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## Chapter

# Influence of Initial Study Activities on Final Academic Performance – An Analysis of Higher Education Students

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## Abstract

The academic performance of the first weeks of the study period, determine or project the final academic performance; This phenomenon, mainly, is since the student seeks and finds stimulus in her results, even if they are very short-term. This article proposes a way of modeling the evolution of academic performance intraperiod, to guide the accompanying actions during the process and not after it. The degree cohort of the distance study system, April–August 2019 (6,675 students), from the Universidad Técnica Particular de Loja, was followed up, through probability models, on the four moments of performance measurement academic and it was found that, at the first moment of measurement, students who accumulated a result equal to or greater than 75% of the possible grade, had a high probability of passing the course.

**Keywords:** Academic performance, dropout, open and distance learning, learning analytics

## 1. Introduction

College students, permanently self-assess their intra-period academic progress, at those various moments, make intuitive predictions [1] regarding their academic performance at the end of the term. Using simple general rules [2], they outline their decisions regarding their academic future. In this research, we simulate the behavior of academic performance (AP) at the end of the period, for this, we take the information of the different moments of measurement that we have in the semester, mainly of the first moment. The quantitative and qualitative information, of the very short term, offers the possibility for teachers and the university to take strategic actions to change the course of students with unfavorable prognosis or to consolidate the course of those who are projected to pass the subjects.

The research was conducted with secondary information from the students enrolled in the distance learning system at the Universidad Técnica Particular de

Loja (UTPL) in Ecuador. Having information from students who live and experience different personal and geographic realities throughout Ecuador ensures the reliability and robustness of the forecast.

The modeling of the behavior was carried out in two moments; in the first, a theoretical model was found in which the movements of academic performance were hypothetically discovered and described; and, in the second moment, empirical evidence was generated with econometric logit probability models. The modeling of the behavior was carried out in two moments; in the first, a theoretical model was found in which the movements of academic performance were hypothetically discovered and described; and, in the second moment, empirical evidence was generated with econometric logit probability models. In the two forms of evidence, it was found that, the first weeks of the academic period are the determinants and have sufficient information to explain the future movements of academic performance; if the student is diligent in the first weeks of study and have an academic performance equal to or higher than 75% of the grade has high probability of passing the subject.

### **1.1 Academic performance**

There are many studies that address AP in higher education, universities need to understand the possible reasons for the academic dropout of their students and thus have elements that facilitate institutional academic management. Most studies on the subject focus on determining the factors that influence AP, [3] point out that many studies that address AP posit that a student's academic performance is directly related to a set of inputs available to the student, such as: context, cognitive competencies and psychological characteristics.

In the study developed by [4] it is indicated that, according to the literature review, it has been shown that students enrolled in higher education studies drop out and do not complete the courses in which they had enrolled for several different reasons that can be very diverse and range from intelligence to personality and absenteeism. Duque et al. [5] pointed out that personal results are the best determinant of university students' dropout and [6] introduced in the analysis of the AP of higher education students, that absenteeism (absence of the student in academic spaces or academic activities) leads to low AP.

Holgado et al. [7] indicated in their study on AP the existence of the relationship between self-concept and AP, pointing out that there are many investigations that have found a significant relationship between these two variables. Eccles, (2005), cited by [8], defines self-concept as "the perception of an individual based on self-knowledge or experience and is formed through interaction with the environment and behavioral attributes". For students to achieve a good self-concept, it is important that they participate in early academic activities in order to achieve their first academic results. In this sense, the present study aims to analyze the influence of the initial academic activities or the first weeks of study on the students' final AP.

### **1.2 Initial academic activities and academic performance**

Incoming students, in the initial weeks of the semester or year, depending on the first academic results, make "intuitive predictions" [1] of the probabilities they have of passing the subjects, at the end of the semester or course [9, 10]. In these first weeks, mainly, the newly arrived student experiences a reaction that is fundamental for his academic future [11], he, instinctively, makes an assessment of his own possibilities and limitations, for that exercise, they have as main and perhaps only factors the academic self-concept [12, 13] and their very short-term results or

academic self-efficacy [14]. The measurement or assessment exercise, positive or negative, that the student performs, in the dim light of the results of the first weeks, has direct implications on attitude, being able to mark the performance of the end of the academic period and its integration [15, 16], at least in the short term.

