TIME2012

Changing Assessment Methods: New rules, new roles

ALFONSA GARCÍA(*) alfonsa.garcia@eui.upm.es
FRANCISCO GARCÍA(*) gmazario@eui.upm.es
GERARDO RODRÍGUEZ gerardo@usal.es
AGUSTÍN DE LA VILLA avilla@upcomillas.es

(*) UPM Innovative Education GIEMATIC

Summary

1. Mathematics and Computer Algebra Systems
2. Two Experiences
3. Conclusions

Mathematics and Computer Algebra Systems

- History
- Here comes the futures: EHEA
- New rules-New roles

1.1 *History: Twenty years Teaching Mathematics in a CAS environment*

- From 1992 to 2012
- Traditional model: CAS has been used as an effective tool in supporting teaching
- Restricted use of the CAS in exams

1.2 Here comes the future: EHEA

- New attitude of teachers and students
- New learning scenarios
- Learning based on competencies
- New methodology
- New material
- New model of assessment
- Long-life learning
- E, b and u-learning

1.3 New rules- New roles

- Mathematical competencies for long life learning
- Collaborative learning
- Integrated use of the CAS
- What is assessed strongly influences what is learned
- New assessment methods, with free use of the CAS

Competencies and learning outcomes

***Meta competency**: To solve engineering problems with mathematical methods*

- Gather and organize relevant information
- Modelling
- Separate data from aims an choose an effective strategy
- Use mathematical knowledge and adequate tools for solving the problem

Student´s aims

The student controls his own learning and his strategy for problems solving

- Mathematics are important (everywhere and every time)
- Teachers define objectives. Students choose tools and strategies
- Use of algorithms and the own toolbox

2. Two experiences

2.1 Linear Algebra

- A first-semester course of Linear Algebra for Mechanical Engineers
- 6 ECTS=156 h student work
- Moodle for teacher-student communication
- A formative assessment model based on different learning activities

The Experience

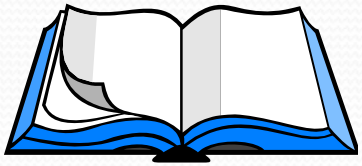
Control Group	Experimental Group
47 students	49 students
Traditional teaching 4 lab sessions with DERIVE	CAS (Maxima) integrated in all learning activities

Choosing the CAS

For the Experimental Group (EG), we propose free and open source software, which offers:

- Freedom to use it anywhere and for any purpose
- Freedom to study and adapt it to our needs
- Freedom to distribute it to students, which working at home

Materials for the EG



- Textbook
- Learning guide
- Maxima files
- Tutorials
- Worksheets

Use of Maxima

- Tutorials and files with solved problems are provided to the students.
- Problems for solving through teamwork
- One hour per week for answering questions concerning Maxima, in a traditional classroom with laptops
- Students can freely use Maxima for doing exercises and problems

Assessment

Control Group	Experimental Group
80%: Three traditional written exams with "paper and pencil" (*)	80%: Three written exams with free use of Maxima (*)
10% DERIVE lab sessions	10% Team work with Maxima
10% Quizzes	10% Face to face problem solving with Maxima

(*) Last exam was the same for both groups

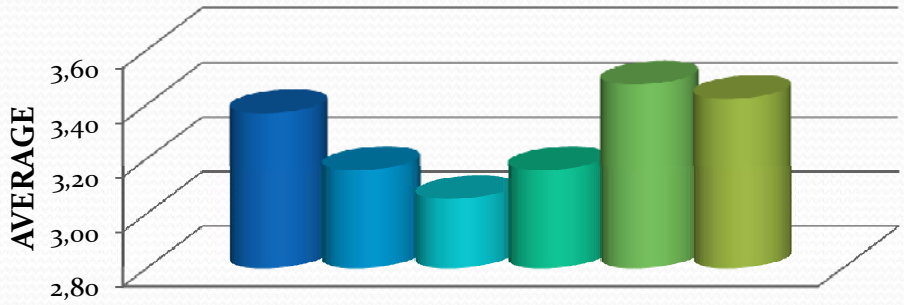
Results

	Control	Experimental
Students	47	49
Does not complete the course activities	1	13
Successfully complete the course	40	33
Do not pass the course	6	3
Efficiency rate	85%	67.3%
Success rate	87%	91%

Students feeling (EG)

- A survey with students opinion about the provided documents: tutorials files and solved problems files
- A survey with general questions
- Several items analyzed: Easiness, usefulness, adequate, etc.
- Perception concerning benefit-impact on competences

