#### Pedagogic case and specific course in which designed tasks and units are used

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| Pedagogic case: | * Inquiry-based approach to Ordinary and Generalized Least Squares, for 3rd year Mathematical Engineering students.
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| Description (including temporal scheme for design, development and implementation) | * To introduce some inquiry-based activity in teaching-learning: inquiry-based tasks.
* Computers will be used to let student explore real data and to let them find out most appropriate tools for the proposed goals.
* Rough planning: design and development: January-February 2019, implementation March-April 2019
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| Aim of pedagogic case | * Let students learn concepts related to parameters estimation in mathematical models; appropiate methods to solve problems in the field of science, technology and society.
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| Mathematical concepts  | * Ordinary least squares (OLS).
	+ Problem statement: Linear regression; geometric interpretation.
	+ Fitting data to linear models by ordinary least square.
* Generalized and weighted least squares.
	+ Modification of the OLS to take into account the inequality of variance in the observations and correlations.
	+ Gauss Markov Theorem.
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| Addressed practice | * 3rd year of the bachelor program in mathematical engineering.
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| Place in specific courseCourse namePlace of units | * The course is called Error’s Theory.
* Teaching units will be used the second month of course (when students already know more about matrix algebra and multivariate statistics).
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| Learners profileorientation, year, age, prior knowledge, other such as math anxiety, special needs, .. | * Orientation: 3rd year of the bachelor programs in ‘mathematical engineering’ and ‘mathematics’.
* Prior knowledge. Basic linear algebra, statistics.
* Special needs: For a large number of students statistics (parameter estimation) is not an attractive subject and many want to see applications.
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| Organisation of specific course study credits/hours, location, group size | * 6 credits ECTS course.
* Course runs on weekly basis from first week of February 2019 up to the second week of May 2019.
* Each week provides two lectures (50 mins each) and two tutorials (one with computers). Tutorials allow students to work on set tasks and discuss them with the lecturer.
* Units developed takes 2 weeks in total.
* Number of students: 80. Two computers sessions (one for each half of the cohort).
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| Expected learning outcomes | * Student will learn to estimate unknow parameters in linear models and analyse results.
* They will use and implement themselves computer models to explore the techniques used.
* They will use real data to propose, analyze, validate and interpret models of real situations, using most appropriate mathematical tools for the proposed goal.
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| Envisioned use of digital technology | * Maple, Matlab and/or R-Studio environment for inquiring approach and digital practice tasks.
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| Planning of tasks | * Performing an a priori analysis of the mathematics in the topic.
* Fitting new forms of activity into the teaching schedule developed in the previous year of the module.
* Design of inquiry-based tasks and teaching approaches.
* Design of R-studio/Maple/Matlab tasks.
* Keeping a record of new tasks/approaches for the current cohort – to include specific details of tasks and approaches, and teacher reflections on the teaching and learning that takes place.
* Student scores from a computer-based task on this material.
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| Names of persons involved  | Prof. M. Benavent; all the Professors of the Spanish Platinum Team and Students of the course. |
| Course: | Error’s Theory |
| Learning objectives | Students learn* To adjust observations in any of the experimental sciences in which the least squares methods are used.
* To solve problems and real cases in the field of science, technology and society through modeling skills, numerical calculation and optimization.
* Use computer applications of statistical analysis, numerical and symbolic calculation and graphic visualization to solve problems.
* Develop programs that solve mathematical problems using the appropriate computer environment for each case.
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| Learning contents | * Linear regression, multiple regression, ordinary least squares, variance, best unbiased minimun variance estimator, weighted least squares, Gauss-Markov theorem.
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| teaching /learning activities | * Each week provides two lectures (50 mins each) and two tutorials (one with computers). Tutorials allow students to work on set tasks and discuss them with the lecturer.
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| Media | * Tutorials, computers, statistical numerical and symbolic computation software.
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| Evaluation | * A percentage in the standard course evaluation.
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| **Instructor role** | * Development of course contents and presentation of course material in lectures.
* In lectures, discussing the mathematical concepts and appliation of them in the context of study cases in fields of mathematical engineering.
* Tutor – working with students in tutorials encouraging their own activity and thinking and providing support.
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| **Student roles**  | * Active participation in the lectures.
* Inquiry-based activities in tutorials: Learning about fitting data to linear and non linear models by ordinary and generalized least squares techniques.
* Practising methods with computer-based tasks.
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