

# An exploratory PLS study of academic success/failure

Mário Basto\* 

Teresa Abreu\*\* 

Estela Vilhena\*\*\* 

Joaquim Gonçalves\*\*\*\* 

Mariana Carvalho\*\*\*\*\* 

Polytechnic Institute of Cávado and Ave, Barcelos, Portugal.

## Abstract

Strategies to combat academic failure in higher education rely on the identification and the knowledge of the causes associated with it. In order to identify these causes, a questionnaire survey was implemented in one public Higher School of Technologies and Engineering in Portugal. Student-related aspects were those that exhibited the highest impact on academic success/failure. Teachers and institution/curriculum exhibited an indirect impact through mediation by student-related aspects. Other variables were identified with a negative residual impact on academic success, such as: being displaced from the habitual residence, disliking to study, and being a male. With a slightly more substantive impact, emerged the sleep time on the eve of the tests.

**Keywords:** Academic Failure; Academic Success; Factor Analysis; Partial Least Squares.

## Resumo

### *Um estudo exploratório PLS do sucesso/insucesso académico*

As estratégias para combater o insucesso académico no ensino superior dependem da identificação e do conhecimento das causas a ele associadas. Para identificar essas causas, uma pesquisa por questionário foi implementada numa Escola Superior de Tecnologias e Engenharia. Aspectos relacionados com os estudantes foram os que apresentaram maior impacto no sucesso/insucesso académico. Professores e instituição/currículo apresentaram um impacto indireto através da mediação por aspectos relacionados com os estudantes. Outras variáveis foram identificadas com um impacto residual negativo no sucesso

---

\* E-mail: mbasto@ipca.pt

\*\* E-mail: tabreu@ipca.pt

\*\*\* E-mail: evilhena@ipca.pt

\*\*\*\* E-mail: jgoncalves@ipca.pt

\*\*\*\*\* E-mail: mcarvalho@ipca.pt

académico, como: estar deslocado da residência habitual, não gostar de estudar e ser homem. Com um impacto um pouco mais relevante, emergiu o tempo de sono na véspera dos testes.

**Palavras-chave:** Insucesso Académico; Sucesso Académico; Análise fatorial; Mínimos Quadrados Parciais.

## Resumen

### *Un estudio exploratorio PLS de éxito/fracaso académico*

Las estrategias para combatir el fracaso académico en la educación superior dependen de la identificación y conocimiento de las causas. Para identificarlas, se implementó una investigación por cuestionario en una Escuela Superior de Tecnología e Ingeniería. Los aspectos relacionados con los estudiantes tuvieron el mayor impacto en el éxito/fracaso académico. Los profesores y la institución/currículo tuvieron un impacto indirecto a través de la mediación de los aspectos relacionados con los estudiantes. Se identificaron otras variables con un impacto residual negativo en el éxito académico, como: estar desplazado de su residencia habitual, no gustarle estudiar y ser hombre. Con un impacto ligeramente más relevante, surgió el tiempo de sueño en la víspera de las pruebas.

**Palabras clave:** Fracaso Académico; Éxito Académico; Análisis Factorial; Mínimos Cuadrados Parciales.

## Introduction

Academic failure in higher education translates into a scholar drop-out and high retention rates and into an extended time to complete university courses. It is necessary to understand the involved dynamics in adaptation, retention, and scholar drop-out, identifying causes of failure so that appropriate preventive measures can be introduced and implemented.

Strategies to combat academic failure in higher education come from the knowledge of associated causes, as well as identification of the importance for each of these causes and eventual interactions between them.

In order to study the leading causes of academic success/failure, it becomes necessary to define metrics to measure it. Different definitions can lead to different results and make it impossible to compare studies carried out on the subject.

Academic success/failure can be measured by academic results as it was done by Monteiro et al. (2005) and Coutinho (2007). Monteiro et al. (2005) analyzed methods of study from 1st-year students at the moment of the entrance at the University of Minho, using the Inventory of Attitudes and Habitual Behaviors of Study – Iache (TAVARES, 2004), which is a questionnaire to measure study methods, consisting of cognitive, motivational and behavioral dimensions. The academic performance of students was measured through the ratio of curricular units performed by students

and the total number included in the semester and through the mean classification obtained on the approved curricular units. The study methods were then crossed with academic achievement. The authors concluded that different approaches to learning are an important explanatory factor for classifications obtained by students.

Brites-Ferreira et al. (2011) grouped variables into factors related to the institution (including equipment and services, pedagogical activities, and extracurricular activities) and factors related to the individual (including the transition to higher education, contextual factors, and individual factors). They also pointed to the gender, age, and cultural and academic heritage of the nuclear family (parents) as sociodemographic and contextual variables that may play a role in student's success/failure.

Zajacova et al. (2005) developed a questionnaire to measure academic self-efficacy level and perceived stress, that is associated with twenty-seven school-related tasks. The structural equation modeling was used to predict three different measures of academic performance: the value of first-year GPA, number of accumulated credits, and failure after the first year.

