Original Article

Dropout and retention of undergraduate students in management: a study at a Brazilian Federal University

Evasão e retenção de graduandos em administração: um estudo em uma universidade federal brasileira

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Abstract

This article analyzes the antecedents of the dropout rate and retention of students in management undergraduate programs. Empirical research was carried out in a management undergraduate program at a Brazilian Federal University, using the data of 1202 freshman students between the years 2004–2009. These students were followed up until the year 2013. In the analysis, we surveyed information regarding the student's time in the program, their graduation or dropout, as well as their socio-demographic information and program characteristics. The statistical technique used was the survival analysis, which allowed us to assess the factors that influence the time of program completion and the evolution of the dropout risk. In the main results, it was found that the number of semesters, student grades, gender, and the existence of failure or dropouts per course, were factors that explained both the time of completion of the course and the risk of dropping out. In addition, variables, such as age, marital status, race and high school background (public or private), showed no influence on these variables (graduation time and dropout rate).
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Keywords: Higher education; Course management; Dropout; Retention; Graduation

Resumo

O objetivo, neste artigo, foi analisar os condicionantes da evasão e da retenção de alunos do ensino superior em administração. A pesquisa empírica foi realizada em um curso de Administração de uma universidade federal brasileira com dados de 1202 ingressantes entre os anos de 2004 a 2009 que foram acompanhados até o ano de 2013. Na análise, foram levantadas informações relativas ao tempo de permanência do aluno no curso, forma de saída (diplomação ou evasão), além de informações sócio demográficas e sobre as características do curso. Para análise, foi utilizada a técnica estatística de análise de sobrevivência, que permitiu avaliar, ordenadamente, os fatores que influenciam o tempo de conclusão do curso e a evolução do risco de evasão. Como principais resultados, foi verificado que o número de semestres do curso, o desempenho do aluno, seu gênero, além da existência de reprovação e trancamento são fatores que explicam tanto o tempo de permanência quanto o risco de evasão. Na pesquisa foi constatado que variáveis relativas à idade no ingresso, estado civil, raça e natureza da escola de educação básica (pública ou privada) não demonstraram influência no tempo de conclusão ou evasão.
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Palavras-chave: Ensino superior; Gestão de curso; Evasão; Retenção; Diplomação

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Introduction

The focus on the expansion policy of Brazilian higher education over the last 20 years has refocused the attention of educational managers on two problems: the dropout levels and the retention of higher education students (Aina, 2013; Arias Ortiz & Dehon, 2013; Belloc, Maruotti, & Petrella, 2010; Des-Jardins, Ahlburg, McCall, 2002; Lassibille & Gómez, 2008; Lightfoot & Doerner, 2008; Platt Neto, Cruz, & Pfitscher, 2008). The concern is associated with the risk that the educational system is not being effective in training professionals. Public managers and policymakers are concerned about the inefficiency and the waste of public resources, both where there is total State funding, as in the case of Brazilian public universities, and where funding is through scholarships and special financing of school fees, such as the United States, the United Kingdom, Italy, and Belgium (Aina, 2013; Arias Ortiz & Dehon, 2013; DesJardins et al., 2002). Many public managers have been measuring rates of dropout, retention, and graduation of higher education students to discover the variables that most influence the possibility of the student's not finishing the program or even delaying the graduation time of his/her program.

Between 2003 and 2014, the Brazilian federal government invested R$ 8.4 billion in the expansion and restructuring of federal universities, increasing the number of institutions, programs, job positions, and students. Through the so-called "Reuni" program, designed to support the restructuring and expansion of federal universities, 2046 new undergraduate programs were created. The admission of students increased from 638,000 to more than one million, between 2003 and 2011 (Brazilian Ministry of Education, 2017).

After more than a decade of these expansion policies, there is enough data to evaluate the effectiveness and value of the program for Brazilian higher education. We understand that the current moment is suitable to evaluate the positive and negative results of the expansion policy, as well as to analyze the need for corrective actions for any gaps and problems that have emerged over the years.

In this article, we analyze the antecedents of dropout and retention of students of higher education in Brazilian public universities. As a context of the empirical analysis, we chose the Management program in a Brazilian Federal University. The choice of this program is justified because management is one of the most commonly found programs in Brazilian higher education institutions and because, at the time this article was written, this is the program with the largest number of enrollments in Brazil (INEP, 2015). Our focus is on the variables that potentially influence dropout and retention in the chosen program.

After this introduction, the paper presents a brief literature review on the theme, followed by the research procedures, the results, and analysis. At the end, we present our final remarks and the conclusions, aiming to improve the view on such an important subject, in the academic and financial sense, to governments and society in general.

Literature review

The phenomena of dropout and university retention have been relevant themes in many countries around the world such as the United States (DesJardins et al., 2002; Hu & St. John, 2001; Lightfoot & Doerner, 2008; Radcliffe, Huesman, & Kellogg 2009), Spain (Lassibille & Gómez, 2008), Italy (Aina, 2013; Belloc et al., 2010), Belgium (Arias Ortiz & Dehon, 2013), the United Kingdom (Arulampalam, Naylor, & Smith, 2007), and Brazil (Furtado & Alves, 2012; Platt Neto et al., 2008). Dropout and retention have been investigated from a variety of perspectives, exploring their causes and consequences and reasoning on preventive and corrective actions that may reduce their impact (Astin, 1975, 1997; Berger, 2001; Braxton, Bray, & Berger, 2000; Furtado & Alves, 2012; Munro, 1981; Tinto, 1975, 1982, 1987).

