the main, these were projects of a local nature which came about as the result of doubts arising over an aspect of teaching practice which the teachers concerned perceived as improvable
- c) There was apparently no known regional, national or international announcements of competitive projects in which aspects of educational innovation could be put into practice
- d) The external scope of educational innovation projects was extremely limited, in spite of the fact that there was a wide range of teaching conferences and specialist magazines available
- e) Groups tended to be relatively unstable and the idea of ongoing work did not appear to be high on the list of priorities
- f) In spite of this, there were important initiatives underway at the University which seek to confer greater continuity and improved the quality of educational innovation activities. In this respect it was worth highlighting the ongoing work of ICE, GATE and initiatives announced by Schools such as the ETSII, the ETSIT and so forth.

THE INSTITUTIONAL QUALITY PROGRAMME AT UPM

(Activities in 2005)

Among others:

- A request for submission calling for the submission of educational **innovation projects** linked to the implementation of the European Space for Higher Education and institutional participation in similar invitations to tender from other organisations
- A request for submission by the UPM calling for the submission of **research into institutional quality** which offers the possibility not only of developing activities spread around the various centres but also favours the **consolidation of groups recently created related to quality based activities**

THE INSTITUTIONAL QUALITY PROGRAMME AT UPM

(Aim of the invitation 2005)

The objectives of this pilot invitation to submit projects are as follows:

- **Encourage the methodological innovation** as related to the European Space for Higher Education, either through the maintenance and improvement of earlier experiences or through the setting up and implementation of new educational innovation projects during the academic year 2005-6
- Encourage research into, and the design of activities aimed at improving the **quality of processes and results of training programmes** leading to official qualifications of the levels that are offered at the UPM

THE INSTITUTIONAL QUALITY PROGRAMME AT UPM
(Educational Innovation Groups, 2006)

Educational Innovation Groups have been set up as bodies which are based on the stable collaboration that is needed in order to promote and develop Educational Innovation within the Universidad Politécnica de Madrid

Their creation forms a part of the framework of the overall strategy of Educational Innovation within the UPM

EDUCATIONAL INNOVATION WITHIN THE UPM

(Objectives of the creation of Educational Innovation Groups)

- a) Encourage the participation of teaching staff in educational innovation activities
- b) Establish a category in which greater recognition is given to teaching activities and whose members are readily identifiable
- c) Encourage long-lasting associations among professors, giving a sense of continuity to efforts made in the field of educational innovation and allowing for greater reflection and self-evaluation of the teaching staff's activities
- d) Give greater protection and exposure to the subject of Educational Innovation and ensure that it acquires a higher profile in both Spanish and international educational forums
- e) Improve the training and preparation of those participating as well as the efficiency of educational innovation projects
- f) Increase the number of specialists working in the different areas of Educational Innovation who are capable of promoting training and the formation of new groups
- g) Favour the channeling of subsidies and promotions run by the UPM in the field of its responsibilities
- h) Improve the overall quality of teaching at the UPM

EDUCATIONAL INNOVATION GROUPS (EIGs)

Objectives

Objectives to be sought through Educational Innovation Groups:

- **Promote Educational Innovation within the UPM**
- **Increase the number of teaching staff motivated by Educational Innovation**
- **Improve Teaching and Training in order to tackle Educational Innovation issues**
- **Create a framework of stability which encourages reflection and self-evaluation of activities**
- **Increase awareness and diffusion of the results achieved**

Set mechanisms in place which raise awareness of teaching activities

THE SETTING UP OF EDUCATIONAL INNOVATION GROUPS (GIE)

The idea was simple...

To be based on Research Groups

The implementation, however, has not been so easy...

As there are essential differences between the two types of “group”

- ***Very little tradition of working within stable, long-lasting group***
- ***Educational Innovation is a term which defines an area without clearly set limits***

We were not aware of any similar initiative in any other University

EDUCATIONAL INNOVATION GROUPS (EIGs)

General Criteria Regarding the Design of the Regulations

Two principles:

- **Be realistic with respect to the situation at the UPM whilst at the same time ensuring that quality criteria are met**
 - **Educational Innovation Groups**
 - **Educational Innovation Groups undergoing a process of consolidation**
- **Keep in line with UPM Teaching Objectives**

Ensure General Objectives associated with the Offer:

- **Adaptation to the European Space for Higher Education**
- **Improve the efficiency of training programmes**
- **Incorporate competitive training objectives**
- **Ensure the active participation of students**
- **Those objectives defined in the Centre Improvement Plan**

EDUCATIONAL INNOVATION GROUPS (EIGs)

EIG Operational Strategies

- **Promote Group Specialisation**
- **Define new operational priorities**
 - **New Learning / Evaluation methodologies**
 - **Attention to the student**
 - **Curriculum design**
 - **Incorporation of New Technologies**
 - **Coordination of University and Secondary School training programmes**
 - **The educational element of R+D+i**
- **Innovation Groups may wish to propose other operational strategies**

EDUCATIONAL INNOVATION GROUPS (EIGs)

Make up and size of Groups

- **A minimum equivalent to three full-time UPM professors is to be established**
 - ...of which two should be able to devote there whole time to this matter and have indefinite permanent contracts
- **The following may form part of an EIG:**
 - **UPM Administrative and Service staff**
 - **Sub-contracted staff and interns (“Temporary” members)**
 - **Teaching staff from other centres of learning (“Collaborative” members)**
- **A person may only be a member of one Educational Innovation Group**

EDUCATIONAL INNOVATION GROUPS (EIGs)

The Evaluation Process

Applications are evaluated according to two criteria:

Quantitative Criteria

Evaluation of “standard” curriculum: Competitive Projects, Congresses and Conferences Attended, Publications, Individual and Group Work

Qualitative Criteria

Evaluation of:

- a) **Composition and Definition of Work**
- b) **“Non-Formal” Curriculum: Prepared teaching materials, non-competitive projects, training, Participation in Commissions, Individual and Group Work**

EDUCATIONAL INNOVATION GROUPS (EIGs)

The Decision

Once all applications have been evaluated, the decision can be:

- ❖ **Educational Innovation Group**
- ❖ **EIG in process of consolidation**
- ❖ **Application rejected**

Educational Innovation Group in Process of Consolidation: New application to be made within a year

All Educational Innovation Groups to renew after two years have passed

EDUCATIONAL INNOVATION GROUPS (EIGs)

EIGs and The Departments

As the UPM's Departments are those responsible for all teaching matters, the introduction of EIGs cannot be imagined without the active participation of the Departments

The successful adjudication of an EIG does not imply that approval has been given to any Plan of Work. Participation in specific Projects will mean that these receive different treatment

*EDUCATIONAL INNOVATION GROUPS (EIGs)
Period of Validity for the Current Regulation*

Given the innovative nature of the regulation and that certain changes might be foreseeable with respect to the way in which educational innovation is implemented in the Universidad Politécnica de Madrid, a maximum period of two years from it coming into effect has been established, after which the current regulation will be reviewed

EDUCATIONAL INNOVATION GROUPS (EIGs)

Complementary Measures

The creation of an Educational Innovation Advisory Commission

- To check all applications and report to the Permanent Commission
- Assist and assess Groups
- Review changes to Groups once these have been made
- Maintain relationships within, and the make up of groups

Programme of Complementary Measures

- Set up diffusion and awareness raising spaces. May 2006
- Announce request for submission of Innovation Projects. June 2006
- Training Plan. September 2006
- Support office(s)

Thank you very much!!

Rosa M. Chueca

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