Survey: Tutorial of linear systems



A: Easy to understand the document

B: Usefullness of functions

C: The document favours the understanding of concepts

D: Proposed examples are feasible

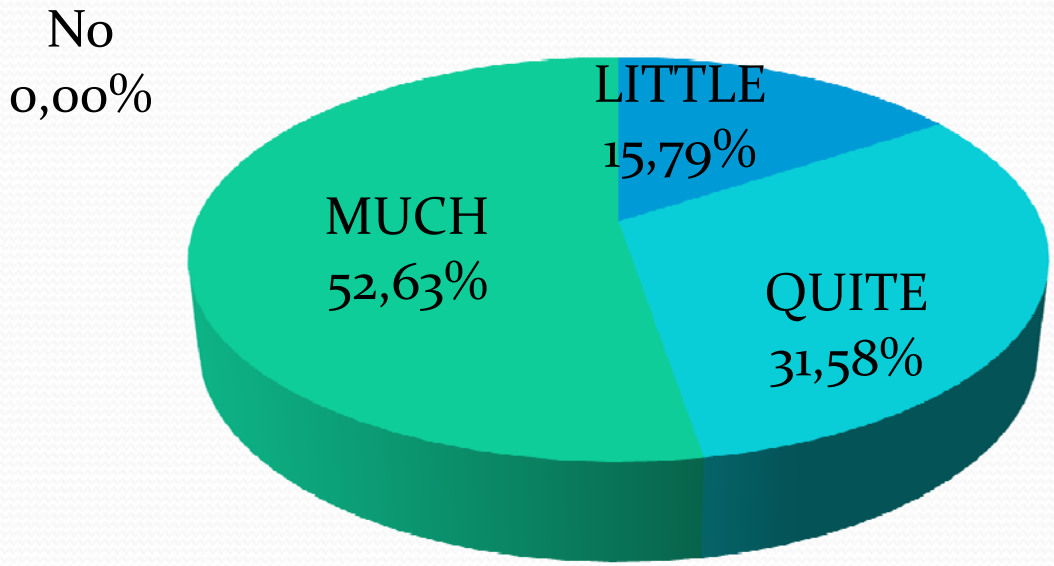
E: Usefulness of instructions in the solution of problems

F: Using documents in exams

Rank:0..4

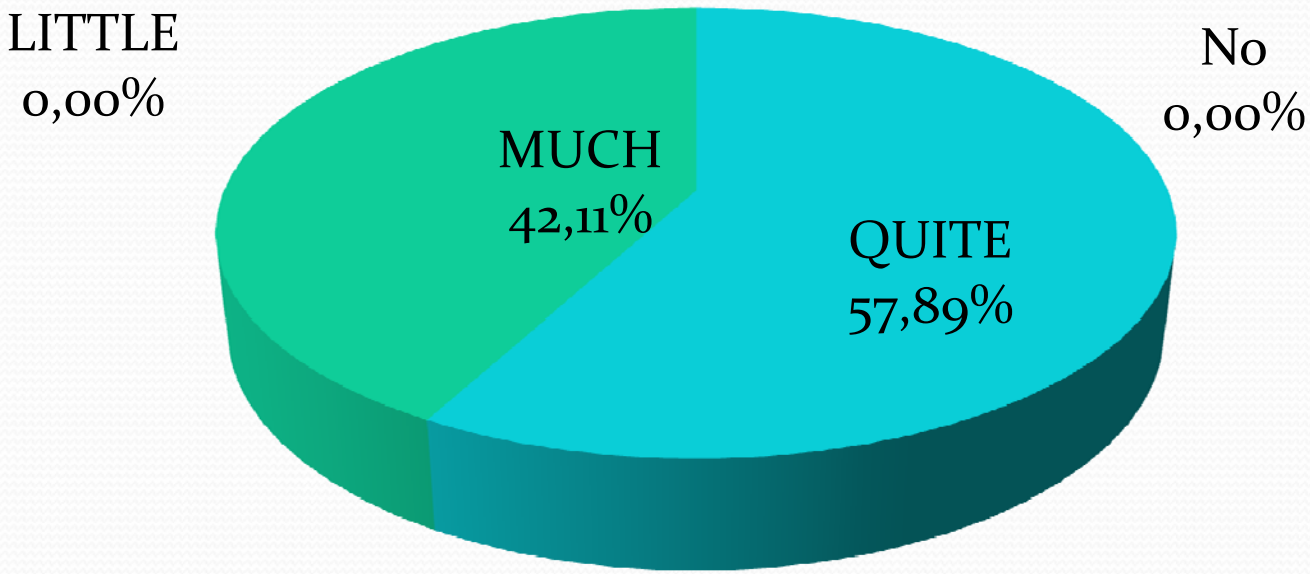
Students opinion about Methodology

The use of Maxima in exams is appropriated?