Dropout is defined as the abandonment of a certain program, regardless of the motivation of the leaving (Lassibille & Gómez, 2008). Retention concerns the student's permanence in the program beyond the original time of completion. Ideally, programs are designed to not have dropout nor retention because of the negative impacts when students do not finish or extend their program time. It is worse in the cases of Brazilian public universities financed exclusively by the state. These negative impacts are associated with both the waste of public money and social losses due to the cost of late training of the professionals demanded and financed by society (Mangum, Baugher, Winch, & Varanelli, 2005; Platt Neto et al., 2008).

The total financing of higher education by the state is not part of public higher education policies in many countries. In the United States, public universities have tuition fees, and state participation in the budget of their public higher education institutions is practically derisory (Hu & St. John, 2001; Marx, Garcia, Butterfield, Kappen, & Baldwin, 2015). As a way of promoting the inclusion of people with lower incomes, the U.S. government has adopted a policy of assisting higher education students based on special funding conditions and scholarships (Hu & St. John, 2001; Lucas, 2006). In Italy and Belgium, there is an important participation of the state in public universities; however, there are also tuition fees albeit at a much lower rate than those practiced by U.S. universities (Aina, 2013; Arias Ortiz & Dehon, 2013).

In the international context, authors have been researching for decades the antecedents of dropout and retention in higher education. For Astin (1975), many causes lead university students to drop out or get retained in their courses, such as the poor quality of teaching, financial difficulties, dissatisfaction with requirements or regulations, changes in career plans, and low grades. Tinto (1975, 1982) endorsed the antecedents mentioned by Astin (1975), giving more attention to the financial aspects of dropouts. More recently, other aspects have been investigated, such as issues related to race (Hu & St. John, 2001), gender (Severiens & Dam, 2012), family history (Aina, 2013), educational background, and adaptation to the program (Arias Ortiz & Dehon, 2013).

In the Brazilian context, authors point out many causes of dropouts and retention phenomena, such as a low quality of high school education and low performance of students (Veloso & Almeida, 2002). The need for many students to work during the day and study at night (Vieira & Frigo, 1991) makes it difficult for students to transition from high school to the requirements of higher education (Dias, Theóphilo, & Lopes, 2006). Moreover, the Brazilian higher education model combined with management inefficiency are two other aspects that contribute to dropout and retention (Freire, Crisóstomo & Castro, 2008; Ristoff, 1995).

Drawing on this context, we hold that dropout and retention are phenomena with multifactorial causes that are related to students' personal issues, academic and pedagogical aspects, and university management. Besides, the historical context is relevant and should not be discarded because it reflects the quality and levels of previous stages of teaching (Baggi & Lopes, 2011).

Regarding the institutional management, the Brazilian federal government defines measures to evaluate in certifying students with a diploma. To this end, the document of the Reuni project establishes the "completion rate of undergraduate courses" (ratio between the total number of graduates in a specific period and the number of students who joined the university five years earlier) as a reference measure. The Union Court of Audit (TCU) evaluates this success by means of the "graduation success rate" (like the previous measure, but specifically considering each program and its specific time of graduation). Platt Neto et al. (2008) present another measure based on the "total dropout rate," which is the ratio of total dropouts to total enrollments.

All these indices measure dropout and/or graduation rates, but we understand that this is not enough. It is necessary to go beyond a knowledge of numbers, and to deepen our understanding, by identifying the factors that hinder the graduation of students. One possibility is to determine the exact moment when students fail or drop out of the program. This will assist public managers to improve their strategies for the management of Brazilian public universities.

Studies in this field have previously been carried out, but their focus has been narrow. For example, in the context of the expansion of the Brazilian Federal University—and in management and public policy actions—the question of quotas and other inclusive actions have been frequently discussed in relation to their effectiveness and impact on the student dropout rate, their retention and the graduation numbers (Kern & Ziliotto, 2011; Pimentel & Pereira, 2004). After the advance of the quota policies implemented in federal universities, it has already been possible to measure and discuss not only their effectiveness, as a social inclusion action, but also the possible differences in the performance of students entering Brazilian federal universities, as a result of these public policies.

The discussion about dropouts and retention involves a critical reflection on the Brazilian university model and its management (Ristoff, 1995). Such a discussion should be based, not only on the description of the student dropout rate and retention numbers but also on an understanding of the conditioning variables of this phenomenon. By deepening the knowledge of these variables, it will be possible to identify the most fragile elements in the education model and to understand the alternatives for improvement. Several international studies empirically analyzed the phenomena of dropout and retention, seeking to understand the reasons for a student's leaving or completing a program. Considering the context of the business schools, we mention the studies performed by Mangum et al. (2005) and Belloc et al. (2010) in the United States and Italy, respectively. In addition, we discuss the studies of Lassibille and Gómez (2008) and Arias Ortiz and Dehon (2013), carried out with data from universities in Spain and Belgium, respectively.

The research conducted by Mangum et al. (2005) identified predictors of dropouts in an American business school. Data were collected from 403 students in two phases, initially, from students who were in the second semester of the first year. Then, the same students' dropout data were collected four semesters later. The method used was the one of point biserial correlation coefficients to determine the relation of each independent variable in the dropout. Three factors had a significant association with future dropouts: the performance of grades in the first semester, the average program evaluation by students in the first semester, and the perception of financial difficulties.

Belloc et al. (2010)'s study, which was also performed in a business school, analyzed the influence of the individual characteristics of the student, such as gender, place of residence, family income, high school history, and performance in undergraduate conclusion. The data were from the School of Economics and Management of the University of Rome (Sapienza) and covered a total of 9725 students of three-year programs in the periods 2001–2002 and 2006–2007, using the modeling technique by generalized linear mixed models. The most relevant results indicated that people of higher social classes, females, and whose university entrance was late in age, are more likely to graduate in higher education. In addition, unlike other studies, the authors identified in their sample that students with the best grades during high school were more likely to drop out. Conversely, the students with the best performance during the undergraduate program had a lower risk of dropout.

