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Socio-academic factors associated with academic performance in university students

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Abstract

Academic performance (AP) is an important dimension in the educational field and can be affected by the incidence of various socio-academic factors. Purpose: This research aimed to analyze AP considering factors such as major, term, and socioeconomic level in students of the Faculty of Health Sciences of the National University of Chimborazo in Riobamba, Ecuador, during the second academic period in 2021. Methodology: The study had a quantitative approach, non-experimental design, and cross-sectional analytical scope. The population consisted of 1,146 students enrolled in the courses of that university environment. The data collected from the individual files were processed using a binary regression model and other comparison and correlation models. Findings: Academic performance classified as regular prevailed in nine of the educational levels included; its relative frequencies ranged between 39.67% and 56.86%. There was a statistically significant dependence between academic performance and the term that the participants were studying (X2=115.80; p=0.00) and the race (X2=142.82; p=0.00). Conclusion: Major constituted a factor with predictive value concerning AP. Medicine students were more likely to score more than 6.99 points than those enrolled in Dentistry.

Keywords: Academic performance, Health occupations, Socio-academic factors, Students.

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1. Introduction

The Academic Performance (AP) constitutes an important dimension in the educational field. In this regard, Caballero et al. [1] establish that it is given by the scope of the goals and competencies outlined in the programs that students take, whose most objective expression is the grade received from the evaluation process. Thus, Solano Luengo [2] defines it as: "the level of knowledge, skills, and competencies that students demonstrate to have achieved and that is operationalized or specified in the grades they receive from their teachers" (p.27).

In the environment of higher education institutions, González and Guadalupe [3] consider it pertinent to implement actions aimed at improving the AP to reduce dropout rates. This author highlights the importance of a tutoring system that guarantees individualized teaching support, allowing greater effectiveness in recognizing, understanding, and addressing student problems that hinder the process of adaptation to the university context, which will include help related to factors related to behavior, and emotional area that could be interfering with the achievement of curricular and individual training objectives.

Barbera et al. [4] consider that AP is a complex category due to its multifactorial nature that encompasses personal, family, social, economic, emotional, behavioral, cognitive, and cultural factors, among others. On the other hand, Lamas [5] recognizes other parameters with which it is associated: circumstances, organic and environmental conditions, as well as aptitudes and experiences.

Analyzing the published empirical evidence, Soto et al. [6] establish three sets of factors that have the potential to affect the AP:

- Socio-demographic: age, gender, place of residence, marital status, stratum, occupation, educational level, occupation of parents, and family environment.
- Cognitive: academic bases, failed subjects, and the skills of observation, interpretation, analysis, comparison, and retention.
- Psychological: motivation for their professional training and cohesion with the academic environment.

The problems related to AP in university students generate social, psychological, and economic effects [7]. By comparing this category by grouping its student population according to various academic and socio-demographic characteristics, Ali et al. [8] observed differences based on age, gender, parental socioeconomic status, major, and semester.

University life usually takes place during individuals' transition from adolescence to adulthood. Academic success is marked by how personal psychosocial characteristics, the demanding and stressful factors of the teaching-learning process, lifestyle, financial status, quality of accommodation, and other socio-demographic elements interact. The nature of the study of careers related to health sciences requires the development of capabilities to assimilate the curricular overload, which may affect the AP [9].

Jeynes [10] established that students with higher parental socioeconomic status tended to have better AP, while Wan et al. [11] determined that the results in the monthly evaluations were predictors for final exam scores. Furthermore, Omolewa et al. [12] observed an increase in AP as the degree progressed when moving to higher terms at university.

Authors such as Essel et al. [13] consider that academic production can be influenced by the student's ability to acquire information and communications technologies, as well as the associated services, taking into account the particularities of contemporary education regarding its intense use in the teaching-learning process.

When addressing financial solvency to ensure adequate nutrition among college students in Georgia (United States of America), Raskind et al. [14] suggest that difficulties can considerably affect academic performance in this population. Alhadabi and Karpinski [15] and Cevállos-Bósquez et al. [16] mention that some research has shown that factors inherent to socioeconomic status have the potential to affect academic results.

In this regard, Rizvi et al. [17] conclude that there is a dependence between the socioeconomic level of the families of university students and the academic AP in the major studied through the online teaching modality.