According to Tavares (2000), three domains establish academic success/failure: academic domain (school performance, study skills, evaluation, and curriculum), social-relational domain (way of being at the university, student role adjustment, insertion on the university context, offered arrival opportunities, satisfaction with relational and social environments) and biopsychological domain (physical and psychological health, quality of life and well-being, satisfaction with life in general).

From a study with students from the University of Minho, Taveira (2000) identified some associated factors with academic failure and grouped them into two main sets: individual and contextual factors. Individual factors cover demographic, academic, personality, and role variables. Contextual factors cover the variables concerning university context, family context, and context of peers.

According to Almeida and Araújo (2015), academic success/failure can be measured by school classifications, a weighted average of ratings; the ratio between the number of approved curricular units and number provided in the curriculum; permanence and completion rates, number of years to complete. They also identify associated factors with academic success/failure. These factors may be associated with the student, teachers, university course, and institution. They identify critical moments for academic failure and dropout. Intervention measures are mentioned.

Tinto (1993) states that the two main reasons for college student attrition are related to low academic and social integration. Academic integration encompasses academic journey, students' perception of their progress, and belief in the personal commitment of teachers to teach and help students. Social integration covers self-esteem, relationships with colleagues, and teachers.

Bento (2008) points out to adaptation difficulties during the first year such as distance or indifference from teachers, work rate, academic traditions, family withdrawal, demanding assessment and complexities of curricular units, teaching methods and evaluation system, large classes, lots of material to learn, and too long classes.

Sibanda et al. (2015) identify several factors that were considered by students as having a significant influence on academic success, such as regular study, presence at classes, hard work, commitment, and dedication.

In the study performed by Fraser and Killen (2003), the authors identify, at the University of Pretoria, which factors teachers and students perceive as having a more critical influence on academic success/failure of students at the university. They found that many students pointed to external sources to explain academic failure.

As stated above, different causes were identified in various studies to explain the academic success/failure of students. The present study aims to explore the role of some of the reasons that may contribute to academic success/failure in the first semester of the 2017/2018 academic year, for students who were enrolled in a public Higher School of Technologies and Engineering in Portugal. Only data and success/failure related to this semester were considered. The factors used in this approach to academic success/failure focused on four factors: factors associated with the teacher, the student, the institution, and the curriculum, factors that can be summarized by empirical studies performed by other authors.

## Materials and Methods

This paper considers school success/failure from the perspective of academic achievement in the course attended. Therefore, a student's failure is when he or she has not been able to reach the approval goals within the predetermined time. However, school success/failure, in a broader sense, cannot be restricted to this aspect alone. Drop out, and the reasons for it, are not addressed in this study.

Based on the identified variables in the literature associated with academic success/failure, and in order to answer the objectives proposed by this study, a questionnaire survey was built (Appendix A). A pre-test was performed with some students and teachers, and suggestions were incorporated in the final questionnaire, which was placed on a digital platform to collect students' answers. They were encouraged to respond, having been explained the importance of it. They were also informed that participation was voluntary and that anonymity would always be guaranteed. The questionnaire was available for a period of two months, from February 27 to April 27, 2018, with 205 responses collected. All students were considered regardless of the academic year.

For the present study, two variables were constructed to measure academic success/failure.

Since university courses of this Higher School have five curricular units in the first semester, only those students who were enrolled in that semester to at least five curricular units were considered, avoiding cases such as when a student was enrolled on a single curricular unit, which would more readily correspond to a success rate of 100%, if he or she got approval to that curricular unit. For students enrolled in more than five curricular units that got approval in at least five, the success rate was considered to be of 100%, since they would have a work overloaded, compared to others, to achieve a real 100% of approved curricular units. Thus, the first constructed variable was calculated as the ratio between the approved and planned curricular units, which would always be five. All students with more than five approvals were considered to have achieved success, in this variable, of 100%.

The second variable concerns the scores, which was computed as the sum of the five (or less, if the student had obtained approval in less than five curricular units) best scores obtained.

Hence, the two variables constructed were the ratio of the number of completed curricular units by the number of planned curricular units for the first semester of the academic year 2017/2018 (corresponding to five), and another by the sum of the five (or less, if the student had obtained approval in less than five curricular units) best scores obtained.

In order to detect situations that could influence the results of the statistical procedures to be performed, all answers obtained were initially reviewed. Three cases were eliminated owing to inconsistencies in the responses.

As only students who were enrolled in the semester in at least five curricular units were considered, all students with fewer than five curricular units were eliminated from the database, which corresponded to 34 students.

Scores were only considered if their number agreed with the number of curricular units performed, except when the student was approved in more than five curricular units and provided at least five scores. In this case, the sum of the five best scores was computed from the available ones. This way, 17 additional cases were eliminated from the dataset. Hence, the database reduced to 151 students, from which four were master students, which were also excluded. Finally, the database remained with 147 undergraduate students.

The items of the questionnaire measuring the factors associated with the teacher, the student, the institution, and the curriculum, were first submitted to exploratory factor analysis, and three factors were identified.