The research of Lassibille and Gómez (2008) was carried out with 6991 people from 40 different programs (undergraduate) from the University of Málaga, totaling 28,999 observations. The authors considered the time (measured in years) as a discrete variable and the information on which year the student dropped out or graduated. The results indicated that factors, such as age, the period of university entrance (late or soon after high school), entry into the desired program, financial support, university residency, and graduation of parents had a positive influence on program completion.

Arias Ortiz and Dehon (2013) investigated the factors that led to the dropout rate and completion of undergraduate programs at the Free University of Brussels in Belgium. A total of 5822 observations were taken from the university records of enrolled students between 1997–1998 and 2001–2002. The data consisted of demographic information provided by the students at their enrollment, and the method used was the survival analysis. The results showed that free access to Belgian higher education does not contribute to a reduction in the dropout

rate, or to student retention. According to the authors, the most relevant factors for dropouts and retentions are related to the students' socioeconomic history, the number of failures in the first year, and the possibility of changing the program after failing in the first year. Students from better socioeconomic conditions, and who have had the opportunity to migrate to another program, after failing in the first year, were more likely to graduate.

From the aforementioned research studies, we noted that there was a wide range of factors contributing to the dropout and graduation rates. However, in the current research, we chose not to take these indications as evidence for defining the hypothesis (in line with the hypothetic-deductive paradigm). An approach was chosen that was inspired and suggested by Haig (2005), who promoted research that confronts and dialogs with the evidence generated by theories and data sets, seeking not to specifically refute or confirm the hypothesis, but to raise more evidence of the phenomena of interest. This approach converges with the definition of the abductive reasoning of knowledge production (Haig, 2005).

Methodological strategy

The analysis was developed with data from the databases of a Brazilian Federal University in the state of Paraíba. At the time of the research, the university had about 100 undergraduate programs, with different dropout and retention rates. For instance, according to calculations provided by the undergraduate dean of the university, the medical program had 6% of dropouts, and the statistics and physics programs had dropouts above 80%. In the business school, programs such as management and accounting have dropouts between 40% and 50%, which is very close to the overall university standard.

We understand that the exploitation of the specific data of a single university carries the risks of biases and difficulties of generalizations, but we understand that the study brings a new contribution to this discussion (considering the methodological approach used here) and other studies that may explore other universities following our methodology and increasing the knowledge on the subject.

On the other hand, our understanding is that although the data are from a single institution, the results may reflect aspects of dropouts and retention that are very similar to the other Brazilian public institutions of higher education, as can be seen in Tables 1 and 2, based on the 2015 Brazilian census of higher education (the last census available at the time this article was written). Table 1 presents data on the number of enrollments, senior-year students, incoming students, and dropouts in seven traditional programs, including management, in Brazilian public and private institutions. It should be noted that there is no national standardization of academic records that can facilitate the development of standard statistical reports to address the issue. The Brazilian higher education census evidences this difficulty through an example in Table 1, where the civil engineering program, in the state of Paraíba, does not have records on the number of students in private institutions in 2015.

Dropout rates in public higher education institutions in the state of Paraíba are very close to the national average, except in economics. If we analyze dropout numbers only for management programs in public institutions in the Brazilian states with the highest number of enrollments in management, the institutions in Paraíba also present dropout rates close to the national context, except for the state of Pará, which has dropout numbers above the national average, as shown in Table 2.

For the purposes of this research, it is important to note that the university under study uses a calculation method for temporal monitoring so that dropouts are calculated by considering the total number of enrollments and the total number of leavers that have elapsed after enough time, to verify the dropout phenomenon.

The data were extracted specifically for the Bachelor's degree in Management, from the academic unit of Applied Social Sciences of the University. From a temporal point of view, the data were taken from the first half of 2004 to the second half of 2013, which comprised 10 years of coverage.

Table 1
National data on Brazilian higher education in 2015.

Programs	Enrollments			Graduate			Total Admissions			% Dropout		
	Total	Pública	Privada	Total	Pública	Privada	Total	Pública	Privada	Total	Pública	Privada
General Data Brazil	8,027,297	1,952,145	6,075,152	1,150,067	239,896	910,171	2,920,222	534,361	2,385,861	39.20	24.88	43.80
Management – National	1,305,571	148,341	1,157,230	258,456	20,425	238,031	547,559	44,434	503,125	53.07	28.30	56.25
Management – Paraíba State	16,591	5180	11,411	2349	595	1754	6851	1751	5100	37.59	21.54	44.87
Computer Science – National	107,240	42,420	64,820	13,481	3958	9523	40,520	12,206	28,314	51.24	32.83	63.30
Ciência da computação – Paraíba State	3413	2568	845	204	137	67	1007	659	348	39.03	37.34	44.14
Law – National	853,211	88,155	765,056	105,324	12,743	92,581	258,143	19,507	238,636	29.98	12.77	31.96
Law – Paraíba State	18,812	4141	14,671	1824	643	1181	5169	937	4232	20.56	13.79	22.47
Business Economics – National	50,422	32,380	18,042	6230	3626	2604	15,859	8283	7576	33.69	26.39	46.78
Business Economics – Paraíba State	742	725	17	59	51	8	283	273	10	53.23	53.79	29.41
Civil Engeneering – National	355,998	48,973	307,025	25,298	4711	20,587	125,179	11,862	113,317	32.52	13.63	35.54
Civil Engeneering – Paraíba State	5595	1616	3979	135	135	–	2200	493	1707	22.14	16.96	24.25
Languages – National	174,928	106,615	68,313	25,791	13,363	12,428	57,472	27,349	30,123	42.94	29.64	63.69
Languages – Paraíba State	7172	6996	176	516	506	10	2078	1949	129	31.32	30.07	80.68
Medicine – National	127,632	48,540	79,092	17,123	6447	10,676	27,294	10,195	17,099	4.91	4.42	5.21
Medicine – Paraíba State	4730	1365	3365	637	254	383	1075	279	796	7.12	10.92	5.59

Source: Elaborated by the authors based on the census of Brazilian higher education (INEP, 2015).