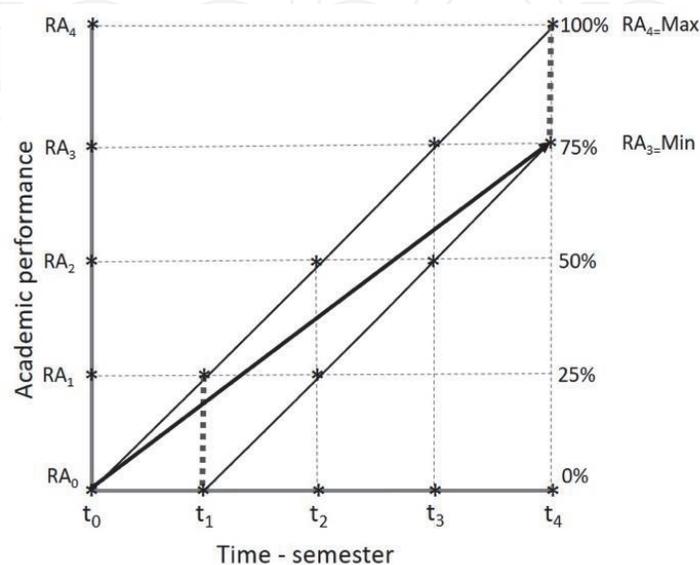
Instinctive reactions are characteristic of human beings, in this case, the student, due to the results of the first weeks, which perhaps are not as expected, may experience, even if only temporarily, lack of confidence and lose control over their academic future [12], the stress generated by not achieving the results in the short term determines the study dynamics of the entire semester or year, influencing AP and the decision to stay or drop out of the career [11, 17].

People, feel aversion to losses [2]. In this case, for the student, failing a subject is a very painful event that can negatively mark the course of his or her university career [17]. If the student can perform well in all stages of the formative process, mainly in the critical first weeks, they will achieve their short-term goals [17] and academic performance will be the lighthouse that allows them to stay the course and have a positive attitude towards academic achievement [18]. The university must offer the best learning experience, so that the student is properly integrated. Johnstone et al. [19, 20] talk about the importance of students having a positive experience that encourages them to continue, especially, in the complex first weeks at the beginning of the semester or year, time in which students at high risk of academic underachievement can be identified and provided, proactively, with support to improve academic performance at the end of the semester [21].

### 1.3 Academic performance model

Simulating the movements that academic performance (AP) has throughout the semester ( $t_i$ ) or year of study, is the main objective of the proposed model presented in **Figure 1**. Hypothetically, the case is established of a University that has four moments ( $i = 0, 1, 2, 3, 4$ ) in which it measures academic performance ( $AP_i$ ), the moments as time are evenly divided and it is expected that in each of them the student reaches the qualitative and quantitative objectives proposed in the academic planning.

The scenarios that were constructed made it possible to evidence the ideal behavior that students should have in order to achieve an AP level between the



**Figure 1.**  
*Behavior of academic performance in a semester.*

minimum to promote ( $AP_3$ ) and the maximum established ( $AP_4$ ). In the first case, the students who achieve the maximum of the performance  $(AP_0t_0)(AP_4t_4)$ , are grouped together, they in each measurement have 100% of the grade; the second case, are the students who did not perform academic activity or had zero in the first measurement,  $(AP_0t_0)(AP_4t_4)$ , at the end of the semester they can only aspire to 75% grade, minimum established - hypothetically - to pass the subject. In the two established segments, the grades of the students who are likely to pass should be moved. If we assume that most of the students have a behavior that, from the beginning of the semester, is projected to reach at least the minimum AP that allows them to pass the course, the third scenario was constructed with the segment  $(AP_0t_0)(AP_4t_4)$ . The projection line, at time  $t_1$ , constructs point B, which is the minimum AP for the student to be likely to pass the subject. Students who in the first measurement ( $t_1$ ) meet the condition  $AP > B$  will have the probability of passing the course. Point B, by similarity of triangles - "Thales' Theorem" - is proportionally equal to the minimum established for passing the subject  $AP_3$ , namely, B is equal to 75% of the grade established in  $t_1$ .

