



# One-variable Calculus: A Spanish overview in accordance with the EHEA

ALFONSA GARCÍA  
FRANCISCO GARCÍA  
GERARDO RODRÍGUEZ  
AGUSTÍN DE LA VILLA

alfonsa.garcial@eui.upm.es  
gmazario@eui.upm.es  
gerardo@usal.es  
avilla@upcomillas.es



# Learning based on competences

A course of Calculus I for  
Engineering students

09/06/2010

15th SEFI MWG Seminar. One  
variable Calculus....

2

# Our considerations

- ◆ Teachers and students
- ◆ Competences
- ◆ Material
- ◆ Technology
- ◆ Learning
- ◆ Assessment

# Teachers and students

- ◆ Teachers must endeavour to monitor students' work and to draw up a high-quality and realistic plan for the course
- ◆ Students should get used to working autonomously daily

# Generic Competences

- ◆ Self-learning
- ◆ Critical thinking
- ◆ Teamwork
- ◆ Problem solving
- ◆ Use of technology

# Specific competence

- ◆ Use of knowledge and general techniques for differential and integral calculus, sequences and series, to solve engineering problems

# Material

- ◆ Textbook
- ◆ Study guide
- ◆ Self-assessment tests
- ◆ Worksheets
- ◆ Projects



# Technology

- ◆ Computer Algebra Systems such as Derive, Maxima, Mathematica...
- ◆ Learning Management Systems as Moodle
- ◆ Specific Portal





# Learning and Assessment

- ◆ Face-to-face learning and b-learning
- ◆ Active Learning Methodologies
- ◆ *Continuous assessment* plan based on students' daily work
- ◆ End-of-course exam: An alternative or part of the assessment plan

# Two Examples

U. P. Madrid	U. Salamanca
Mathematical Analysis <i>Computer Engineering</i>	Calculus <i>Construction Engineering</i>
73 students	135 students
Maxima Moodle	Mathematica EVLM portal
Continuos assessment or end-of-course exam	Continuous assessment and end-of-course exam

# 1. The experience of Madrid

- ◆ A first-year course
- ◆ 6 ECTS=156 h student work
- ◆ Moodle as a learning tool and a means for on-line teacher-student communication
- ◆ A continuous assessment model based on different learning activities and a team project.
- ◆ Almost 30% of the students chose the single-exam option

# Temporal distribution

	Hours for face-to-face activities	Hours for non-contact activities
Teaching and learning concepts	26	30
Problem-solving	26	30
Laboratory sessions	14	6
Team work	2	10
Tutorial Activities	4	
Assessment	6	

# A project for autonomous team work: Numerical Integration

## Objectives

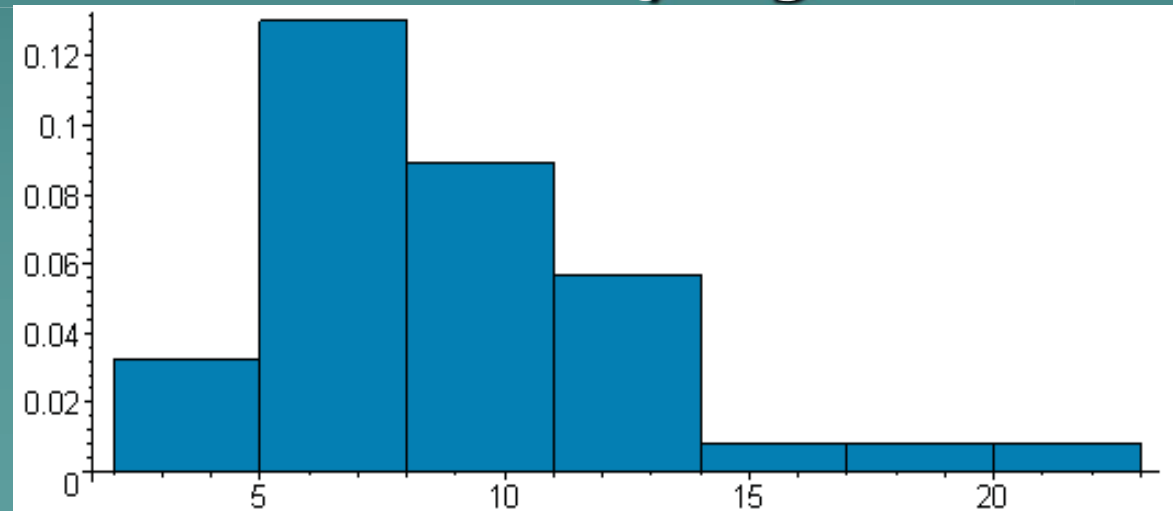
- ◆ Autonomous learning of some numerical integration algorithms.
- ◆ To program the appropriate functions to implement these algorithms using a CAS (Maxima).
- ◆ To test the programmed functions by means of a comprehensive test battery.
- ◆ To model and solve an engineering problem.