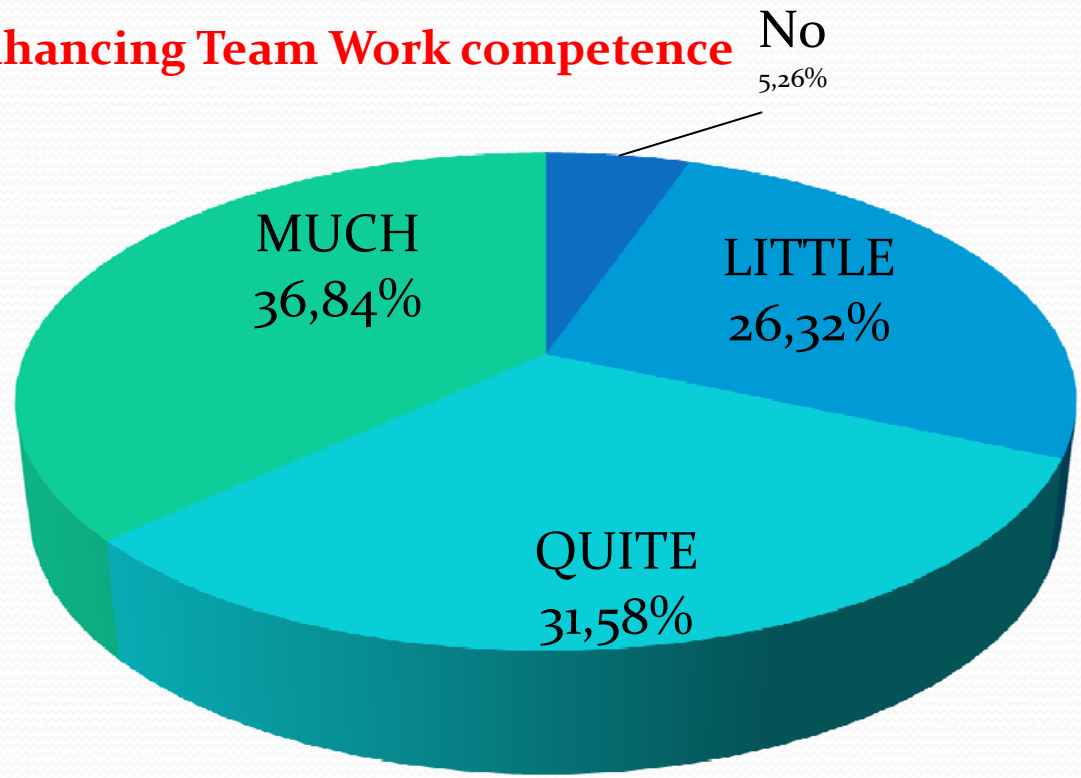


Impact on competences

Enhancing Self Learning competence



Impact on competences



2.2 Methods for Signal Processing

- An optional subject for a continuing education course of Computer Engineering.
- Students are “workers who study”
- Mathematical Support for Signal Processing
- 3 ECTS= 78 h student work
- B-learning with Moodle: 30% face to face , 70% on line

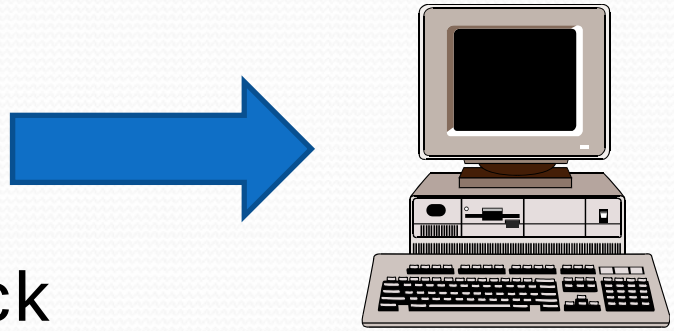
Choosing the Mathematical Software

MATLAB

- The most widely used software for Signal Processing
- Students can define tools to be used in other subjects (Signal Processing, Systems Control, Robotic…)
- Industrial Applications

Materials

- Learning guide
- Presentations
- Documents
- Forum
- On line Quizzes with feedback
- Matlab Worksheets
- Projects



Learning Activities	
Attending Lectures	9h
Displaying on line presentations	6h
Individual study	12h
Tutorials	3h
On-line quizzes (two attempts with feedback)	3h
Solving exercises with MATLAB	10 h
Doing a Matlab toolbox	10h
Small Projects (team-work)	20h +2h
Exams	3h

Assessment

- Exams (2), with free use of Matlab and the personal toolbox: 50%
- Team-Work Projects (2): 40%
- Online Quizzes: 10%

Results

- Students: Good marks and satisfaction with the assessment method
- GC:Team-work and self-learning competences has been developed
- SC:Teacher of Signal Processing appreciates the students' mathematical background

Conclusions (I)

- Students should be responsible for their own learning
- The use of Mathematical Software in the assessment activities is a crucial part in a learning framework based on competences, provides self-efficacy and promotes a way of working closer to the real work.

Conclusions (II)

- Students viewpoint:

  -Active learning helps to improve their competences

  -Good feeling about material and learning strategy

THANK YOU

GRACIAS

TÄNAN