Table 2
National data on Brazilian Management programs in 2015.

Management	Enrollments			Graduate			Total Admissions			% Dropout		
	Total	Public	Private	Total	Public	Private	Total	Public	Private	Total	Public	Private
National	1,305,571	148,341	1,157,230	258,456	20,425	238,031	547,559	44,434	503,125	53.07	28.30	56.25
Paraíba State	16,591	5180	11,411	2349	595	1754	6851	1751	5100	37.59	21.54	44.87
Pará State	31,245	1483	29,762	5382	115	5267	15,679	382	15,297	60.77	53.74	61.12
Goiás State	35,303	3795	31,508	7817	721	7096	14,114	1166	12,948	52.81	30.12	55.54
São Paulo State	378,027	32,174	345,853	84,175	5230	78,945	159,014	14,194	144,820	56.78	35.41	58.77
Rio Grande do Sul State	96,971	7345	89,626	18,133	850	17,283	37,174	2183	34,991	63.58	24.02	66.83

Source: Elaborated by the authors based on the census of Brazilian higher education (INEP, 2015).

Since the purpose of the study was to ascertain the regularity of dropouts and retentions, and considering that the expected time of graduation of students is between 4 and 5 years (in the university under analysis, the course had two day-time curricula, one with eight and another with nine semesters, as well as a 10-semester evening curriculum), only students who had been admitted to the first semester of 2009 were accepted, as newcomers in this period would have five years to complete the course by the end of 2013. Using this time-frame, we analyzed 1202 students.

In the selection of the potential antecedents of dropout and retention processes, three aspects were taken into account: (1) the pertinence of some predictors, considering the signs of literature; (2) the availability of the data, or the cost of access, if they were not accessible; and (3) the possibility of exploring conditions that were not indicated in the literature, but that, since they were available in the dataset, could be explored in the analysis.

Taking into account the aforementioned aspects, the following information was obtained from each student, which was useful both for the description of the sample and for the modeling implemented (later detailed): year of admission; year of exit (when the student had already checked out of the institution); exit by graduation or dropout (all cases involving abandonment, transfer, and cancelation); curriculum (8, 9 or 10 semesters); gender; marital status at time of admission; age at entry (estimated from date of birth); school of basic education (whether 'public only' or not); race (in the analysis, classified only as 'white' or not); student's academic performance coefficient (an average of the grades in all subjects, weighted by the hours of the subjects); information about failed courses (we take the binary response of 'failed course' or not); and information about dropping a course (we take the binary 'dropped a course' or not).

Other potentially relevant variables (such as student satisfaction, level of socialization, family tradition in the chosen profession, etc.) had their inclusion considered, but they would not be able to be accessed because no data were available. Thus, the set of investigated variables was restricted to potential predictors associated with individual characteristics and student performance in the program.

In addition to the descriptive techniques, we adopted the survival analysis technique to analyze the data. This technique has wide applications in the evaluation of events that occur over time (for instance, in disease prediction, problems in the mechanical parts, the bankruptcy of small companies, besides the dropout rate and graduation of students in undergraduate programs). In Brazil, this technique is most commonly used in the health and engineering fields and is denoted as the "survival analysis" and "reliability analysis," respectively.

In the Social Sciences, the term used for this technique is "event history analysis" (Box-Steffensmeier & Jones, 2004; Mills, 2011). Specifically focusing on the dropout and retention analyses, the survival analysis technique has already been used in similar international studies, for example, by DesJardins et al. (2002) at the University of Minnesota, and Arias Ortiz and Dehon (2013) at the Free University of Brussels. There have been no similar studies in the Brazilian context, to the one we performed.

Concerning the survival analysis, we used the Kaplan–Meier non-parametric estimation and Cox semi-parametric modeling. The first (Kaplan–Meier) estimates the level of survival (in our case, the non-occurrence of retention and dropouts), with evaluation being mainly through graphical analysis or bivariate comparison with categorical variables.

The Cox model estimates the risk of occurrence of an event from the regularity of its occurrence in time and is conditional on the variations in predictor variables. This model assumes that a set of independent variables predicts a dependent variable from its linear combination with a set of parameters that signal the direction and intensity of influence if this influence exists (Carvalho et al., 2011). The central assumption is that the risks, conditional on each independent variable, are proportional over time (for this reason, the technique is also indicated by 'proportional hazard modeling').

The technique allows modeling the risk of an event from its occurrence history. This makes the technique richer compared to alternative modeling using classical binary logistic regression (which would be based only on the verification, not of the event of interest, in our case, the retention or dropouts). Additionally, by estimating the influence of a given variable on the risk of occurrence of an event over time, we have therefore the prediction of the influence of the same (independent) variable on the time of occurrence of the event, considering that a greater (lower) risk in time implies a shorter (greater) expected time until the occurrence of the event.

For this reason, we can use the Cox regression to neatly analyze the antecedents over time for the 'retention' event, as well as about the risk of occurrence of the 'dropout' event. Further details of the technique and its use are presented in the

next section as additional information to the results. All the procedures were performed based on the specialized literature (Box-Steffensmeier & Jones, 2004; Colosimo & Giolo, 2006; Mills, 2011), using the statistical packages R and SPSS.