Based on what has been described, it was established as the main hypothesis that: The student who in the first measurement  $t_1$  of the  $AP_1$  have results that are equal to or higher than 75% of the grade have the highest probability of passing the subject, this because projects positively and is confident that will have the academic achievements raised in the planning of the subject.

$$\text{Model 1 : } Y_i = \delta_0 + \delta_1 X_i + \mu_1 \quad (1)$$

$$\text{Model 2 : } \ln \left( \frac{P_A}{P_R} \right) = \delta_0 + \delta_1 X_i + \mu_1 \quad (2)$$

$$\text{Model 3 : } \ln \left( \frac{P_A}{P_R} \right) = \delta_0 + \delta_1 D_1 + \mu_1 \quad (3)$$

Where:

- $Y_i$  is the academic performance at the end of the semester or the cumulative AP at time  $t_4$ .
- $\frac{P_A}{P_R}$  is the likelihood ratio of a student passing the subject compared to failing the subject.
- $X_i$  is grade obtained  $AP_1$  at time  $t_1$ .
- Alternatively,  $X_i$  will be transformed into  $D_1$  which sets the dichotomy between grades at  $t_1$  that were greater than or equal to 75% of those that are not.

## 2. Methodology

The purpose of this study was to examine if the academic performance of the first weeks is associated with the academic performance at the end of the academic period (16 weeks) in university students of the distance learning system of the Universidad Técnica Particular de Loja (UTPL) - a leading institution in distance learning in Ecuador. Academic performance is measured by the grades obtained by the students on a scale of zero to forty, with the possibility of accumulating ten

points at each moment of measurement. The final AP was calculated as the sum of the four AP measurement moments. The results were taken by subject or course enrolled by the student.

Participants were ( $n = 6675$ ) students from the April–August 2019 cohort, enrolled in 19 degrees or majors and 288 subjects or courses. With these data, 31928 enrollments per subject were generated, with a total of 127712 ( $31928 \times 4$ ) evaluation moments. The student population presented a heterogeneous profile in terms of personal, academic, socio-family, pedagogical and perhaps psychological characteristics. The information was taken from the academic records of each student, with the authorization of the Vice Rectorate of Open Modality of the University analyzed. At no time during the research were the personal data of the students used, guaranteeing the confidentiality of the participants.

To rule out systematic bias, comparative statistics of sample and cohort are presented. No systematic differences were found between sample and cohort. The average for the sample ( $n = 380$  with 95% confidence) of students, taken at random, was 6.69 out of ten points in each event in which academic performance is measured, while for the population it was 6.59/10. In the sample the number of positive cases of passing the subject was 44.21%, while in the population it was 43.88%.

The analysis was carried out at two levels. The first was descriptive, using graphical tools and measures of central tendency; the second was inferential, calculating correlations, simple regression models and logit probability models.