To explore the possible causal effect of the different variables and of the three factors that arose from the exploratory factor analysis, on the academic success/failure, a partial least squares (PLS-SEM) model was built.

## Results

The final database included 84.4% male and 15.6% female students. The majority of the students on the sample (72.1%) were not displaced from their habitual area of residence. About 28.6% of the students in the sample considered that their financial situation was insufficient or very inadequate, and 25.2% reported suffering from a chronic health problem.

## Factor Analysis

The items of the questionnaire measured on a Likert scale with seven levels were first submitted to exploratory factorial analysis. The number of factors to extract was determined using criteria applied to the polychoric correlation matrix, such as the parallel analysis and the Velicer minimum average partial criterion (RUSCIO, ROCHE, 2012; VELICER et al., 2000; ZWICK, VELICER, 1986) since these criteria usually yield optimal solutions for the number of factors to retain (ZWICK, VELICER, 1986; BASTO, PEREIRA, 2012). The software used was the IBM SPSS

Statistics Software (INTERNATIONAL BUSINESS MACHINES , 2010) and SPSS R-Menu (BASTO, PEREIRA, 2012).

For the present sample, parallel analysis and Velicer's minimum average partial pointed to the existence of three factors. Through principal component analysis followed by a varimax rotation, three factors were identified: one associated with teachers, one associated with students, and a third associated with the institution and the curriculum. It was not possible to separate the institution, and the curriculum in two different factors since the analysis pointed to one single factor. The factors that emerged from the exploratory factorial analysis with the items measuring each of them are described in Table 1.

**Table 1.** Factors that emerged from the exploratory factorial analysis.

---

Items of Factor Teachers

- Teachers are not consistent between what they say and what they do.
- Teachers displease me.
- Teachers do not treat all students equally.
- Teachers are not very sympathetic.
- The questions in the exams do not capture the essence of the program.
- Teachers do not clearly state the program.
- Teachers do not take my level of understanding into account.

Items of Factor Students

- I have difficulty managing my personal problems.
- I am afraid I will fail.
- The complexity of the topics exceeds my ability to understand.
- I cannot compete with my colleagues.
- I am worried about my future.
- My family does not support me.
- I do not feel integrated into my class.
- I have no close friends.
- I cannot concentrate on the classroom.
- My knowledge is insufficient for the course I am attending.

Items of Factor Institution/curriculum

- The same subjects are taught several times.
  - The contents are not attractive.
  - Counseling services are not efficient.
  - Teaching is not practice-oriented.
  - The material resources are insufficient (bibliography, laboratories, computers, or other equipment).
  - The teachers do not articulate the programs among themselves.
- 

Source: Our research.

## Structural Equation Modeling

PLS-SEM (WOLD, 1980; HAIR et al., 2014) was used to analyze the relationships between the variables. It consists of two distinct submodels, the measurement model and the structural model. The later establishes the relationships between latent variables aiming to minimize the residues of fundamental equations. The model applies the ordinary least squares method to each of its equations. PLS-SEM is thus suitable for predictive or exploratory analyses, and when the sample is small (HSU et al., 2006). The model can work well with variables measured in ordinal scale and dummy variables. The distribution of the estimators is unknown; therefore, it is necessary to use methods such as bootstrap to evaluate their significance. The measurement and structural submodels were analyzed.

The model considered is formed by two central endogenous variables already described. In essence, these are the rate of curricular units performed, and the total score obtained, metrics used to quantify academic success/failure. The model considers that the rate of curricular units completed with success impacts the overall score and that there is an indirect effect on the two central endogenous variables, by the factors “Teachers” and “Institution/curriculum”, through mediation by the “Students” factor. Besides the two primary endogenous variables, all other variables, except for latent variable “Students”, are exclusively exogenous.

The software used to analyze the PLS-SEM model was Smart-PLS 2.0 (RINGLE et al., 2005). Estimates for the relationships between the variables were obtained, that is, the values and importance of the impact of different variables on the endogenous variables, in particular, the two central variables that measure academic success/failure.