Results

The program under analysis was created in 1963 and is linked to an academic unit in which there are other undergraduate and graduate programs in applied social sciences (Archival Studies, Librarianship, Actuarial Sciences, Accounting Sciences, Economics, Public Management, and International Relations). In the evaluation of the general index of programs of the INEP (National Institute of Studies and Educational Research Anísio Teixeira) of 2013 (the IGC-INEP), the program under analysis was evaluated with grade 4 (out of 5). According to institutional data, between 2004 and 2013, a total of 2425 students were enrolled, of which 518 (21.4%) graduated, 792 (32.6%) dropped out, and 1115 (46%) were still studying by the end of 2013.

The descriptive data showed the following characterization: 40.7% of the students graduated, and 41.1% had dropped out (the remaining 17.8% were in progress); 91.6% were single people; 62.3% were male; 20.6% had basic education only in public schools; and 46.6% declared themselves as white. We also had an indication that 77.8% of the students had failed at least once in a course and that 55.7% dropped a course. The average age of admission was 21.2 years (the median was 19.5 years). Although these data are peculiar to the institution of origin, these are close to the reality in the programs of Management of Brazilian public institutions.

Bivariate evaluation

In the analysis of graduation time constraints and dropout risk, the survival curves and accumulated risk by the Kaplan–Meier non-parametric estimator were used as an extraction procedure. We focused our analysis on the evaluation of the graphs and the comparison test of the curves generated in each category, so we used the log-rank test whose null hypothesis is that there is no difference between the estimated curves.

We present the results for four categorical variables in which we verified statistical differences in the time and risk curves that were associated with the variables 'curriculum,' 'gender,' 'existence of failed course,' and 'drop a course.' In the categorical variables 'marital status,' 'age at admission,' 'school of basic education,' and 'race,' there was no difference between groups, and therefore, we chose not to present the results here.

Regarding the curriculum, the test carried out showed that there was an effective difference in the regularity of graduation time (chi-square = 43.70, 2 df (degrees of freedom), $p < 0.001$) and the risk of dropout (chi-square = 10.76, 2 df, $p < 0.01$). It is worth remembering that the program under analysis had three curricula in progress at the time of the analysis (8, 9 and 10 semesters). Graph 1A shows that the proportion of students graduating is higher for the curriculum with 8 semesters (which has 51.2% of the students), followed by the curriculum with 10

semesters (33% of the students), and the higher student retention is in the curriculum with 9 semesters (in which 15.7% of students were enrolled).

Regarding the risk of dropouts, Graph 1B shows that, over time, the curriculum with 9 semesters is configured as the one responsible for diminishing the risk of dropouts. The others have close risks up to a certain point in time. However, the curriculum with 8 semesters is associated with an increased risk of dropouts over time. Overall, the signaling is that students in a curriculum with 8 semesters have a shorter graduation time, but also have a higher risk of dropping out.

Regarding the gender of respondents, the log-rank test showed that there is an effective difference in the regularity of graduation time (chi-square = 22.84, 1 df, $p < 0.001$) and in the risk of dropping out (chi-square = 6.98, 1 df, $p < 0.001$). As Graph 2A illustrates, males are retained in larger volumes over time; that is, males take longer to graduate than females. Similarly, Graph 2B shows that the risk of men's dropout is consistently greater than the risk of women's dropout. These results are evidence that women take less time to graduate and have a lower risk of dropping out compared to men.

With respect to the variable 'drop a course', the test showed a statistically significant difference in the graduation times (chi-square = 457.96, 1 df, $p < 0.001$), as well as the risk of dropping out (chi-square = 6.81, 1 df, $p < 0.01$). The student who does not register failure fulfills the almost ideal survival curve model, that is, the end of the program between 4 and 5 years; students with a record of failing are more retained in the course over time. In relation to the risk of dropping out, the behavior per group fluctuates (Graph 3B) so that until approximately half of the course, the cumulative risk of dropping out is greater for those who do not have a record of failed course. From that point on, the unsuccessful student has a systematically greater risk of dropping out the course than the student who does not fail. We have evidence that failure in the curriculum implies more time of graduation and a greater risk of dropping out.

Finally, in the variable 'drop a course,' a statistical difference was found per period to graduate (chi-square = 92.28, 1 df, $p < 0.001$), as well as the risk of dropping out (chi-square = 110.11, 1 df, $p < 0.001$). The result of Graph 4A shows, as expected, that dropping a course generates retention of the student in the program; thus, taking longer for graduation. Concerning the risk of dropout, the evidence is that, over time, the risk of dropping out is systematically lower for students who have dropped a course. We have evidence that 'drop a course' implies a longer graduation time, but also, a lower risk of dropping out of the program.

These initial checks attest to the influence of these variables in the time spent to graduate and the risk of dropping out, but it is possible that this influence is altered in the conjoint analysis with other variables.

Cox modeling

The Cox regression generates an estimate of the influence of a covariate on the risk of occurrence of the event, based on its achievement history. The Cox modeling procedure consisted

