Gender Equality at University: Evidence From IRIS Survey

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1. Overview

IRIS endorses that female students are more successful than their male fellows. In the academic years 2008/2009 and 2009/2010, female students obtained an average about 20% higher than their male fellows. Not only a numerical supremacy: 56% of females in 2009/2010 but also an academic success with an average IRIS = 41/100 of female students vs 34/100 of males. A supremacy that occurs not only in humanities faculties, but also in technical/scientific ones. A quantitative research [5] has been done to study the grade and intensity of gender differences as measured by the IRIS performance indicator used in the context of the University of Genova.

2. IRIS: the history of a performance indicator

IRIS is an acronym for *Indicatore di Rendimento Interfacoltà Studenti* (Interfaculty Students' Performance Indicator). The idea of IRIS belongs to Professor Giuseppe who was led to devise IRIS due to demands of some high schools of Genova asking the Faculty of Engineering to have information about their former students' performance. In 2005 the University of Genova Guidance Committee noticed the importance of such an indicator and stated to promote and extend the use of IRIS to all the students. In 2009 the report was added with a gender analysis, conducted under a convention signed among Genova University, the Regional Office for Equality Gender and the Province of Genova. The study has shown the best performance of girls in all faculties. The aim of this perspective is to provide guidance support in order to release students' choices by gender stereotypes [7].

2.1 IRIS: description and methodology

IRIS is an indicator measuring "efficiency" expressed as a percentage value between zero, in the case of students with no passed exams, and 100, in the case of students who passed all the exams of their curriculum with the highest rating. The value of IRIS is detected at 31 December of the year following the entry of each matriculated cohort and it is obtained by calculating the ratio between what a student has really done, in terms of credits earned and marks obtained, and how much he could have done if he had passed all his curriculum exams with the highest ratings.
The value of IRIS is therefore the ratio [6]:

$$IRIS = \frac{\sum_1^n Vi \cdot CFUi}{1{,}860} \cdot 100$$

- n = number of passed exams by December 31
- V_i = mark of the i-th exam
- CFU_i = number of credits on the i-th exam
- 1,860= the result of the product 31 (value conventionally attributed to the "thirty *cum laude*") by 60 (number of CFU generally provided in the first year): *Student's Potential (Pot)* in a Faculty

The *Student's Efficiency* value (*Pre*) in a Faculty: this value is obtained by multiplying the mark by CFUs related to that exam, and summing the products.
The *Student's Performance (IRIS)* in a Faculty corresponding to the ratio between student's efficiency value and student's potential, multiplied by 100.
IRIS was then associated with the students' sending high schools. $IRIS_{S/F}$ is a measure of overall performance in an academic year of the high school (S) former students registered in the faculty (F). $IRIS_{S/F}$ value is obtained by summing the performance values of former students coming from a high school (S) registered in the faculty (F), divided by the sum of the students' potential and multiplying the quotient by 100 to turn $IRIS_{S/F}$ in a percentage value [6]:

$$IRIS_{S/F} = \frac{\sum_{i=1}^{n_{S/F}} Pre_{St,/F}}{\sum_{i=1}^{n_{S/F}} Pot_{St,/F}} \cdot 100$$

- $n_{S/F}$ = number of former students of a high school (S) registered in a Faculty (F).

In general, graduates at high school (S) are registered in one of the eleven faculties. To give an indication of overall performance during their first university year, an estimated IRIS value was calculated without the breakdown by faculty but considering the overall university-wide students' performance measurement (AT): $IRIS_{School/Athenaeum}$ is calculated using the same criterion of $IRIS_{S/F}$ [6]:

$$IRIS_{S/AT} = \frac{\sum_{i=1}^{n_{S/AT}} Pre_{St,iF}}{\sum_{i=1}^{n_{S/AT}} Pot_{St,iF}} \cdot 100$$

- $n_{S/AT}$ = number of former students of a high school (S) matriculated at University of Genova (AT).

3. Participants and method

The participants involved in the analysis are all “pure matriculated” of AY 2009/2010, that is 5,048 freshmen of which 56% are female gender.
A secondary analysis [5] was performed on available data provided by the Statistical Office of the University of Genova about IRIS value of pure matriculated in AY 2009/2010. The University of Genova changed its organizational structure, that is eleven faculties were aggregated into five university Schools: Polytechnic School (Architecture and Engineering), Mathematical, Physical and Natural Sciences School, Medical and Pharmaceutical Sciences School (Medicine and Surgery and Pharmacy), Social Sciences School (Economics, Law, Education and Political Sciences), Human Sciences School (Arts and Humanities and Foreign Languages and Literature). The analysis showed gender differences by type of School compared to pure matriculated with IRIS zero, the direction and strength of the association between IRIS and the average rating of high school diploma and finally the effect of variables such as "gender", "residence", "type of high school attended" and "mark of high school diploma" on the “IRIS variable” of students with IRIS different from zero.
Descriptive, correlation and regression analyses were carried out by SPSS software [3].

4. Results

4.1 Pure matriculated

The data analysis shows a higher incidence of females in the School of Humanities, where every four students three are female gender, also in the School of Social Sciences and the School of Medical and Pharmaceutical Sciences, the incidence of females is approximately three every five pure matriculated. The situation is different in the Polytechnic School, where 60.99% of pure matriculated are male gender, while in the School of Mathematical, Physical and Natural Sciences there are no significant gender differences.