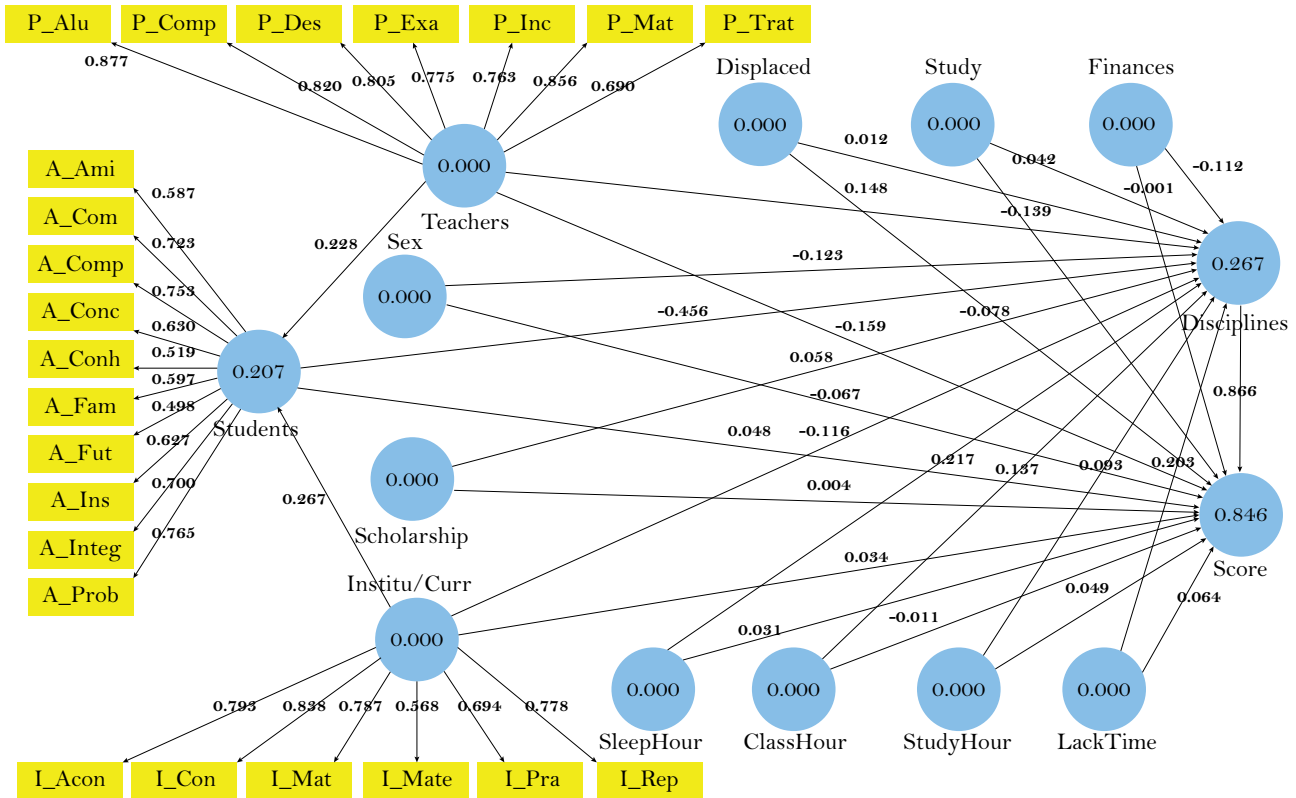
The tested model (after elimination of some others exogenous variables due to being simultaneously nonsignificant and having very low impact coefficients, so that their inclusion could not be justified), and the results obtained by the PLS-SEM analysis, loadings of the measurement model, impact factors and determination coefficients of the structural model, are depicted in Figure 1 (the abbreviations are described in appendix B).

### *Measurement Model*

The loadings in the measurement model were not too low; therefore, none of the items were eliminated. Also, a model with good convergent validity and good discrimi-



Figure 1. The estimated model obtained with SmartPLS 2.0.



Source: Our research using SmartPLS 2.0.M3.

nant validity should have cross-loadings with reduced and lower values compared to the loadings associated with the factor they measure. All cross-loadings have fulfilled this premise, which is why they support the convergent and discriminant validity of the model.

The values of the Cronbach’s alpha and the composite reliability index for each of the three factors presented good or excellent values, which point to good reliability of the factors. For Cronbach’s alpha, values higher than 0.9 are considered excellent, superior to 0.8 good, superior to 0.7 acceptable, superior to 0.6 weak, and inferior to 0.6 unacceptable (MACHADO et al., 2017). The obtained values were 0.8485, 0.8446 and 0.9084, for the “Institution/curriculum”, “Students” and “Teachers” factors respectively. The Dillon-Goldstein rho or composite reliability index is calculated based on the loadings obtained by the model and not on the correlations between the manifested variables, as with the previous index. Their values should be higher than 0.7 (VINZI et al., 2010). The obtained values were 0.8826 for the “Institution/curriculum” factor, 0.8755 for the “Students” factor, and 0.9253 for the “Teachers” factor.

The obtained values for the average variance extracted (AVE) were 0.5597 for the “Institution/curriculum” factor, 0.4175 for the ‘Students’ factor, and 0.6401 for the

“Teachers” factor. The AVE value should be at least 0.5 to support good convergent validity. Although one of the values was less than 0.5, the criterion of Fornell-Lacker was verified (FORNELL, LARCKER, 1981). This criterion stipulates that the square root of the AVE for each of the factors of the model should be superior to all correlations between that factor and all the others. It serves to evaluate the convergent and discriminant validity of the model.

*Structural Model*

The model explains 26.7% of the variable “Rate of disciplines performed”, and 84.6% of the variable ‘Total score obtained’ in the five best disciplines.

The SmartPLS software standardizes all the variables before estimating the impact factors. What this represents is that if an impact factor takes the value  $x$ , for each variation unit of the exogenous variable standard deviation, on average, the change in the endogenous variable is of  $x$  standard deviations.

