Studies on Academic Performance According to Gender in Students of Information Technology Faculty at Universidad Latina de Costa Rica

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Abstract— **This paper studies the academic records at the Universidad Latina de Costa Rica (San Pedro) Information Technology Faculty during the 2011 and it is an extension of our first research that was focused on the first period of the same year [9]. It has been proposed the courses were grouped by two characteristics: a) competence components, and b) knowledge area. They were divided into seven different groups to determine on each, if there is a gap between genders and if it is necessary to take specific initiatives to reduce the found gap. The previous analysis [9], show that women consistently have better performance, higher frequency approving courses and less average abandoning them. There is an exception in the sciences courses.**
With new data, for a complete academic year instead of a four-month period, there is no difference in sciences courses performance, but stills about the dropout rates in this area.

Keywords – gender, academic record, IT education, women

I. INTRODUCTION

The acknowledgement of an existing gender gap in study areas like science and engineering has been taken on the late years. In certain universities, a department has been created to study the gender gap on the academic level and propose ways to shorten it. Other actions are being taken on governments and organizations that try to work on social preconceptions created on childhood that are considered to influence the choice of one university degree over another. There are multiple sociological and psychological studies to determine some differences on cognition processes according to gender [1],[2]. Some authors like Bell and Sternberg[3] (1993) propose that these differences are part of a biological point of view, but other views, specially radical feminists, propose that sex determination is socially constructed. Some authors like Bank [4] (2007) go deeply in educational theories and institutional backgrounds that could affect directly on a teaching and learning context.

At Universidad Latina de Costa Rica, specifically on the Information Technologies Faculty (ITF) located in San Pedro, a study has started with the information available to evaluate the academic performance of students according to gender. For this study, we are using as primary source the grades obtained by students on 2011 (three periods), on the bachelor's degrees offered on San Pedro's campus that are part of the ITF, which are: a) Systems Engineering (CSE), b) Business Technologies (BT) and c) Software Engineering (SE). We used a total number of 7934 grades, 5041 more than our first study [9].

This study attempts to dig deeper in issues related to gender in order to offer information that could be used when planning a curriculum or establishing educational strategies in areas related to Information Technologies (IT). The parameter that is normally used to evaluate gender integration in university degrees in Costa Rica is the gender proportion according to degree. On the total sample selected, we find that there are 80% males and 20% females enrolled on the different courses offered on each degree. Now, this parameter do not give more information on the status of gender situations on university degrees, and that is why we find necessary to create studies with a farther outreach.

At first, the goal is to understand how is the performance of active students working, and according to the information found, to create a support strategy for this specific population. In the future, the project would be to propose some actions for elementary and high schools to create solutions that would allow new students to overcome some obstacles they could find in the ITF careers.

It is necessary to point that this initiative does not mean to be a feminist struggle, but an internal analysis that can let us understand the students' performance according to gender, in the different areas in which courses can be classified. After that, it is going to be possible to determine the factors that origin low performances, and at the same time, offer some

improvement opportunities and some focalized attention to the existing gender gap.

This paper is organized in the following way: on section II, we will show the group classification used for the courses offered in the ITF degrees, on section III we will identify some variables related to academic performance, as example, average grade per gender on different subject classification, including frequencies according to grades and levels of desertion. On the last section (IV), we will conclude and propose future studies that could come out front this research.

II. CLASIFICATION ACCORDING TO SUBJECT

For subject classification, we proposed two types of groups. First, we used the learning development outline based on competences, created by de Miguel (2005) [5]. We took on account the three components of competences that could be developed on the subjects of the degrees offered in the ITF.

These components are:

a) *knowledge*
b) *habilities and skills*
c) *atittude and values.*

The development and program of each course, in spite of not being oriented for the comprehensive development of competencies, could be analyzed in a general way, and every subject could be considered as oriented to one or other component of the competencies.