A Graduation time

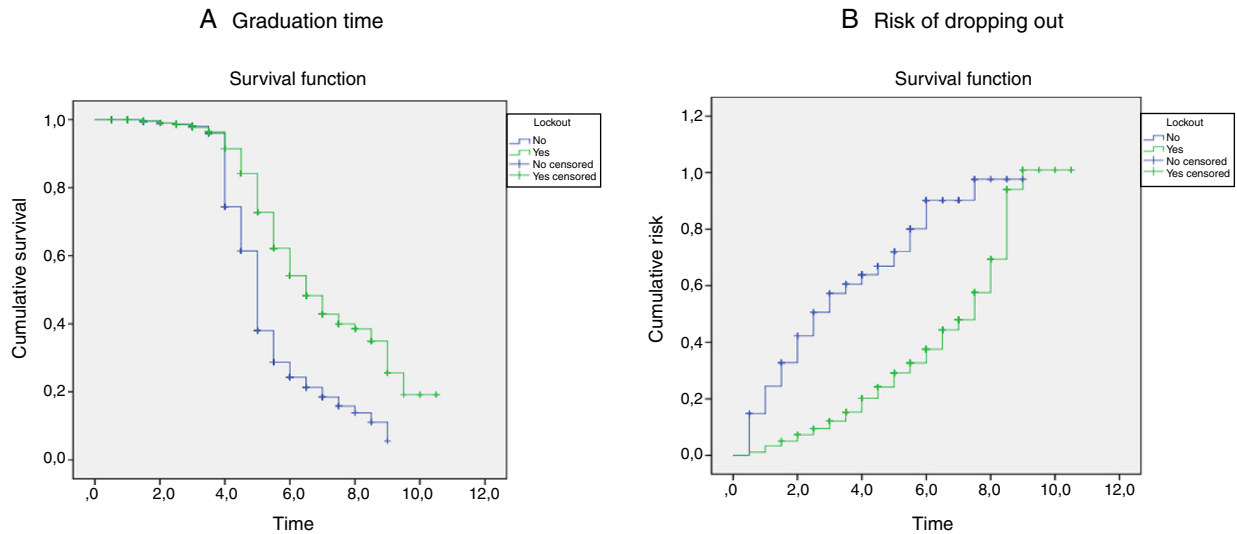B Risk of dropping out
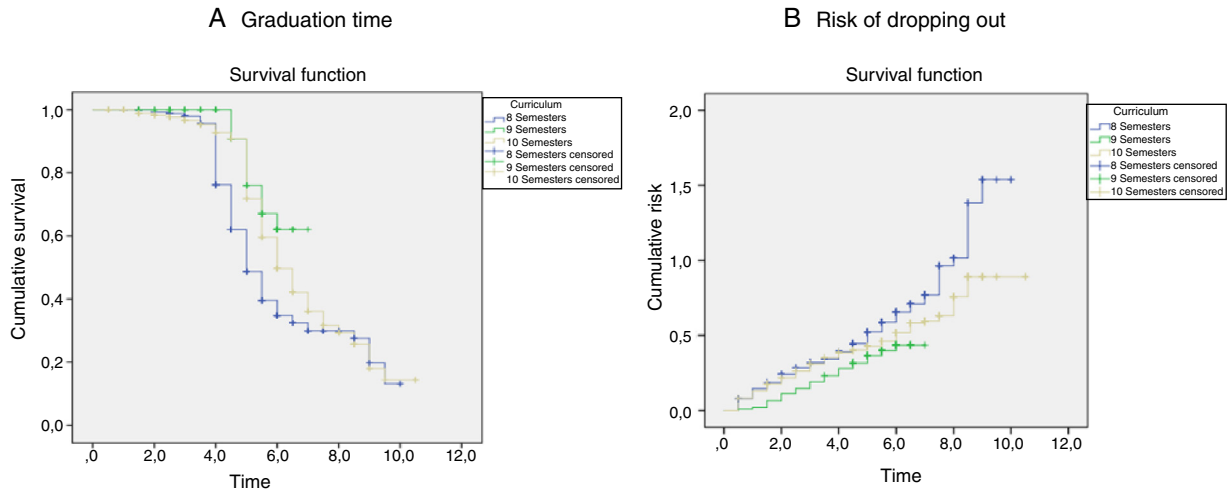
Graph 1. Assessment according to curriculum.

A Graduation time

B Risk of dropping out
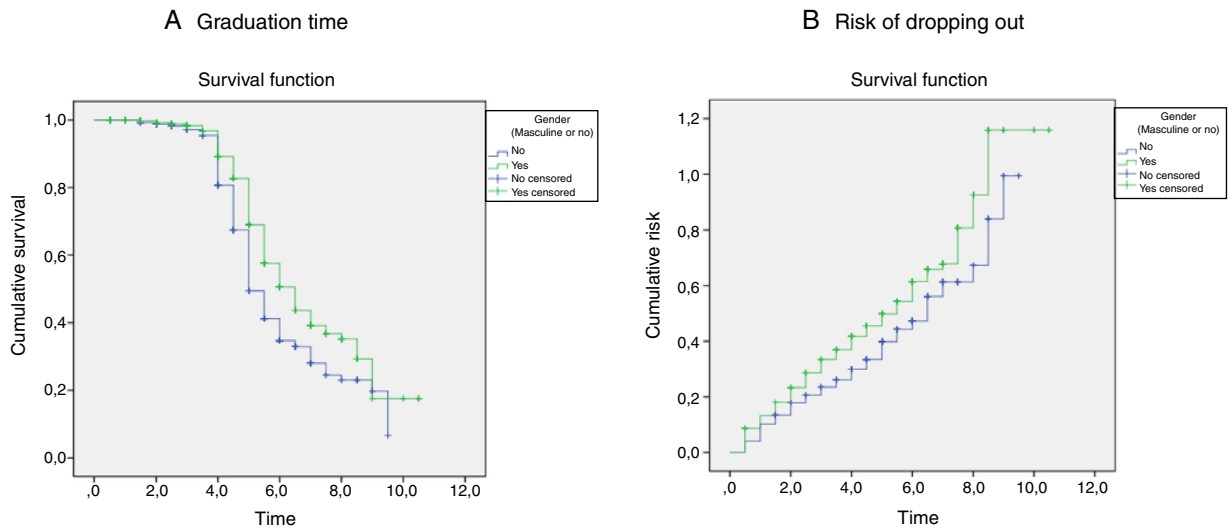
Graph 2. Assessment according to gender.