The significance of the model was estimated using bootstrap resampling, in which 5000 subsamples were randomly taken from the original sample with replacement. A minimum of 5000 samples was used (HAIR et al., 2014) so that the empirical  $t$  statistic follows approximately a normal distribution. The statistical significant impact coefficients, obtained by bootstrap, are depicted in Table 2.

**Table 2.** Statistical significant impact coefficients.

	Coefficient	$t$ Statistic	
Students (negative direction) -> Rate of disciplines performed	-0.4564	4.6064	***
Teachers (negative direction) -> Total score	-0.1591	2.2958	**
Displaced from residence (no-0, yes-1) -> Total score	-0.0777	2.1067	**
Do not like to study (negative direction) -> Total score	-0.1393	3.1945	***
Gender (female-0, male-1) -> Total score	-0.0668	1.8206	*
Gender (female-0, male-1) -> Rate of disciplines performed	-0.1235	1.6916	*
Hours slept per night in the days before the tests -> Rate of disciplines performed	0.2175	2.4993	**
Lack of time to prepare appropriately -> Rate of disciplines performed	0.2031	2.2987	**
Institution/curriculum -> Students	0.2670	1.8368	*
Teachers -> Students	0.2283	1.6472	*
Rate of disciplines performed -> Total score	0.8664	19.617	***

\*\*\*significant at 0.01 level

\*\*significant at 0.05 level

\*significant at 0.10 level

Source: Our research using SmartPLS 2.0.M3.

There was a marginally significant coefficient of 0.1373 ( $t = 1.5172$ ,  $p = 0.129$ ), which translates the impact of “Hours dedicated weekly, on average, to class attendance” over “Rate of disciplines performed”. Hence, class attendance has a marginally significant association with the success/failure of the student.

The non-significant impact coefficients displayed simultaneously small effects, so they were not considered for the identification of the variables that explain the success/failure of the student. The mean scores for each factor and variables involved in the significant associations with the inclusion of the variable “Hours dedicated weekly, on average, to class attendance”, are shown in Table 3. These values indicate that the three factors, “Students”, “Teachers”, and “Institution/curriculum”, were positively evaluated by students, especially the “Students” factor. It is also observed that the students, on average, like to study and do not have a lack of time to prepare appropriately. The students spent weekly, on average, only 3.6 hours to class attendance, a deficient value.

**Table 3.** Mean scores obtained.

	Coefficient
Students (negative direction)	2.6249
Teachers (negative direction)	3.4167
Institution/curriculum (negative direction)	3.3741
Displaced from residence (no-0, yes-1)	0.2789
Do not like to study (Likert scale 1 to 7)	3.0204
Gender (female-0, male-1)	0.8435
Hours dedicated weekly, on average, to class attendance	3.5986
Hours slept per night in the days before the tests	6.4980
Lack of time to prepare appropriately (Likert scale 1 to 7)	3.5578
Rate of disciplines performed (frequency)	0.8816
Total score	63.1701

Source: Our research using SmartPLS 2.0.M3.

## Discussion

Student-related features were the ones that had the most impact on academic success/failure. All other aspects showed a smaller substantive impact. It was not possible to demonstrate the existence of any significant direct impact of

the “Institution/curriculum” on the academic success/failure of the student. “Teachers” seem to have only a residual direct influence on student achievement. However, these two factors (“Teachers” and “Institution/curriculum”) had a significant impact, at a significance level of 10%, on the “Students” factor, which leads to the conclusion that their main action is perhaps via mediation through the “Students” factor and not by direct effect.

Other variables not usually referred to in the literature, were recognized as being explanatory variables of academic success/failure. Therefore, variables such as disliking to study, being displaced from the permanent residence, and being a male were identified with a negative residual impact on academic success. With a slightly higher substantive impact, the sleep time on the eve of tests appears as a reason for academic success/failure.

The number of hours dedicated weekly, on average, to class attendance appears as a marginally significant variable for academic success/failure. The sample showed that the students spent weekly, on average, only 3.6 hours to class attendance, which is a deficient value and can negatively impact academic success.

Finally, the lack of time for students to adequately prepare arises as a cause for academic success/failure. In this case, the result is unexpected, since the model indicates that success increases, on average, with the lack of time. However, the variable is just the perception that students have about the time they need to prepare and not the actual time they have. The best students, those who generally achieve success, may perceive a higher lack of time than the less successful students.

For this Higher School, the three factors “Students”, “Teachers”, and “Institution/curriculum” were positively evaluated by the students, and on average, they like to study and do not have a lack of time to prepare appropriately.

Although students in the first year have more adaptation issues to the university, in the present study the variable academic year revealed to be not significant and with a minimal impact in the model constructed.

Initially, a more substantial response rate, close to the population, was the goal. Several efforts have been made to achieve this goal. However, the obtained response rate was considerably low. This factor, somehow, may bias the interpretation of the obtained results. Further studies with larger samples should be performed. New

ways for students to cooperate should also be tried. Nevertheless, since not every student answered the questionnaire, there is no guarantee that the sample collected is representative of this Higher School, which implies that generalization of results to it must consider this fact.