Table 1. % pure matriculated by gender and by type of University School

SCHOOLS	Male		Female		Total
	count	%	count	%	count
Social Sciences	701	38.41	1124	**61.59**	1,825
Polytechnic	619	**60.99**	396	39.01	1,015
Medical and Pharmaceutical Sciences	371	39.94	558	**60.06**	929
Humanities	152	24.76	462	**75.24**	614
Math, Physical and Natural Sciences	226	50.45	222	49.55	448
Interfaculty	118	54.38	99	45.62	217
Total	2,187	43.32	2,861	56.68	5,048

4.2 Who are students with IRIS zero?

Students with IRIS zero are those students who have passed no exams during their university first year and therefore they are likely to be more in trouble than their fellows and at risk of study delays. With regard to gender differences 23.3% of male gender pure matriculated has an IRIS zero vs 13.8% of females. The analysis of the results for each of the five Schools shows that Mathematical, Physical and Natural Sciences (MPNS) has more students with IRIS zero regardless of gender; it is also evident that males have a quality performance lower than females.

Table 2. Students with IRIS zero and percentage within University Schools

		MPNS	Medical and Pharmaceutical Sciences	Social Sciences	Humanities	Polytechnic	Interfaculty	Total
male	count	62	73	166	38	146	25	510
	%	27.40	19.70	23.70	25.20	23.60	21.20	23.30
female	count	52	58	163	68	40	12	393
	%	23.40	10.40	14.50	14.80	10.10	12.10	13.80

4.3 Analysis of correlation between IRIS and the average mark of high school diploma

If we assume a statistically significant correlation between the student's high school diploma rating and his performance at university (.447 significant at p-value ≤ 0.01) females seem to perform worse even if their high school diploma rating was high. With regard to gender the average mark of high school diploma is more predictive for males about the possible success at university and less predictive for females, as shown by the correlation coefficients. In other words, the marks obtained in high school diploma by females attending the Schools of Mathematical, Physical and Natural Sciences (MPNS), of Medical and Pharmaceutical, Polytechnic and Inter-faculty courses are less predictive than males.

Table 3. Correlation coefficients by Schools and by gender (correlations are significant at p-value ≤ 0.01)

School	Males	Females	Total	**Distance between gender coefficients**
MPNS	.501	.313	.413	.188
Medical and Pharmaceutical	.466	.368	.412	.098
Social Sciences	.494	.502	.510	-.008
Humanities	.416	.465	.457	-.049
Polytechnic	.419	.330	.401	.089
Inter-faculty	.523	.382	.462	.141

4.4 A model on gender performance by high schools

How much does the kind of gender affect the good performance of university students? To answer this question is useful a regression model designed to highlight what are the effects on IRIS of some variables entered in three stages: gender and residence place in the 1st model, type of high school attended in the 2nd model and mark of high school diploma in the 3rd model. The null model is assumed to be the pure matriculated male gender, coming from the province of Genova who attended the high school and came out with minimum mark (60/100). The data analysis shows that overall all variables are statistically significant: a female student has a 2.75 points better performance than a male student, but if she does not come from Genova her performance decreases by 2.60 points. Compared to a student who attended high school "Liceo", a student coming from a Technical institute has a worse performance by 8.29 points and the distance increases significantly in negative by 6.26 points in the case of a student who has attended a vocational school. Finally, one more point in high school diploma mark increases significantly IRIS by 0.78 points. With particular regard to gender, from model 1 to model 3 the effect of gender increases and becomes significant in the School of Mathematical, Physical and Natural Sciences (MPNS) and Inter-faculty courses in favor of the male gender; it decreases and loses significance in Social Sciences; it decreases but remains significant in favor of the female gender in the Polytechnic School and remains constant in the School of Medical and Pharmaceutical Sciences in favor of the female gender but not significant in the School of Humanities.

Table 4. Regression model: trend of gender effect on overall IRIS and by Schools

	MPNS ↑	Medical and Pharmaceutical Sciences =	Social Sciences ↓	Humanities	Polytechnic ↓	Inter-faculty ↑	Total ↓
Model 1	-5,61	6,66***	4,17***	- 1,21	10,10***	- 1,20	4,69***
Model 2	- 6,59	6,62***	4,01***	- 1,29	8,85***	- 4,45	4,22***
Model 3	- 6,56*	6,21***	0,868	- 5,21	7,17***	- 7,92	2,75***

Legend: * 0,05< p-value ≤ 0,10; ** 0,01 < p-value ≤ 0,05; *** p-value ≤ 0.01; the underscored coefficients are close to the significance value (p-value ≤ 0,15).

5. Discussion and Conclusions

The data analysis shows that students who did not pass any exam in their first university year (IRIS zero) are predominantly male gender; the correlation analysis between the high school diploma rating and the first university year performance shows an unpredictable females' performance than males; eventually the regression model shows the significance degree and the effect of gender variables on performance. These results show also the different characteristics of university Schools and can be useful to define new guidance actions based on an evidence approach.

In the School of Medical and Pharmaceutical Sciences and in the Polytechnic School there are more males with IRIS zero, better performances of females and less predictability of their future performance than males: here it would be necessary to activate stronger guidance actions for males.

In the School of Social Sciences and in the School of Humanities there are more males with IRIS zero and there is the same predictability level about future performance for both males and females: here males need a stronger guidance. In the School of Mathematical, Physical and Natural Sciences there is a high number of students with IRIS zero regardless of gender: here males have a better performance but females show less predictability than males about their future performance: here it would be necessary to activate stronger guidance activities for females.

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