Based on these components we established a subject classification by defining if the subject, as given during 2011, was more oriented on knowledge or on skills and abilities. This was decided through interviews with directors and professors of each degree on ITF.

For the subject classification, we used a qualitative data scale from 0 to 10, where 0 represents course oriented on knowledge with no focus on skills and abilities, and 10 represents a course oriented only on skills and abilities with no focus on knowledge. A course qualified with 5, on this scale, would be a course that works equally on components, knowledge and skills and abilities. On figure 1, we show a diagram of the scale established.

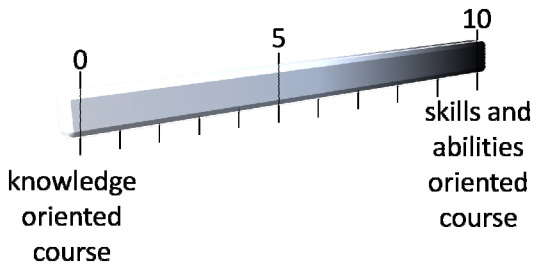

Figure 1. Graphic representation of the qualitative scale for courses, according to the component of competences developed.

Using this concept, we did a classification on three groups, according to the points assigned using the scale defined on figure 1. On table 1, we show an example of the classification that has been established:

TABLE 1. GROUPS DEFINED ACCORDING TO COMPONENTS OF COMPETENCE TO DEVELOP.

Groups	Competency scale classification	Subject orientation
Group 1	0, 1, 2 y 3	Focus on knowledge
Group 2	4, 5 y 6	Focus on different components of competencies, both knowledge and skills and abilities
Group 3	7, 8, 9 y 10	Focus on components of competencies related to skills and abilities

The second method was to establish a qualitative classification of ITF subjects according to the knowledge area that studies in depth. This classification was made according to the areas showed on table 2.

TABLE 2. GROUPS SPECIFIED ACCORDING TO THE KNOWLEDGE AREA THAT STUDIES IN DEPTH

Group	Knowledge area
Group A	Basic sciences
Group B	Information systems and technology
Group C	Humanities and language
Group D	Management and administration

It is important now to indicate that some courses cannot be classified in a single group for an area of knowledge, so they are classified in two areas at a time. For example, on table 3, we show the courses offered on the degree for Business Technology, with its classification.

TABLE 3. GROUPS DEFINED FOR THE COURSES OFFERED IN THE BUSINESS TECHNOLOGY DEGREE

Course	**Group by knowledge area**	**Classification by Competence scale classification** (figure 1)	**Group by components of competence**
Databases	**B**	8	**3**
Communication Skills	**C**	3	**1**
Information Technology Introduction	**B**	5	**2**
Software Development Methodology	**B**	8	**3**
Information Technology Legislation	**C**	3	**1**
Programming I	**B**	8	**3**
Programming II	**B**	8	**3**
Networks	**B**	8	**3**
Operating Systems	**B**	8	**3**

III. PERFORMANCE PARAMETHERS ACORDING TO GENDER IN THE DEFINED GROUPS

At Universidad Latina de Costa Rica, the grade on every course is given by a number between 0 and 100, the minimum score to pass the course is 70. The scores were distributed in groups of 10 points each. After that, for each subject we calculated de relative frequency according to gender. For example, in the course Data Center Administration, part of the degree Computer Systems Engineering, during the first 2011 period had a total of 35 students, 29 males and 6 females. The absolute frequencies are shown on table 4.

TABLE 4. ABSOLUTE FREQUENCIES OF QUANTITY OF STUDENTS ACCORDING TO GRADES OBTAINED ON THE SUBJECT DATA CENTERS ADMINISTRATION.

Score obtained	From 0 to 9	From 10 to 19	From 20 to 29	From 30 to 39	From 40 to 49	From 50 to 59	From 60 to 69	From 70 to 79	From 80 to 89	From 90 to 100
FEMALE	0	0	0	0	0	0	0	0	4	2
MALE	0	0	0	0	1	0	0	0	5	23

The relative frequencies were calculated in relation with the totals for each gender on the subject. The table for relative frequencies on a single subject is show on tablet 5.