It is also relevant to emphasize that this was an exploratory study applied to only one Higher School. Possible generalizations to other Higher Schools require further investigations.

## APPENDIX A – QUESTIONNAIRE

1. Sex

Female	
Male	

2. Age

3. What type of course do you attend?

Professional Technical Course	
Undergraduate	
Master	

4. What was the entry regime? (only for those who answered “ Undergraduate” in the previous question)

National Access Examination	
Technological Specialization Course/ Professional Technical Course	
Undergraduate	
Transfer/Change of course	
More than 25 years old	
Other	

5. What was your entry score? (only for those who answered “National Access Examination” in the previous question)

6. Which course are you enrolled, and what is the regime (daytime or after work)?

---

7. What is the curricular year in which you are enrolled?

8. How do you assess your economic and financial situation in the first semester of the current academic year?

Very good (that is, could save money)	
Good (that is, did not have to make any restrictions)	
Reasonable (that is, sufficient to cover necessary expenses)	
Insufficient (that is, had to cut back on many expenses)	
Very inadequate (that is, had to resort to loans/savings)	

9. In the semester just finished, did you had any scholarship?

Yes	
No	

10. How many hours did you spend each week, on average, in the first semester of the current academic year, on the frequency of classes?

Up to 10 hours	
From 11 to 15 hours	
From 16 to 20 hours	
From 21 to 25 hours	
More than 25 hours	

11. How many hours did you spend each week, on average, in the first semester of the current academic year, studying outside the classroom?

Up to 5 hours	
From 6 to 10 hours	
From 11 to 15 hours	
From 16 to 20 hours	
From 21 to 25 hours	
More than 25 hours	

12. How many hours did you sleep per night, on average, in the days before the tests, in the first semester of the current academic year?

13. Do you suffer or have suffered, during the first semester of the current academic year, any acute health problem (such as infections, fractures, etc.)?

Yes	
No	

14. If you answered yes, which one(s), and what was its duration?

---

15. How many cigarettes do you smoke, on average, per day?

Zero, I don't smoke	
From 1 to 5	
From 6 to 10	
From 11 to 15	
From 16 to 20	
More than 20	

16. Do you have a chronic health problem, whether it is a disease or some non-specific symptom (such as epilepsy, asthma, allergies, panic attacks, arthritis, ulcerative colitis, lupus, tremors, neurological problems, low platelets, blood issues, etc.)?

Yes	
No	

17. If you answered yes, which one(s)? \_\_\_\_

---

18. In the semester just finished, did you have any extracurricular activity, whether remunerated or not?

Yes	
No	

19. If your answer was yes, how many hours did you dedicate to that activity in the first semester of the current academic year, on average, weekly?

20. To how many disciplines were you enrolled in the first semester of the current academic year (regardless of the year to which those disciplines belong)?

21. To how many disciplines did you achieve success in the 1st semester of the current academic year (regardless of the year to which those disciplines belong)?



22. What are the scores obtained in the disciplines referred to in the previous question?

--	--	--	--	--	--	--	--

23. In the first semester of the current academic year, have you been displaced from your usual residence to study in this institution?

Yes	
No	

24. How long do you spend, on average, to travel to the institution (in minutes)?

25. Point out, according to a Likert scale from one to seven, the degree of your agreement with the following statements:

1	2	3	4	5	6	7
<i>I totally disagree</i>	<i>I fairly disagree</i>	<i>I disagree, but little</i>	<i>Neither agree or disagree</i>	<i>I agree, but little</i>	<i>I fairly agree</i>	<i>I totally agree</i>

Teachers are not consistent between what they say and what they do.	1	2	3	4	5	6	7
Teachers displease me.	1	2	3	4	5	6	7
Teachers do not treat all students equally.	1	2	3	4	5	6	7
Teachers are not very comprehensive.	1	2	3	4	5	6	7
The questions in the exams do not capture the essence of the subject.	1	2	3	4	5	6	7
Teachers do not clearly state the subjects.	1	2	3	4	5	6	7
Teachers do not take my level of understanding into account.	1	2	3	4	5	6	7
I'm not interested in the subjects taught.	1	2	3	4	5	6	7
I cannot concentrate on the classroom.	1	2	3	4	5	6	7
I do not like to study.	1	2	3	4	5	6	7
I cannot compete with my colleagues.	1	2	3	4	5	6	7
I have difficulty managing my personal problems.	1	2	3	4	5	6	7
I do not feel integrated into my class.	1	2	3	4	5	6	7
I have no close friends.	1	2	3	4	5	6	7
I am afraid to fail.	1	2	3	4	5	6	7
My family does not support me.	1	2	3	4	5	6	7
I do not feel that I am guaranteed to get a job at the end of the course.	1	2	3	4	5	6	7
I'm worried about my future.	1	2	3	4	5	6	7
I have lack of time to prepare properly.	1	2	3	4	5	6	7