A Graduation time

B Risk of dropping out
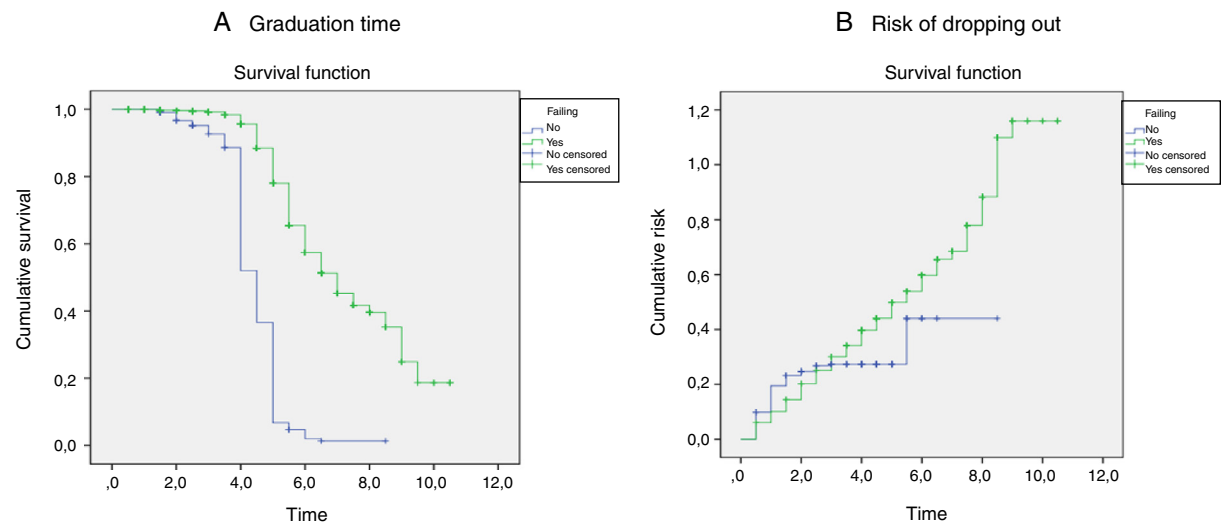
Graph 3. Assessment according to failed course.

Graph 4. Assessment according to drop a course.

of selecting the variable 'time' (of graduation or dropping out) as a dependent variable and the set of predictors as independent variables. In each case, we initially construct the model and then verify the assumptions. As reported, Cox modeling assumes conditional risks to the predictor variables that are proportional over time. This verification was performed in the statistical package R which has better diagnostic routines.

As an interpretation reference, we have that, for estimated parameters as statistically null, there is no evidence of covariate influence on the risk of dropping out or on the time of graduation; otherwise (that is, if we reject the hypothesis that the parameter is null), we have evidence of influence, which may be to raise the risk of the event (for the positive sign) or to reduce the risk (with negative sign). Thus, if an event has a greater risk of conditional occurrence to a covariate, then the event occurrence time will be more accelerated, conditional to that same variable. Thus, for the purposes of graduation analysis, the assumption was that increasing (or reducing) risk implies a reduction (or augmentation) in graduation time. For extraction of results, all the defined predictors were inserted in the modeling, with a decision of exclusion only for cases in which there was failure of assumptions of the model. Details of the variables are given in Table 3.

As a result of the first analysis, we obtained in the modeling of the graduation time a problem in the proportionality of the risks in at least 5 variables, one of which, the academic performance coefficient (APC), had the highest level of influence in the response variable. We understand that the checking of the assumptions is statistically relevant, but the non-adherence of modeling to what is assumed does not invalidate at all the 'signaling' of influence of an independent variable in the dependent one. Considering that the modeling is in addition to the Kaplan–Meier non-parametric estimation, we chose to present the results of this first analysis by considering them as 'evidence of verified relationships.'

From the above understanding, the evidence is that the curriculum, taken in the categories with nine and 10 semesters,

compared to the curriculum with eight semesters is a condition of the increase in the time of graduation, which converges with the result of item 4.1. Similarly, the variables 'failed course' and 'drop a course' reaffirmed their influences to be also in line with previous results. The influence of gender (previously verified) dissipated in the operationalization of the variable, along with the other variables. The variables 'marital status,' 'age at admission,' 'school of basic education,' and 'race' proved to have no influence on the time spent to graduate. Although the analysis needs to be done with caution, due to the above-mentioned assumption problem, it is evident that the level of impact that the academic performance coefficient (APC) has on the time spent to graduate is the variable with the highest parameter of influence estimated and with the clear indication that higher levels of APC's lead to lower graduation time.

In the analysis of prediction of the risk of dropouts, we had a better adjustment of the model, and a problem in the proportionality assumption of the risk was found only in the 'failed course' variable that was generating statistically null results. In view of this problem, and the lack of effect, due to its absence, we chose to exclude the problematic variable in this evaluation, which gave us more consistent results. Since our interest was to verify the risk of the occurrence of dropouts, the analysis is direct, that is, we evaluate the estimated parameters and their signals, besides the statistical nullity test in what is estimated (the risk).

As shown in Table 5, the risk of dropouts is significantly reduced in the curricula of the 9 and 10 semesters (compared to the curriculum of 8 semesters), as well as the fact that the students had dropped a course. These results converge with what was observed in the Kaplan–Meier estimation. As verified in the time to graduate, the influence that was verified associated with the gender was dissipated in the joint operation with the other variables. Here again, the strong impact of the academic performance coefficient has been noted, with the evidence that high APC is associated with a lower risk of dropouts. The other variables did not reach evidence of influence.

Discussion of results

The results shown in Tables 3–5 indicate to the set of antecedents of dropout and retention. Table 6 presents the results of the two evaluations.