On the other hand, Gutiérrez-Monsalve et al. [18] found the presence of a statistically significant relationship between sex and age with respect to AP in university students from a private institution in Colombia.

Thus, the authors of this manuscript posed several research questions for the context in which the study was carried out:

- Is there an association between socio-demographic variables nature and the AP?
- Is the AP significantly associated with the major the student is studying?
- Is the student's degree level statistically associated with the AP?
- Are there differences in academic performance between students who attend different levels in their respective majors?
- Do students from different university majors have a similar AP?
- What socio-academic variables constitute predisposing factors for AP?
- Consequently, the researchers who carried out this study proposed the following hypotheses:
- The socioeconomic level of university students is significantly associated with AP in the investigated context.
- The AP is statistically different depending on the studied major and the level studied by the students participating in the research.
- The AP is a variable dependent on the socioeconomic level of the university students participating in the research.

Thus, an investigation was carried out to analyze the AP, considering major, term, and socio-academic level factors in students of the Faculty of Health Sciences at the National University of Chimborazo in Riobamba, Ecuador, during the second academic term of 2021.

2. Materials and Methods

2.1. Design and Participants

This study was developed with a quantitative approach and a non-experimental research design with a cross-sectional analytical scope. The population was composed of 1146 students from six university majors: Medicine, Nursing, Clinical Psychology, Dentistry, Clinical Laboratory, and Physical Therapy, in the Faculty of Health Sciences of the National University of Chimborazo (Riobamba, Ecuador). All of them participated voluntarily (Table 1).

Table 1.
Distribution of the population according to major and gender.

Major	Female		Male		Total	
	f	%	f	%	f	%
Clinical Psychology	267	23.3	77	6.7	344	30.0
Medicine	150	13.1	76	6.6	226	19.7
Nursing	123	10.7	31	2.7	154	13.4
Clinical Laboratory	125	10.9	62	5.4	187	16.3
Physical Therapy	110	9.6	35	3.1	145	12.7
Dentistry	59	5.1	31	2.7	90	7.9
Total	834	72.8	312	27.2	1146	100.0

2.2. Procedures and Measures

According to Wan et al. [11] criteria, most postsecondary institutions use grade point average as an indicator of AP. Thus, the researchers used the values of the averages of the scores obtained in the different subjects enrolled in the previous academic period (term), establishing the following scale: very low (1), low (2), regular (3), high (4) and very high (5); which was dichotomously recategorized into two levels: disapproved (very low and low) and approved (regular, high, and very high.

The socio-academic variables studied were major, academic period (from the first to the tenth term), and socioeconomic level (low, medium, high), whose data were obtained through documentary review from the students' files.

Data Analysis

The organization and processing of the data were done using SPSS 26.0 software. In this regard, descriptive analysis (relative and absolute frequencies) and inferential analysis (association, comparison, and regression) were carried out.

Pearson's chi-square test made it possible to verify the dependence between the study variables. The one-factor ANOVA allowed us to establish the existence of differences in the AP between groups formed according to major, term, and socioeconomic level, as well as post hoc binary multiple comparisons through the Tukey test. The statistical contrast model was described by Omolewa et al. [12], Ceniceros Angulo [19] and De Tejada et al. [20] using Cox and Snell's R^2 and Nagelkerke's R^2 to analyze causality; as well as a binary logistic regression to detect the degree of predictability of the socio-demographic characteristics concerning the AP.

Ethical Considerations

The corresponding ethical principles were considered during the research process, such as implementing informed consent for the participants and respecting their anonymity. The study was endorsed by the Research Directorate of the National University of Chimborazo through Resolution No. 40-CIV-16-2-2022, approving the execution and financing of the project.

3. Findings

The average age of the students involved in the research process was 21.3, ranging between 18 and 32 years old, with a standard deviation of 1.92.

Overall, the results of the AP in the study population showed a predominance of those scores that fell into the *regular* category (45.37%) (Tables 2, 3, 4).

Table 2.
Academic performance according to the academic period in which the participants were.