It takes me too long to go to the institution.	1	2	3	4	5	6	7
I do not like the institution.	1	2	3	4	5	6	7
The material resources are insufficient (bibliography, laboratories, computers, or other equipment).	1	2	3	4	5	6	7
Counseling services are not efficient.	1	2	3	4	5	6	7
The environment among colleagues is not healthy.	1	2	3	4	5	6	7
Communication between the various bodies of the institution does not work properly.	1	2	3	4	5	6	7
The number of students in the classroom is excessive.	1	2	3	4	5	6	7
Teaching is not practice-oriented.	1	2	3	4	5	6	7
The same subjects are taught several times.	1	2	3	4	5	6	7
The teachers do not articulate the subjects among themselves.	1	2	3	4	5	6	7
The complexity of the topics exceeds my ability to understand.	1	2	3	4	5	6	7
The contents are not attractive.	1	2	3	4	5	6	7
The evaluation criteria of the curricular units are not adequate.	1	2	3	4	5	6	7
My knowledge is insufficient for the course I am attending.	1	2	3	4	5	6	7

## APPENDIX B – ABBREVIATIONS

The following abbreviations were used to display the variables in Figure 1:

P\_Inc -> Teachers are not consistent between what they say and what they do

P\_Des -> Teachers displease me

P\_Trat -> Teachers do not treat all students equally

P\_Comp -> Teachers are not very sympathetic

P\_Exa -> The questions in the exams do not capture the essence of the program

P\_Mat -> Teachers do not clearly state the program

P\_Alu -> Teachers do not take my level of understanding into account

A\_Prob -> I have difficulty managing my personal problems

A\_Ins -> I am afraid I will fail

A\_Comp -> The complexity of the topics exceeds my ability of understanding

A\_Com -> I cannot compete with my colleagues

A\_Fut -> I'm worried about my future

A\_Fam -> My family does not support me

A\_Integ -> I do not feel integrated in my class

A\_Ami -> I have no close friends

A\_Conc -> I cannot concentrate on the classroom

A\_Conh -> My knowledge is insufficient for the course I am attending

I\_Rep -> The same subjects are taught several times

I\_Cont -> The contents are not attractive

I\_Acon -> Counseling services are not efficient

I\_Pra -> Teaching is not practice-oriented

I\_Mate -> The material resources are insufficient (bibliography, laboratories, computers or other equipment)

I\_Mat -> The teachers do not articulate the programs among themselves

Teachers -> “Teachers” factor

Students -> “Students” factor

Institu/Curr -> “Institution/curriculum” factor

Sex -> Gender (female-0, male-1)

Scholarship -> The student had a scholarship (no-0, yes-1)

Displaced -> The student is displaced from the habitual residence (no-0, yes-1)

Study -> Likert scale from one to seven to measure the degree of agreement with the sentence “I do not like to study”

Finances -> Economic and financial situation of the student (1-very inadequate, 2-insufficient, 3-reasonable, 4-good, 5-very good)

SleepHour -> Student’s hours slept per night, on average, on the days before the tests

ClassHour -> Student’s hours spent per week, on average, on the frequency at the classroom

StudyHour -> Student’s hours spent per week, on average, studying outside the classroom

LackTime -> Likert scale from one to seven to measure the degree of agreement with the sentence “I have lack of time to prepare properly”

Disciplines -> Rate of disciplines performed

Score -> Total score for the best five disciplines

## References

- ALMEIDA, L.; ARAÚJO, A. Sucesso académico: variáveis pessoais e respostas institucionais. In: SEMINÁRIO SUCESSO ACADÉMICO, 5. 2015, Lisboa. *Acta...* Lisboa: Ministério da Educação e Ciência, 2015. Available at: <<http://www.dgeec.mec.pt/np4/499.html>>. Accessed on: June 9, 2019.
- BASTO, M.; PEREIRA, J. An SPSS R menu for ordinal factor analysis. *Journal of Statistical Software*, Innsbruck, v. 46, n. 4, p. 1-29, 2012. <https://doi.org/10.18637/jss.v046.i04>
- BENTO, A. O insucesso no ensino superior: perspectivas e situações dos alunos do 4º ano via ensino da Universidade da Madeira. In: ESCALLIER, C.; VERÍSSIMO, N. (Orgs.). *Educação e cultura*. Funchal: Grafimadeira, 2008. p. 147-56. Available at: <<http://hdl.handle.net/10400.13/53>>. Accessed on: June 9, 2019.
- BRITES-FERREIRA, J. et al. (In)sucesso académico no ensino superior: conceitos, factores e estratégias de intervenção. *Revista Iberoamericana de Educación Superior*, v. 2, n. 4, p. 28-40, 2011.
- COUTINHO, S. The relationship between goals, metacognition, and academic success. *Educate*, London, v. 7, n. 1, p. 39-47, 2007.
- FORNELL, C.; LARCKER, D. F. Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, Chicago, v. 18, n. 1, p. 39-50, 1981. <https://doi.org/10.1177/002224378101800104>
- FRASER, W. J.; KILLEN, R. (2003). Factors influencing academic success or failure of first-year and senior university students: do education students and lecturers perceive things differently? *South African Journal of Education*, Pretoria, v. 23, n. 4, p. 254-60, 2003.
- HAIR, J. et al. *A primer on partial least squares structural equation modeling (PLS-SEM)*. London: Sage, 2014.
- HSU, S. -H.; CHEN, W. -H.; HSIEH, M. -J. Robustness testing of PLS, LISREL, EQS and ANN-based SEM for measuring customer satisfaction. *Total Quality Management & Business Excellence*, v. 17, n. 3, p. 355-71, 2006. <https://doi.org/10.1080/14783360500451465>
- INTERNATIONAL BUSINESS MACHINES – IBM. *IBM SPSS statistics*: version 25. Armonk, NY, 2018. Available at: <<https://www.ibm.com/analytics/spss-statistics-software>>. Accessed on: June 9, 2019.