TABLE 5. RELATIVE FREQUENCIES BY GENDER (STUDENT PERCENTAGE) ACORDING TO GRADES OBTAINED IN THE COURSE DATA CENTERS ADMINISTRATION – FIRST PERIOD 2011

Obtained Scores	From 0 to 9	From 10 to 19	From 20 to 29	From 30 to 39	From 40 to 49	From 50 to 59	From 60 to 69	From 70 to 79	From 80 to 89	From 90 to 100
FEMALE	0%	0%	0%	0%	0%	0%	0%	0%	67%	33%
MALE	0%	0%	0%	0%	3%	0%	0%	0%	17%	79%

This same analysis was made for each of the courses for the three periods of 2011. Subjects were grouped according to the classification proposed for knowledge area and competence formation, as suggested of section II, and the average was calculated for each one of the groups, according to the relative frequencies regarding the scores obtained.

A.Average performance for each group per competence component

The data obtained for the percentage average on groups 1, 2 and 3 is shown on figure 2.

B. Average performance for each group per area of knowledge

The data obtained for the percentage average on groups A, B, C and D is shown on figure 2.

C. Approved students average for the specified groups

Out of the data on figure 2, we extracted the information about the relative approval indexes per gender for the different groups. On figure 3 we show the data obtained.

D. Desertion Index

On the scores provided by teachers to the records office is possible to find the quantity of students who dropped out the course before finishing it, because they get a grade of NS (No Show), which means the student did not complete the lessons and exams of the subject. On figure 3 we show the average values of the desertion index obtained according to the selected groups, for the first period of 2011.