Term	Academic Performance											
	Very low		Low		Regular		High		Very high		Total	
	f	%	f	%	f	%	f	%	f	%	f	%
1st	2	2.86	16	22.86	3.4	48.57	15	21.43	3	4.28	70	100
2nd	1	1.72	5	8.62	32	55.17	19	32.76	1	1.73	58	100
3rd	26	14.13	38	20.65	73	39.67	37	20.11	10	5.44	184	100
4th	16	7.66	39	18.66	91	43.54	51	24.40	12	5.74	209	100
5th	2	0.86	46	19.74	122	52.36	52	22.32	11	4.72	233	100
6th	17	7.69	49	22.17	90	40.73	56	25.34	9	4.07	221	100
7th	1	1.96	4	7.85	29	56.86	16	31.37	1	1.96	51	100
8th	1	2.70	2	5.41	19	51.35	14	37.84	1	2.70	37	100
9th	--	--	3	6.98	19	44.19	19	44.18	2	4.65	43	100
10th	1	2.50	--	--	11	27.50	26	65.00	2	5.00	40	100
Total	67	5.85	202	17.63	520	45.37	305	26.61	52	4.54	1146	100

Note: X^2 =115.80; p=0.00. Abbreviations: f, frequency; %, percentage.

The *regular* category of the AP stood out in nine of the academic periods (semesters) studied, with relative frequency values that ranged between 39.67% and 56.86%, being different in the tenth term, where the high level stood out (65%). Furthermore, it should be noted that the third semester was the only time when a higher cumulative incidence of scores in the *low*, *very low*, and *regular* ranges was observed (74.45%) (Table 2). The chi-square analysis allowed us to establish the presence of statistically significant dependence between the AP and the semester the participants took (X^2 =115.80; p = 0.00)

Table 3.
Academic performance based on major.

Major	Academic Performance											
	Very low		Low		Regular		High		Very high		Total	
	f	%		%	f	%	f		f	%	f	%
Clinical Phycology	15	4.36	64	18.60	146	42.44	107	31.11	12	3.49	344	100
Medicine	5	2.21	23	10.18	109	48.23	71	31.42	18	7.96	226	100
Nursing	16	10.39	59	38.31	64	41.56	14	9.09	1	0.65	154	100
Dentistry	17	18.89	19	21.11	39	43.33	12	13.33	3	3.34	90	100
Clinical Laboratory	6	3.21	17	9.09	93	49.73	63	33.69	8	4.28	187	100
Physical Therapy	8	5.52	20	13.79	69	47.58	38	26.21	10	6.90	145	100
Total	67	5.85	202	17.63	520	45.37	305	26.61	52	4.54	1146	100

Note: X^2=142.82; p=0.00. Abbreviations: f, frequency; %, percentage.

Consistent with the results mentioned above, in all majors, students with grades that established their AP as *regular* predominated, with percentages between 41.56 and 49.73; determining that, in the Dentistry and Nursing majors, the accumulated frequencies of the *very low*, *low, and regular* levels were more significant than the opposite direction (83.33% and 90.26% respectively) (Table 3). The chi-square value indicated the existence of statistically significant dependence between the AP variables and the race (X^2 =142.82; p = 0.00).

Table 4.
Academic performance based on socioeconomic level.

Level	Academic Performance											
	Very low		Low		Regular		High		Very high		Total	
	f	%	f	%	f	%	f	%	f	%	f	%
Low	17	10.62	35	21.87	71	44.38	27	16.88	10	6.25	160	100
Medium	50	5.09	165	16.79	448	45.57	278	28.28	42	4.27	983	100
High	--	--	2	66.67	1	33.33	--	--	--	--	3	100
Total	67	5.8	202	17.6	520	45.4	305	26.6	52	4.5	1146	100

Note: X^2=22.51; p=0.00. Abbreviations: f, frequency; %, percentage.

Most students identified themselves as having a *medium* socioeconomic level (85.78%), with the frequency at a *high* level (0.26%). The AP values framed in the *regular* category predominated (44.38% and 45.57%) (Table 4).

A significant statistical association was also observed between both variables, based on the chi-square test results (X^2 =22.51; *p = 0.00*) (Table 4).

Table 5.
Significant differences in AP between terms through binary multiple comparison.