MACHADO, M.; BASTO, M.; SALAZAR, A. Novo modelo de satisfação do cliente para o setor da distribuição de energia em Portugal. *Revista Brasileira de Pesquisas de Marketing, Opinião e Mídia*, São Paulo, v. 10, n. 1, p. 82-101, 2017.

MONTEIRO, S.; VASCONCELOS, R.; ALMEIDA, L. Rendimento académico: influência dos métodos de estudo. In: CONGRESSO GALAICO PORTUGUÊS DE PSICOPEDAGOGIA, 8. 2005, Braga. *Actas...* Braga: Universidade do Minho, 2005. p. 3505-16. Available at: <<http://hdl.handle.net/1822/4204>>. Accessed on: June 9, 2019.

RINGLE, C.; WENDE, S.; WILL, A. *SmartPLS 2.0 M3*. Hamburg: SmartPLS, 2005. Available at: <<http://www.smartpls.de>>. Accessed on: June 9, 2019.

RUSCIO, J.; ROCHE, B. Determining the number of factors to retain in an exploratory factor analysis using comparison data of known factorial structure. *Psychological Assessment*, v. 24, n. 2, p. 282-92, jun. 2012. <https://doi.org/10.1037/a0025697>

SIBANDA, L.; IWU, C.; BENEDICT, H. Factors influencing academic performance of university students. *Demography and Social Economy*, Kyiv, v. 24, n. 2, p. 103-15, 2015. <https://doi.org/10.15407/dse2015.02.103>

TAVARES, J. et al. *Inventário de atitudes e comportamentos habituais de estudo Iache*. Aveiro: Universidade de Aveiro e Braga, 2004. Available at: <<https://www.jpctavares.com/textos>>. Accessed on: June 9, 2019.

TAVARES, J. et al. Factores de sucesso/insucesso no 1º ano dos cursos de licenciatura em ciências e engenharia do ensino superior. In: SOARES, A. P. et al. (Eds.). *Transição para o ensino superior*. Braga: Universidade do Minho, 2000. p. 189-214. Available at: <<https://hdl.handle.net/10216/101716>>. Accessed on: June 9, 2019.

TAVEIRA, M. C. Sucesso no ensino superior: uma questão de adaptação e de desenvolvimento vocacional. In: TAVARES, J.; SANTIAGO, R. (Eds.). *Ensino superior: (in) sucesso académico*. Porto: Porto, 2000. p. 49-72.

TINTO, V. *Leaving college: rethinking the causes and cures of student attrition*. 2. ed. Chicago, IL: University of Chicago, 1993.

VELICER, W.; EATON, C.; FAVA, J. Construct explication through factor or component analysis: a review and evaluation of alternative procedures for determining the number of factors or components. In: GOFFIN, R. D., HELMES, E. (Eds.). *Problems and solutions in human assessment*. Boston, MA: Springer, 2000. p. 41-71.

VINZI, V.; TRINCHERA, L.; AMATO, S. PLS path modeling: from foundations to recent developments and open issues for model assessment and improvement. In: ESPOSITO, V. V. et al. (Eds.). *Handbook of partial least squares: concepts, methods, and applications*. Berlin: Springer, 2010. p. 47-82.

WOLD, H. Model construction and evaluation when theoretical knowledge is scarce: theory and application of partial least squares. In: KMENTA, J.; RAMSEY, J. B. (Eds.). *Evaluation of econometric models*. Cambridge, MA: Academic Press, 1980. p. 47-74. Available at: <<https://www.nber.org/chapters/c11693>>. Accessed on: June 9, 2019.

ZAJACOVA, A.; LYNCH, S. M.; ESPENSHADE, T. J. Self-efficacy, stress, and academic success in college. *Research in Higher Education*, v. 46, n. 6, p. 677-706, 2005. <https://doi.org/10.1007/s11162-004-4139-z>

ZWICK, W.; VELICER, W. Comparison of five rules for determining the number of components to retain. *Psychological Bulletin*, Washington, v. 99, n. 3, p. 432-42, 1986. <https://doi.org/10.1037/0033-2909.99.3.432>

**Submissão em:** 26/09/2019

**Aceito em:** 05/04/2020