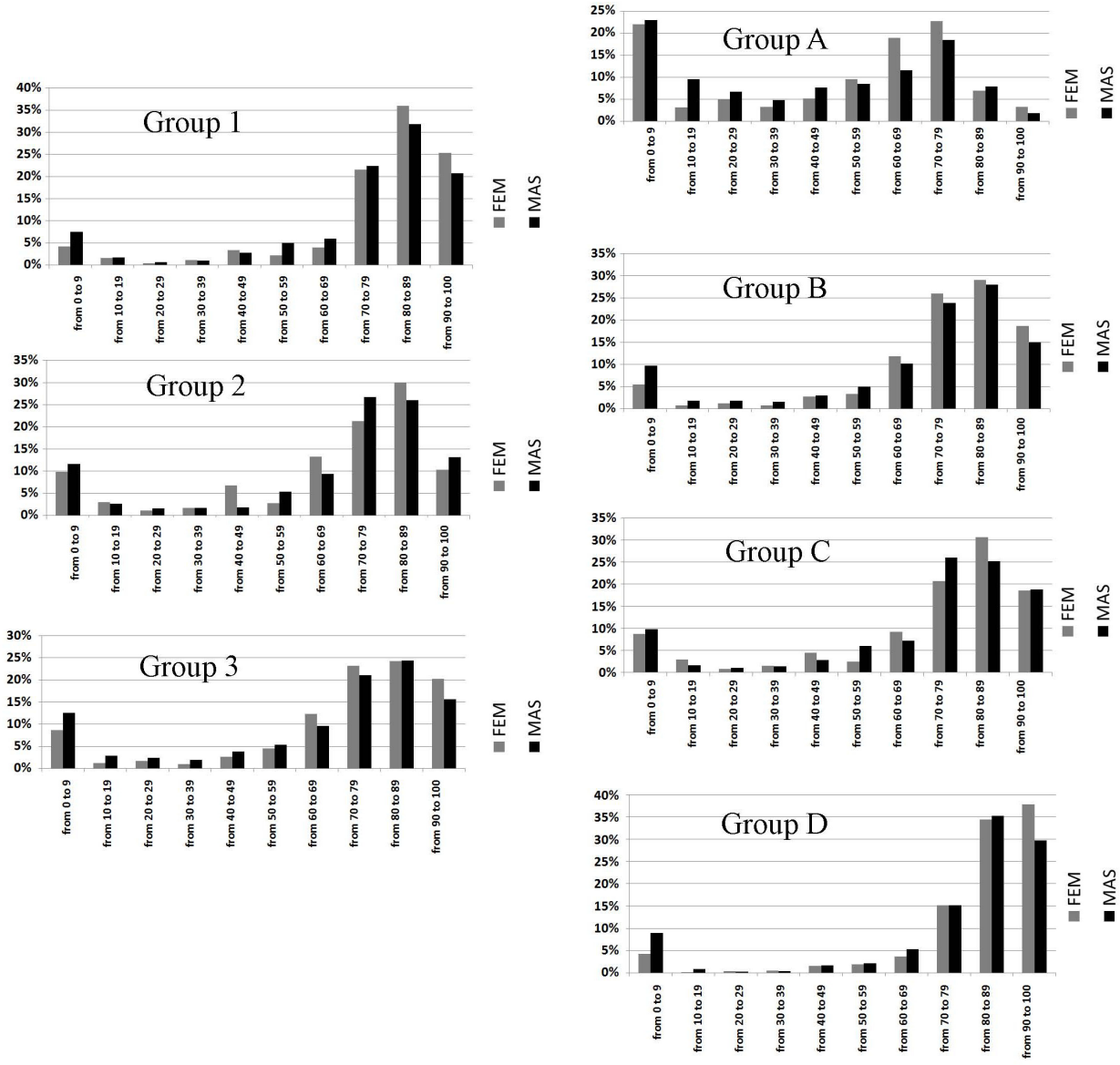

Figure 2. Average of frequencies obtained in the subjects for the different groups defined. Note the FEM means female gender and MAS corresponds to masculine

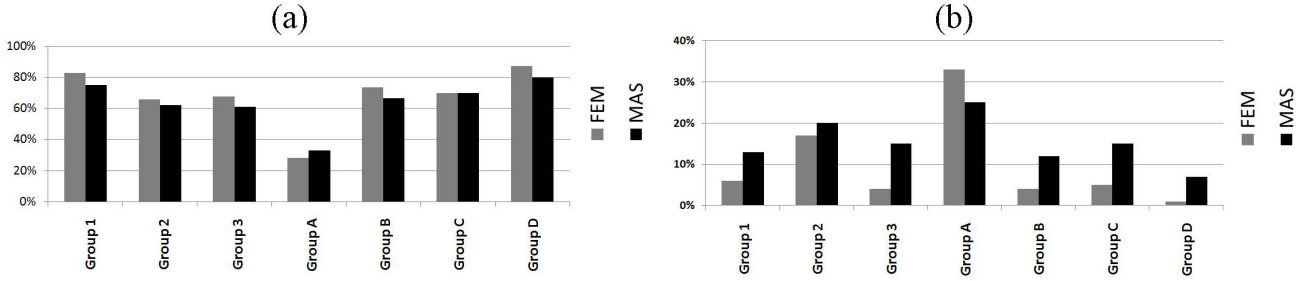

Figure 3. Average levels of (a) approval and (b) desertion for the different groups defined, for scores obtained in the IT Faculty at ULatina-Campus San Pedro. Note the FEM means female gender and MAS corresponds to masculine

E. Results Analysis

Several studies have been made about the SAT test (**Scholastic Assessment Test),** that is an admission test used in most universities and superior education academies in the United States, and allows establishing parameters and measure skills for critical reasoning that every student needs to achieve academic success at the university. These studies show that women obtain lower scores than men on the mathematics section.