# Learning Goals

- ◆ Self-learning. (There is no explanatory lecture.)
- ◆ Ability to solve an engineering problem.
- ◆ Use of appropriate mathematical language to describe algorithms and define concepts.
- ◆ Understanding and applying relevant concepts for problem-solving using algorithmic skills and a CAS.

# Results

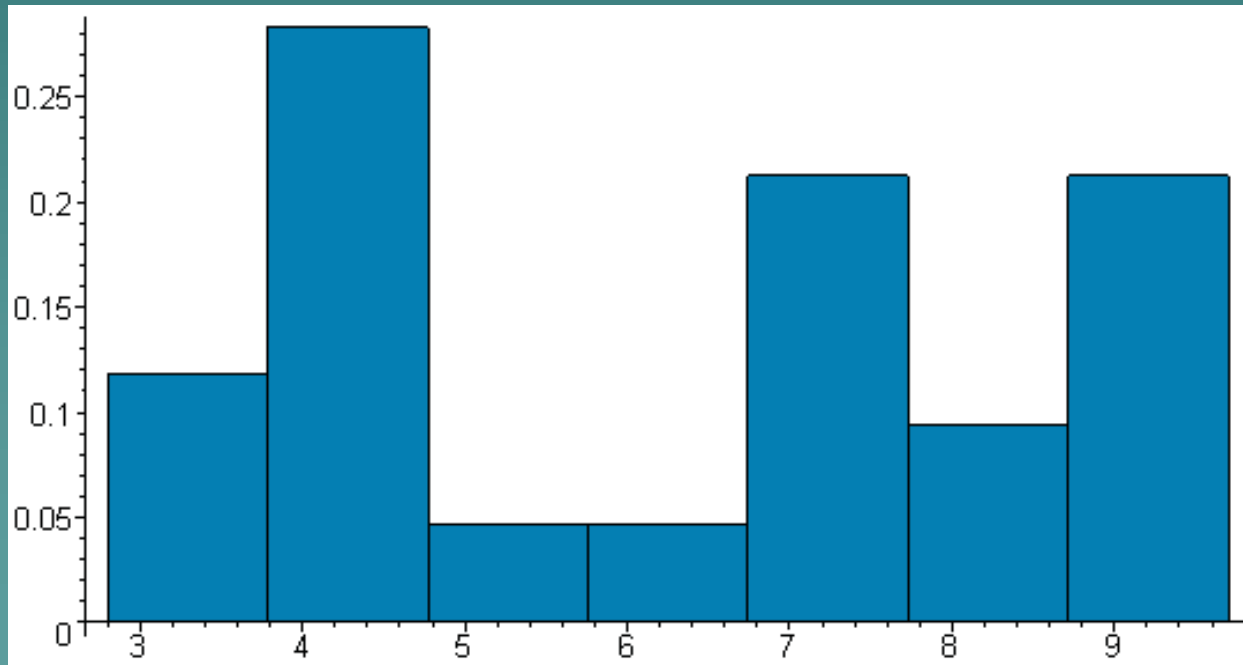
- ◆ Acquisition of competences: the students proved capable of applying self-acquired knowledge
- ◆ Workload: It was estimated that each student should devote around 10 non-contact hours to carrying out this project



# Results

This activity involved 15% of the student's final grade.  
45 students carried out the work  
26 achieved a grade above 5 points (out of a maximum of 10)

Average = 6.3, Median = 6.8, Standard deviation = 2.23.





