



## **Teaching genetics, genomics and related disciplines to Erasmus students in English, language versus conceptual weaknesses.**

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**Indique uno o varios de los seis temas de Interés: (Marque con una {x})**

{ X } Enseñanza bilingüe e internacionalización

{ } Movilidad, equipos colaborativos y sistemas de coordinación

{ } Experiencias de innovación apoyadas en el uso de TIC. Nuevos escenarios tecnológicos para la enseñanza y el aprendizaje.

{X } Nuevos modelos de enseñanza y metodologías innovadoras. Experiencias de aprendizaje flexible. Acción tutorial.

{ } Organización escolar. Atención a la diversidad.

{ } Políticas educativas y reformas en enseñanza superior. Sistemas de evaluación. Calidad y docencia.

**Idioma en el que se va a realizar la defensa: (Marque con una {x})**

{ } Español      { X } Inglés

### **Resumen.**

El alto número de alumnos Erasmus nos llevó a iniciar la docencia en Inglés en el curso 2000-1. Se han impartido asignaturas optativas como Biología Molecular Aplicada, Ingeniería Genética Vegetal y Genómica, cursos de master: Herramientas de Genómica en Investigación o troncales como Genética. La evaluación se ha llevado a cabo con presentaciones orales, y desde 2009 se ha añadido un examen tipo test. El examen test criba a los alumnos sin conocimientos básicos y falta de atención a las clases. Presentar un artículo de investigación requiere tutorías debido a la densidad de la escritura científica comparada con la de los textos para estudiantes. Los estudiantes de grado obtuvieron notas similares independientemente de su origen. Por el contrario los estudiantes de master españoles obtuvieron notas significativamente mejores. Esta discrepancia podría deberse a que los alumnos extranjeros de grado tienen un nivel de conocimientos previo parecido a los españoles para las asignaturas. Sin embargo en el master, los españoles eligen por afinidad temática mientras que los extranjeros lo hacen porque se oferta en Inglés. El principal predictor del éxito de los alumnos no es que la

asignatura se imparta en Inglés, sino el grado de conocimientos previos relacionados con la materia impartida.

**Palabras Claves:** Erasmus, genética,

**Abstract.**

As a result of a relative important number of Erasmus students we started to teach in English in 2000-2001. Throughout the years the courses included optional courses like Applied Molecular Biology, and Plant Genetic Engineering for undergraduates, Genomics for graduate students, Genomic tools in research for master and compulsory courses like Genetics. Despite the offer of the different courses in English, the main predictor for the students success was a general knowledge of biological concepts and genetics rather than their English level beyond a certain minimal threshold. Grading was performed on the basis of an oral presentation of a scientific paper and since 2009 we included a short multiple-choice test of basic concepts. Both proved difficult but the multiple choice weeded out those students that did not do the every day work of attendance. The preparation of a scientific paper required tutorial guidance as a result of the density of the scientific writing as compared to regular undergraduate textbooks. Undergraduate students graded equal irrespective of their origin while graduate students were significantly better when coming from Spanish universities probably as a result of choosing the subject based on previous knowledge and not on the language used.

**Keywords:** Erasmus, genetics,

**Texto.**

Genetics is a subject central to biological systems. It is taught from different perspectives, as a fundamental subject and as one of the basic tools in biotechnology in all its different branches. Genetics is taught in many different curricula with different levels of depth and approaches. These include veterinary sciences, medicine, biochemistry, agriculture engineering, food technology, environmental sciences and biology. As a result the heterogeneity of students that can be encountered when teaching genetics to foreign students can be considerable.

We started to teach genetics-related subjects in 2006 in order to accommodate the Erasmus students. We also believed that it would help with the language burden, as most had a very low level of Spanish at the time of arrival.

We have been teaching several subjects in English described on table 1

Table 1 Genetics related subjects taught in Cartagena in English

Type		Content
First degree	Applied Molecular Biology	Basic molecular biology techniques



	Plant Genetic Engineering	Technologies used in horizontal gene transfer
	Genomics	Basic genome structure
	Genetics	Basic course in genetics
Master	Genomic tools in research	Advanced course in genome analysis

Although early work performed in the sixties showed that the best practice to obtain solid learning is through the discussion of research papers (Beard, 1976), this strategy has not been implemented at the undergraduate level in Spanish universities. We started with this approach as we felt that that the difficulty imposed by the English presentation for undergraduate students would be roughly the same irrespective of their origin. We could confirm this hypothesis as we found that the grades of the Erasmus and Spanish students did not differ in the average (Figure 1)