Terms compared		Mean difference	p
First	Tenth	-0.63 (0.17)	0.01*
Third	Fifth	-0.31 (0.08)	0.01*
	Eighth	-0.58 (0.15)	0.00*
	Nineth	-0.63 (0.14)	0.00*
	Tenth	-0.87 (0.15)	0.00*
Fourth	Tenth	-0.64 (0.15)	0.00*
Fifth	Tenth	-0.55 (0.14)	0.00*
Sixth	Nineth	-0.49 (0.14)	0.02*
	Tenth	-0.73 (0.15)	0.00*

Note: *statistical significance at $p<0.05$ level.

The values of the one-way ANOVA test (p<.05) made it possible to establish that some mean values were not similar. Thus, the results of the post hoc binary multiple comparison by using the Tukey test showed significant differences in the AP between the most advanced terms (eighth, ninth, and tenth) and those corresponding to the first half of the training time of the respective major (first, third, fourth, fifth, and sixth) (Table 5).

Table 6.
Significant differences in AP between majors through binary multiple comparison.

Comparative major		Mean difference	p
Clinical Psychology	Medicine	-0.22 (0.07)	0.02*
	Nursing	0.68 (0.08)	0.00*
	Dentistry	0.54 (0.09)	0.00*
Medicine	Nursing	-0.22 (0.07)	0.00*
	Dentistry	-0.76 (0.10)	0.00*
Nursing	Clinical Laboratory	-0.79 (0.09)	0.00*
	Physical therapy	-0.72 (0.09)	0.00*
Clinical Laboratory	Dentistry	0.65 (0.10)	0.00*
Physical Therapy	Dentistry	0.58 (0.11)	0.00*

Note: *statistical significance at $p<0.05$ level.

ANOVA test was less than 0.05, indicating the presence of differences between the races in terms of AP, which was evidenced by the Tukey test, whose results showed that Dentistry was the one that differed the most from the others (Table 6).

Table 7.
Binary logistic regression analysis criteria summary.

DV: AP	X^2	df	Sig.	-2Log likelihood	Cox and Snell R^2	Nagelkerke R^2	Prediction	
							Yes	*No*
Values	161.17	16	0.00	1075.86	0.13	0.19	96.60	11.00

Note: Abbreviations and acronyms: df (degrees of freedom); R^2 (R squared); AP, academic performance; Sig. (statistical significance); DV (dependent variable); X^2 (chi-square).

Although the chi-square test (X^2=161.17; $p<0.05$) showed a statistically significant association between the socio-demographic variables and the AP, the Nagelkerke's R^2 values (0.19) were very close to 0, being an indicator of low level of goodness of fit in the applied model (Table 7).

Table 8.
Predictability by independent variables established by binary logistic regression.

Independent variable	AP (dependent variable)				
	B.	Sig.	Exp (B) = Odds ratio	95%. CI. for EXP(B)	
				lower	Superior
Medicine major	1.57	0.00**	4.84	2.63	8.92
Term	-20.18	0.99	0.00	--	--
Socioeconomic level	1.46	0.31	4.34	0.24	78.14

Note: Abbreviations and acronyms: B (beta); EXP(B) (exponential beta- odds ratio); CI (confidence interval); Sig. (statistical significance).

The binary logistic regression analysis made it possible to establish that major constituted a factor with a predictability value concerning AP (p=0.00). The Odds ratio value indicated that Medicine students are 4.84 times more likely to have grades higher than 6.99 points than those enrolled in Dentistry (Table 8).

4. Discussion

In the present study, higher semesters showed higher AP. Regarding this result, Abu Saa et al. [21] suggest that university students who obtain low grades in the first academic period tend to improve them at higher levels when they maintain interest in their professional training. On the other hand, Del Carmen Ibarra and Michalus [22] consider that the subjects approved at the beginning of the degree represent a relevant factor in subsequent academic results. Accumulating curricular subjects due to failure in the first term can affect students' performance and delay graduation [23].

Álvarez Loureiro et al. [24] state that students who train as dentists commonly have difficulties consolidating a knowledge system in which they integrate theory with practice. This approach is consistent with the findings in this research regarding the predominance of medium and low levels of AP in that career.

Al-Tameemi et al. [25] suggest that adopting individualized technical advice and appropriate teaching strategies constitutes a valid way to reverse similar situations.

The results showed that most study participants at the low socioeconomic level had an AP in the categories from medium to very low (76.87%), finding an association between both variables. Karakolidis et al. [26] reported that students involved in their research who came from families with low socioeconomic status were 2.7 times more likely to have a low AP.