## 2. The experience of Salamanca

- ◆ A first-year course
- ◆ 6 ECTS=150 h student work with similar temporal distribution
- ◆ Specific portal (EVLM portal) as a learning tool
- ◆ Mathematics Centre a means for teacher-student communication
- ◆ A continuous assessment model based on different learning activities

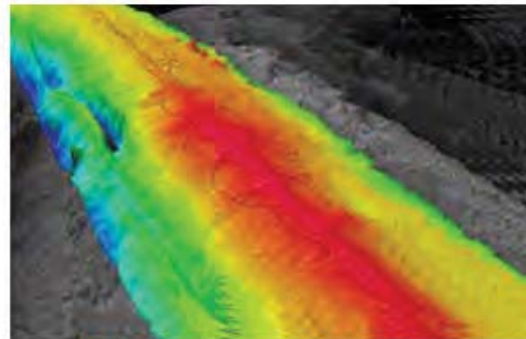
# EVLM Portal

The screenshot shows the EVLM Portal website. At the top, there is a header with the EVLM logo on the left and the University of Salamanca logo on the right. Below the header is a navigation bar with flags for various countries. The main content area is divided into several sections. On the left, there are three images showing students in a classroom setting. In the center, there is a grid of four mathematical blog thumbnails: 'Blog Matemáticas Discretas' (with a blue geometric diagram), 'Blog Cálculo Diferencial' (with a colorful heatmap), 'Blog Matemáticas Aplicadas I' (with a colorful network diagram), and 'Blog Ampliación de Matemáticas' (with a black silhouette of a person's head). On the right, there is a sidebar with a search box, a list of publications, and a section for the Leonardo da Vinci award.

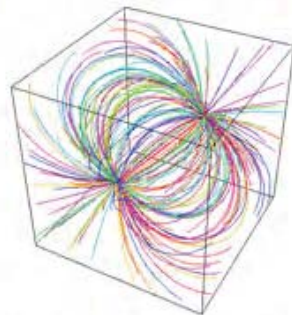
# EVLM Portal



**Blog Matemática Discreta**



**Blog Cálculo Diferencial**



**Blog Matemática Aplicada I**



**Blog Ampliación de Matemáticas**

## Base de datos

Regístrese  
Acceso a la base de datos

## E-Books

Guía del alumno  
Guía del profesor

## Proyecto EVLM

¿Qué es el proyecto EVLM?

## Temas

Categorías

## Consultas on-line

Consultas en español  
Consultas en inglés

## Cuestionario (ayúdenos a mejorar)

Cuestionario para alumnos

# Assessment

- ◆ Student daily work (including blog activities, solved problems, new Mathematica files, etc.) 60% of final grade
- ◆ One hour examinations (one per month) 40% of final grade
- ◆ End of course exam only for some students (some doubts in the final grade)

# Comparing results between new and old system

- ◆ 90% following the course versus 30% last year
- ◆ 75% of students passed the course (with continuous evaluation) versus 30% with single end-of-course exam last year.

# General Conclusions

- ◆ EHEA: new scenario. Students and teachers have to adapt to it.
- ◆ Students' daily work contributes to an improvement in the knowledge and understanding of mathematical concepts.
- ◆ Autonomous learning is very convenient for algorithmic processes once the concepts have been understood. Algorithm's implementation increase the development of competences.

# Conclusions (advantages)

- ◆ Students take advantage of new materials and emerging technologies to create their own learning scenarios
- ◆ The percentage of passing students has increased
- ◆ The percentage of absences has diminished

# Conclusions (disadvantages)

- ◆ Large number of students per class
- ◆ Teacher's work
- ◆ Absent students: What to do?



# DANKESCHOEN THANK YOU



09/06/2010

15th SEFI MWG Seminar. One  
variable Calculus....

25