Nevertheless, there has been found that, previous to the test, the performance in high school does not show gender differences in solving mathematical problems [6]. The score obtained in SAT highly determines the opportunities of being admitted in the major desired, therefore, a low score reduces the probability of being admitted for a higher education program. This impacts the individual's professional development, because it could cause a gap in opportunities and ability to obtain a degree, especially in majors like sciences, technologies and engineering.

On the other hand, there is a generalized stereotype that leads to believe that men will get better grades on subjects like mathematics and sciences. This expected behavior is observed in figure 3, where the average levels of approval on group A favors the males, contrary to the rest of the groups, where the higher scores belong to females.

As a summary of the results, figure 3 shows that women consistently have, in average, the same or higher approval index that men, except on group A (where we find specially the math courses), despite having better scores also. Furthermore, as an exception, the average desertion index is higher on women for courses in group A, while on the rest of groups, men have higher desertion indexes.

The "expected" social behavior matches also at the level of desertion indexes, as can be seen in figure 3, there is a difference in this index in the Group A subject in comparison to the rest of groups. In group A, there is a slight difference on the average of desertion index, women have an average barely higher than men. Nevertheless, in the rest of groups, women consistently have a desertion index that is approximately half of the men's. For group D, the difference in desertion levels is a lot higher.

It could be argued that this behavior is caused by cultural situations and not by skills or abilities in a certain area. For example, Patel (2009) indicates that many parents, when asked about their children's talents for mathematics; they usually highlight men more than women [7]. It is also important to mention a study by Hyde y Mertz (2009), where it was found that in certain ethnic groups there is no gap in mathematics, maybe because of the cultural value given to that subject, where there's no different approach concerning gender [8].

As part of stereotypes, it is common to hear that women perform better in administrative labors, because of their perseverance and order. When we analyze chart 2, the section that corresponds to subjects on Group D that are the administration area, we can see that women are way ahead in the rank of the best scores. There is no such difference in Group C, where we find subjects also known for women's good performance, like languages and humanities, but in the ITF students there is no a meaningful difference. This behavior remains the same as in the first period.

On figure 3(a) we observe a behavior consistent with the previous statement about areas where women get better performance. In subjects of Group D, women show a desertion index on less that 1%, while men show a 10% desertion index on the same area. This fact brings out the spirit of perseverance and drive usually attributed to women.

IV. Conclusions and Future Work

Unlike first study [9] (a four-month period), reviewing the full 2011, using the same analysis shows that the gender gap is not significant, except in desertion indexes.

Based on figure 2 women get better grades than men, but we must realize that women are a minority and this could encourage them to go for it.

As shown in figure 3, both males and females show a very low approval rate on Group A. Therefore, it is completely necessary to start a follow up of all students on these subjects. A system will be established that allows feedback from students about subjects before the end of the course period, and that would facilitate a projection of students' performance in different times of the period, so immediate actions could be taken on students that could fail or desert. This feedback will be done first with females, as a way to determine if the approval rate increases with this initiative.

Reduce the desertion index and increase approval average on Group A

We propose the establishment of study groups as a complement to the regular school year. These study groups will be in charge of women, with the objective of establishing a connection among students between mathematics and women. We will study also the professorship on mathematics subjects for the ITF, and propose gender equity in the case of teachers, so there would be a similar number of men and women teaching mathematics. The objective is to show students a gender equity in subject related to mathematics.

A specific program should be developed to counteract the gender gap on women, oriented basically to math courses and others related.

When classifying the subjects according to components of competencies to develop, there was no difference found,

even the approval and desertion indexes are very similar when the grades are classified using this kind of groups. This demonstrates that in the studied population, the capability to develop skills or knowledge is not related to gender.

As a future study, we propose to group the courses on each degree according to the level, because it is possible that courses from the first year have higher desertion indexes that those from the following years. This could define specific actions for first year students, second or third year. Finally we recommend studying the professorship on mathematics subjects for the ITF, and establishing some gender equity criteria that students can perceive in subjects related to mathematics.

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