Sothan [27] states that socioeconomic status includes factors that can affect AP since obtaining high-quality institutionalized education is expensive in certain sociocultural contexts [28, 29].

University students with high AP constitute a human resource with a qualification that generates growth in personal socioeconomic level and potentially impacts local or national development [30].

The binary logistic regression model made it possible to observe the existence of a degree of predictability between the major and the AP ($p < 0.05$), especially in the case of medical students, who were 4.84 times more likely to have an AP greater than seven than the rest of the options. Using the same statistical procedure, other authors found different results in the same academic field:

Rodriguez Fontes et al. [31] analyzed academic success and failure; However, its most important predictor was the grade record during pre-university training concerning the AP:

- Vélez van Meerbeke and Roa González [32] report that performance during the first semester predicted AP.
- Ponsot et al. [33] found causal relationships between different courses at the Faculty of Economics and Social Sciences, with a value of less than 3% as an explanatory factor of the AP.

For their part, Ali et al. [8] point out that the factors associated with RA are age, gender, study major, and the father's socioeconomic level, since they can explain up to 31% of the variation in AP. In the present investigation, that indicator was 96% (obtaining more than 7 points in the grade record), while Vélez van Meerbeke and Roa González [32] got 85%. In addition to these variables, Baradwaj and Pal [34] point out the predictive capacity of the score obtained in the preceding semester concerning the AP.

Likewise, Considine and Zappalà [35] state that socioeconomic level is one of the main predictors of AP.

Knowledge of the factors related to the AP constitutes a necessity for improving educational teaching processes, allowing better curricular planning from macro to micro levels, and implementing more effective teaching strategies [36].

Al Husaini and Shukor [23] insist on exploring other factors that could influence the AP of university students: grades upon entry to higher education, family support, accommodation, and gender, among others.

In a Ghanaian educational context, Essel et al. [13] established the presence of a statistically significant and positive relationship between age and AP ($p<0.01$), which is similar to the current research since the term or level of study of the major was associated with AP. They increase proportionally with the progress in the levels that the participants went through taking into account the average age.

Destin et al. [37] determined that socioeconomic level was a 7% predictive factor of AP in their university study population. However, the results of the regression model applied in this research showed the absence of statistical significance in this regard.

Zamora and Castro [38] found similarities in the results of several original published investigations through a systematic literature review, which confirmed the presence of an association between the AP and certain factors of the socio-demographic and socioeconomic dimensions, determined through appropriate methodologies and statistical tests that allowed the verification of the respective hypotheses and the reaching of conclusions in each context [2].

When studying the factors that predict AP, Solano Luengo [2] and Bautista-Rodríguez and Gatica-Lara [39] established the existence of correlation concerning the term or level they study in the respective major ($r = 0.450$; $p<0.005$); in addition to a statistical predictive capacity of up to 23% (adjusted $R^2 = 0.230$; $p<0.05$).

The main limitations of the research were the narrow geographical and institutional location of the study population and the number of variables modeled based on the instruments used. Therefore, future research is suggested to investigate other higher education environments and expand the modeling to other variables with possible interference in the AP.

5. Conclusion

It can be concluded that the following characteristics predominated in the population: the regular category in the AP, those studying from the third to the sixth semester, students from families with a medium socioeconomic level, and those enrolled in the Clinical Psychology school.

The AP was significantly associated with major, term enrolled, and socio-academic level. Major constituted a factor with predictability value concerning AP. Medicine students were likelier to score more than 6.99 points than those enrolled in Dentistry.

Some reflections about the factors studied in academic performance indicate that:

Educational systems must guarantee solid curricular training during the primary and secondary academic levels, preparing students to better adapt to the cognitive demands of university education and mitigate the effects of socio-demographic risk factors.

Educational policies must be projected from interdisciplinary and holistic perspectives based on implementing quality teaching and learning processes.

Students with socioeconomic risk factors require interventions through measures that mitigate their situational vulnerability. The university must achieve a symbiotic integration with the family and society, knowing that the most significant remuneration focuses on incorporating human potential prepared to contribute significantly at the local and national levels.

Academic performance in university students is more than a variable related to individual success. It constitutes an indicator of institutional success and the educational system itself, showing the effectiveness of training future professionals that society needs.

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