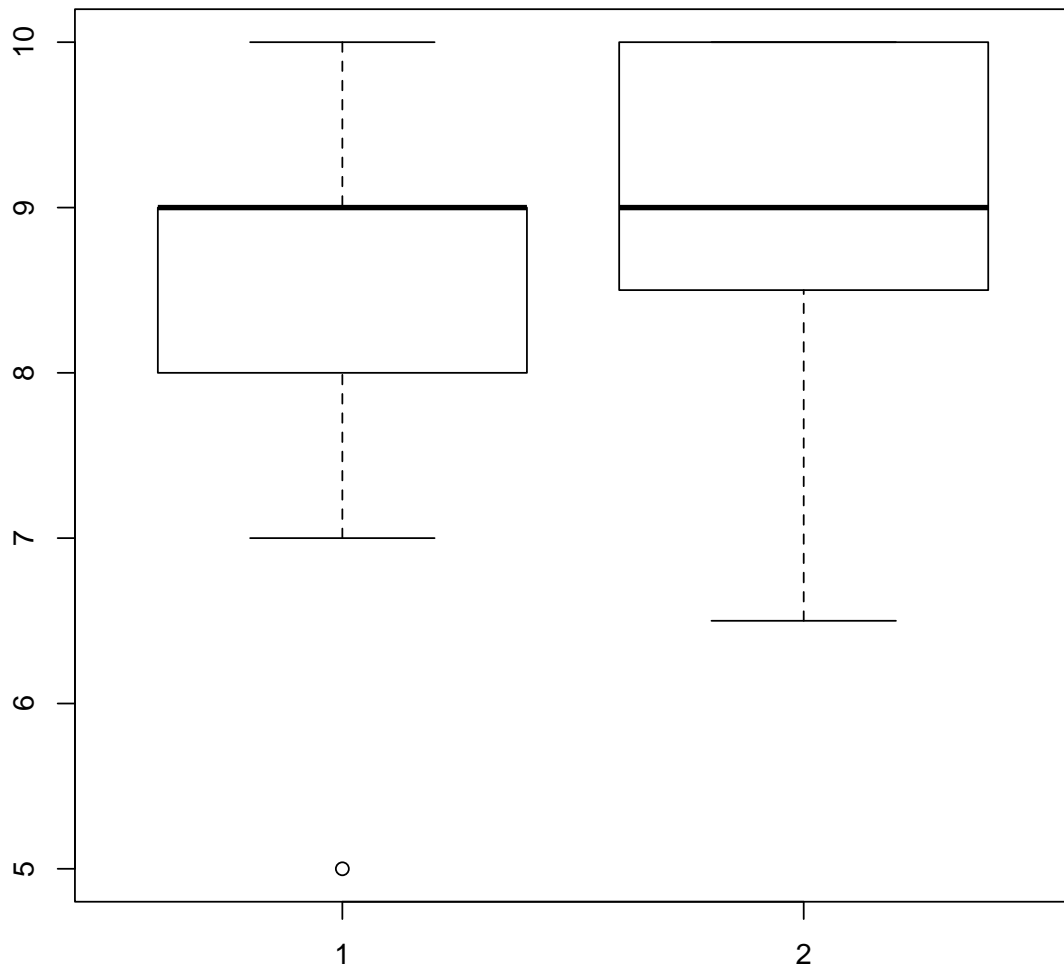


Figure 1 Boxplot of grades of Erasmus (1) and Spanish (2) students in the undergraduate courses during a time span of 7 years.