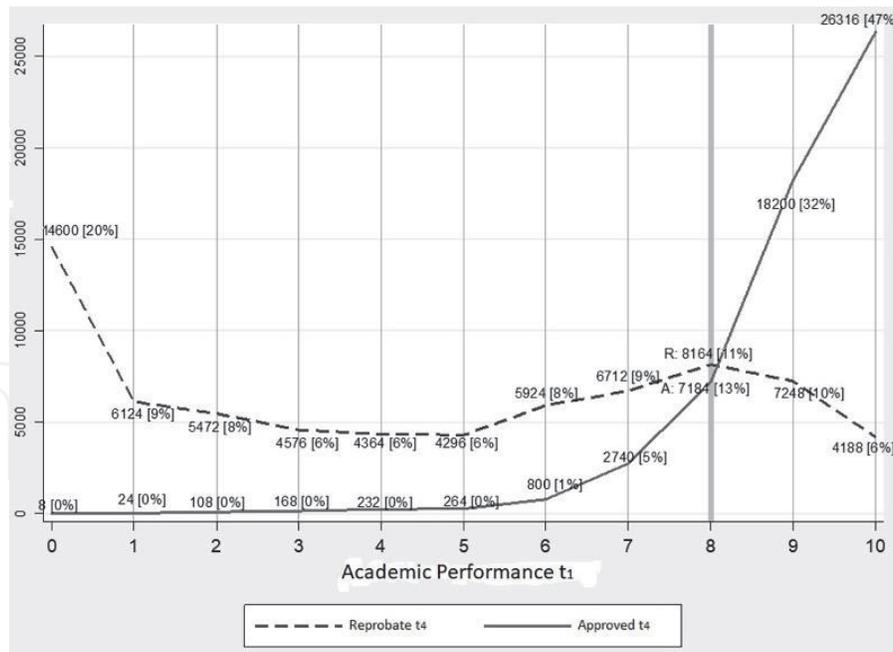
### 3. Results

The results indicate that there is a direct and positive relationship between the grades of the first weeks of activity and the final result or AP of the subject. Likewise, it was established that, from 8 points out of a possible ten, in the first measurement of the academic activity, students pass more than those who fail. **Figure 2** shows the behavior of academic performance at the end of the semester, depending on the AP of the first weeks. As an example of the reading of the results, we point out the following cases:

- 20% of the students who failed a subject had zero AP at time  $t_1$ . In contrast, in this same scenario, only eight cases (0%) passed the subject at the end of the semester.
- 47% of the students who passed a subject had ten or the maximum possible AP at time  $t_1$ . Six percent of those who had the maximum grade in the first weeks at the end of the semester failed the subject.
- 92% of the students who passed a subject had between eight and ten points at time  $t_1$  and 55% of those who had a grade equal to or lower than five points at time  $t_1$  failed the subject.

**Figure 2** shows the positive relationship between the first moment of  $AP_{t_1}$  and  $AP_{t_4}$ , the higher the grade in  $t_1$  the more likely it is that the subject will be passed, especially when the first moment has more than eight points. Between the AP measured at  $t_1$  and the AP measured at  $t_4$  there is a correlation of 86%.

The relationship between the moments of academic performance over time, initially measured with a simple regression, Model 1:  $Y_i = \delta_0 + \delta_1 X_i + \mu_1$  (Ec. (1)) the results are positive and conform to the initial theoretical approach.



**Figure 2.** Number of students according to promotion at the end of semester t4 compared to the results in the first weeks of study.

$Y_i =$	4.24+	2.73 $X_i$ +	$\mu_1$
s.e	0.01	0.07	
p	0.00	0.00	
R2	74%		

The 74% of the changes that could occur in the academic performance at the end of the semester ( $AP_{t4}$ ) are explained by the academic performance at the first moment of the semester evaluation ( $AP_{t1}$ ). The  $AP_{t4}$  that does not depend on  $AP_{t1}$  is 4.24 points, a very low value in relation to the 40 points that can be accumulated; while, the  $AP_{t4}$  that depends on  $AP_{t1}$  has a positive effect and increases to an average of 2.73 for each additional point of  $AP_{t1}$ . The estimated results passed all the tests of correct specification and therefore, the prediction is valid and confirms the proposed relationship.

Model 2:  $\ln\left(\frac{P_A}{P_R}\right) = \delta_0 + \delta_1 X_i + \mu_1$  (Ec. (2)), shows the relationship between the natural logarithm of the probability that  $AP_{t4}$  is above the minimum necessary (75%) to pass the course versus not passing, as a function of  $AP_{t1}$  or  $X_i$ . The results of the five-iteration logit model suggest a relationship with positive effects (0.87) and a null probability (-6.99) of  $AP_{t4}$  for the cases in which  $AP_{t1}$  is null.