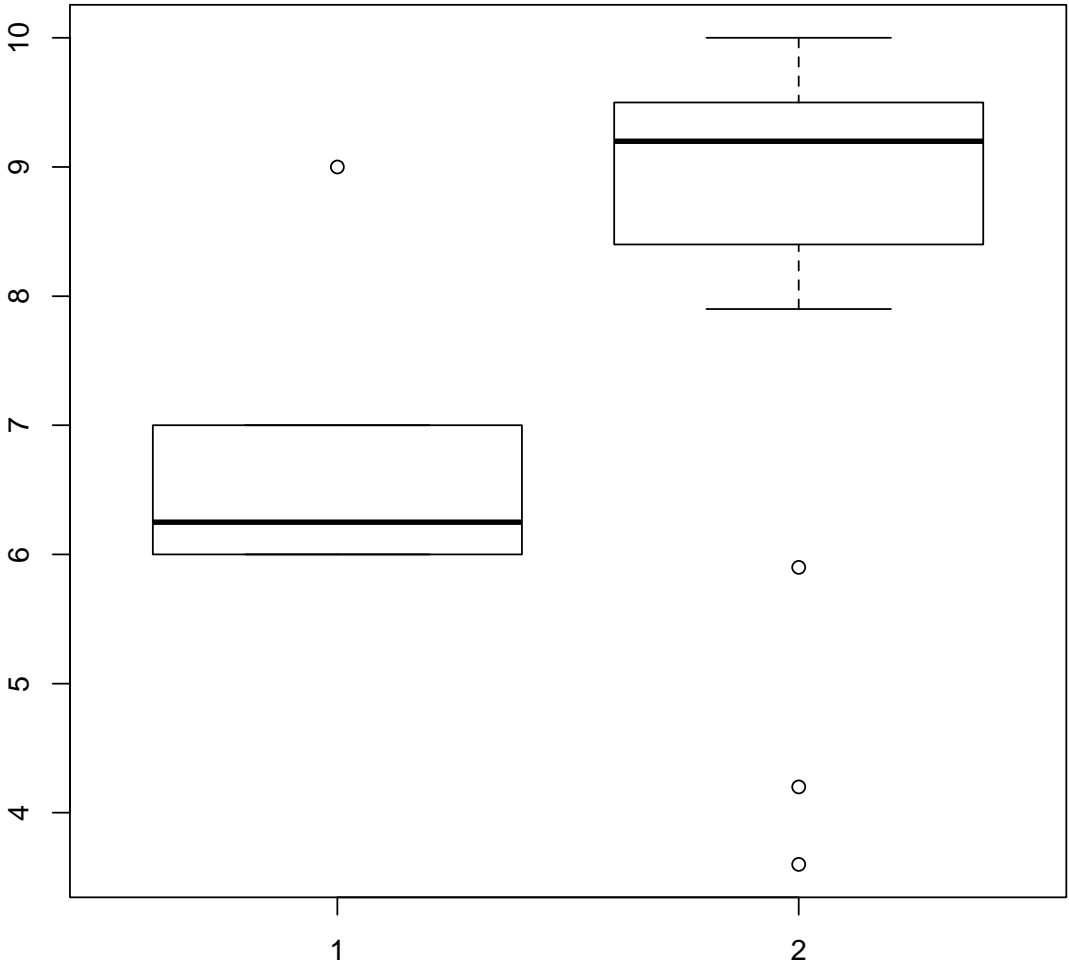
We performed a statistical analysis and we could confirm that the two populations were not statistically significant.

<b>Statistics</b>
t = -1.3126
Degrees of freedom 39.972
p-value = 0.1968
95 percent confidence interval: -1.1065998 0.2351713

Our results indicate that oral presentations in undergraduate courses, are of similar difficulty for Spanish and Erasmus students provided with a simple English research paper as the subject of presentation. Our results demystify the concept of how capable our students are and show that if required they can deliver high quality work.

We had a different situation in students accessing the Master studies. In principle they should be in the same situation as undergraduate students but they were not. Inspecting the data of Erasmus and local students we found a larger dispersion of the data, and a clear difference on the average grading obtained by the two groups of students (6.75 Erasmus versus 8.5 local) (Figure 2).

Figure 2. Boxplot of grading's corresponding to Erasmus (1) and local (2) students in the Master course Genomic Tools in Research.



Performing a statistical comparison showed that indeed the difference between both samples was significant.

<b>Statistics</b>
t = -2.8441
Degrees of freedom 12.437
p-value = 0.01434
95 percent confidence interval: -3.0938260 -0.4156978

Our interpretation of the data presented is that the difference found between undergraduate and graduate students has two origins. First students accessing a Master might come from different backgrounds, and the level of previous knowledge on a given subject can vary to a large extent. This was the case as the lowest ranking students from local origin were those that came from careers with low formal training in biological subjects, or genetics (Environmental studies and Electronic Engineering). The best students were those that had a higher level of biological knowledge or had taken an undergraduate course in genetics, previous to the genomics tools in research.

In contrast, Erasmus students from undergraduate studies, had a somewhat similar level of knowledge as at the level or 3<sup>rd</sup> or 4<sup>th</sup> year the amount of biological training is not substantially different for those careers that have Erasmus agreements with a given faculty.

Our conclusion is that the main predictor for students grading learning in English or using part of the material in English is the previous basic knowledge on the subject, and of course a minimal level of foreign language that differs on a personal basis, and seems to be very low in students coming from certain universities.

### **Bibliografía y Referencias.**

Beard, R. (1976). *Teaching and learning in higher education*. Penguin books.