The marginal effect (0.15), determines that unit changes in  $AP_{t1}$  have a positive effect equivalent to 15% on the probability that  $AP_{t4}$  is greater than or equal to the 75% grade required to pass. Alternatively, we can say that as  $AP_{t1}$  increases by one point, the probability of having  $AP_{t4} = 1$  increases by 15%. This model predicts very well, according to the ROC curve, 89% of the cases were well classified.

$\ln\left(\frac{P_A}{P_R}\right) =$	- 6.99	+ 0.87 $X_i$	$\mu_2$
$dy/dx$		0.15	
s.e	0.10	0.01	

$\ln\left(\frac{P_A}{P_R}\right) =$	- 6.99	+ 0.87X <sub>i</sub>	$\mu_2$
p	0.00	0.00	
Pseudo R2	0.43	Curve ROC	0.89

Finally, Model 3:  $\ln\left(\frac{P_A}{P_R}\right) = \delta_0 + \delta_1 D_1 + \mu_3$  (Ec. (3)), raises the possibility of the relationship between the natural logarithm of the probability ratio (PR) that AP<sub>t4</sub> is above the minimum necessary (75%) to pass the subject, versus that it is not, this as a function of a dichotomous variable  $D_1$  that is equal to one when AP<sub>t1</sub> > 75% and zero when AP<sub>t1</sub> < 75%. The results of model 3, are conclusive to test the hypothesis proposed in the theoretical model “The student who in the first measurement  $t_1$  of the AP<sub>t1</sub> have results that are equal to or higher than 75% of the grade have the highest probability of passing the subject”.

$\ln\left(\frac{P_A}{P_R}\right) =$	- 2.48	+ 3.45D <sub>1</sub>	$\mu_3$
$dy/dx$		0.65	
s.e	0.03	0.04	
p	0.00	0.00	
Pseudo R2	0.35	Curve ROC	0.82

The estimation of the -logit- model, with four iterations, confirms the positive effects of models one and two. The logarithm of the likelihood ratio is positive (3.45) when  $D_1=1$ , otherwise the probability is zero. Therefore, a student who has less than 75% of the grade, in the first weeks of study (AP<sub>t1</sub>), is unlikely to pass the subject or have an AP<sub>t4</sub> > 75%. The marginal effect is 65% for unit changes in AP<sub>t1</sub>. The ROC curve (0.82) certifies the adequate classification of the predictions of this model.

#### 4. Conclusions

The importance of acting, prior to enrollment and during the crucial first weeks of study [22], is ratified by the empirical evidence found. Students who are diligent in the first weeks of study of the academic period and who have an AP equal to or higher than 75% of the grade, have the best chances of passing the semester in that subject. This result is not a coincidence, nor a simple modeling, it is a phenomenon related to human behavior, because students base their behavior on the evidence that they are generating of their learning process, with this the academic self-concept is formed [13] that will surely influence the decision to remain or abandon the studies in that career and even in the university.

In light of the evidence, the models found and validated can be used as a tool to proactively identify - in the first weeks - students at high risk of low AP and with them work intervention strategies [9, 23], which allow changing the course of the final behavior of AP. If the course of AP is not modified in the first weeks, the risk is to have an unsatisfactory final AP, the latter, will be the cause for the student to make the decision to drop out early and that in the vast majority of cases becomes desertion. Students with low intrasemester or short-term AP are less willing to continue their studies, their decision is based on a simple rule: the quantitative

academic results are not very satisfactory and do not generate a favorable expectation in the long term.

In this research, the behavior of AP in the very short term is collected, and what might happen in the short term - at the end of the semester - is analyzed, but grades are strongly correlated and the short term affects the long term [24]. The initial results, in time have direct consequences on the terminal efficiency rates and personally are determinants of post-education, other higher studies and work.

## **Acknowledgements**

We would like to thank the Universidad Técnica Particular de Loja for providing the information required for the development of this research.

## **Conflict of interest**

The authors declare no conflict of interest.

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