We can observe concerning the number of semesters that curricula with nine and 10 semesters, as compared to eight semesters increase the time for graduation, but on the other hand, reduce the probability of the student dropping out of the program. This result reveals that although the student has a cost of spending more time to complete the program, they tend to stay in the program. This may indicate that an ideal program time is not the shortest due to pressures and a greater load of contents, which can cause the overloaded student to give up. Thus, a program whose flow allows a longer time to complete the courses and the possibility of dropping a course, as we will see below, can cause fewer dropouts than a shorter program. In the bivariate analysis, this had already been evidenced, with the curriculum with nine semesters showing the lowest risk of dropouts. This finding is relevant and has not been considered in studies carried out in business schools (e.g., Belloc et al., 2010, Mangum et al., 2005). In addition, the number of semesters of the program may also be relevant to analyze dropouts and retention in other fields.

Regarding gender, the results indicate that women are more likely to be enrolled and less likely to drop out of a program. Severiens and Dam (2012) argue that in OECD countries women enroll more than men in higher education and are also more successful. This has also been revealed in the empirical research conducted by the authors in the Netherlands (Severiens & Dam, 2012) and in the research conducted by Yue and Xuanning (2017) in the United States. Barrow, Reilly, and Woodfield (2009) also reported that, on average and in the same conditions, women are better academically than their male peers.

The performance gap between the genders can be due to individual characteristics such as discipline, motivation, time management skills, goals, or contextual features such as family responsibilities, labor market structure, and economic situation (Severiens & Dam, 2012). However, it should be noted that the study by Belloc et al. (2010) found that men presented a lower risk of dropping out. In the research carried out by Lassibille and Gómez (2008), gender was a variable that did not have a significant influence on students' qualifications, which partially converges with our study (by the regression result).

The influence of the academic performance coefficient on program time indicates that dedicated and better-off students are more likely to graduate in less time than others. CRP also had an influence on students' risk of dropping out, such that poor performance in CRP positively influences the likelihood that students would leave the program. A similar finding was found in Yue and Xuanning (2017), where the cumulative income index was the strongest predictor of graduation and time spent to graduate. In the United States, Mangum et al. (2005) identified that the academic performance coefficient, the GPA (grade

Table 3
Details of the model variables.

Variable	Nature	Comment
Curriculum with 9 semesters (in relation to '8 semesters')	Dummy	0 indicates '8 semesters', and 1 indicates '9 semesters'
Curriculum with 10 semesters (in relation to '8 semesters')	Dummy	0 indicates '8 semesters', and 1 indicates '10 semesters'
Marital status ('single' basis)	Dummy	0 indicates 'married' and 1 indicates 'single'
Gender ('male' basis)	Dummy	0 indicates 'female' and 1 indicates 'male'
Age at admission (estimated)	Quantitative	Estimated values from the date of birth and the semester of admission
School of basic education ('public' basis)	Dummy	0 indicates 'not public' and 1 indicates 'public'
Race ('white' base)	Dummy	0 indicates 'non-white ethnicity' and 1 indicates 'white'
Academic performance coefficient (APC)	Quantitative	Values indicated in the database
Failed course (basis 'at least one failure')	Dummy	0 indicates 'no failure' and 1 'at least one failure;
Drop a course (basis 'at least one drop a course')	Dummy	0 indicates 'no drop a course' and 1 'at least one drop a course'

Table 4
Results of influence factors on the time spent to graduate.

Variable	Average	B	SD	Wald	Sig.	Exp (B)	Exp (−B)
Curriculum with 9 semesters (in relation to '8 semesters')	0.17	−0.52	0.16	10.16	0.001	0.592	1.689
Curriculum with 10 semesters (in relation to '8 semesters')	0.33	−0.37	0.11	12.50	0.000	0.688	1.454
Marital status ('single' basis)	0.91	0.29	0.20	2.14	0.144	1.340	0.746
Gender ('male' basis)	0.61	0.05	0.10	0.25	0.617	1.049	0.954
Age at admission (estimated)	21.25	0.01	0.01	0.16	0.689	1.005	0.995
School of basic education ('public' basis)	0.21	−0.19	0.12	2.43	0.119	0.831	1.203
Race ('white' base)	0.46	0.00	0.09	0.00	0.994	0.999	1.001
Academic performance coefficient (APC)	6.33	0.84	0.06	18.580	0.000	2.313	0.432
Failed course (basis 'at least one failure')	0.80	−0.28	0.13	4.78	0.029	0.754	1.327
Drop a course (basis 'at least one drop a course')	0.61	−0.30	0.10	9.22	0.002	0.741	1.349

Note: In the first row, B indicates the estimated parameter, SD is the standard deviation of the estimate, Wald is the Wald statistic associated to the estimated parameter, Sig is the statistical significance for evaluating the null hypothesis that the population parameter is null, Exp (B) Is the exponential of the estimated parameter, and Exp (−B) is the exponential of the inverse of the estimated parameter.

Table 5
Results of influence factors on the risk of dropouts.

Variable	Average	B	SD	Wald	Sig.	Exp (B)	Exp (−B)
Curriculum of 9 semesters (in relation to '8 semesters')	0.16	−0.74	0.14	26.24	0.000	0.48	2.10
Curriculum of 10 semesters (in relation to '8 semesters')	0.33	−0.29	0.11	7.18	0.007	0.75	1.33
Marital status ('single' basis)	0.92	0.30	0.20	2.26	0.133	1.34	0.74
Gender ('male' basis)	0.62	−0.05	0.10	0.26	0.610	0.95	1.05
Age at admission (estimated)	21.18	0.01	0.01	0.91	0.339	1.01	0.99
School of basic education ('public' basis)	0.21	−0.19	0.12	2.50	0.114	0.82	1.21
Race ('white' base)	0.47	−0.06	0.09	0.42	0.517	0.94	1.06
Academic performance coefficient (APC)	5.91	−0.37	0.02	43.439	0.000	0.69	1.45
Drop a course (basis 'at least one drop a course')	0.56	−0.74	0.10	55.33	0.000	0.48	2.10

Note: In the first row, B indicates the estimated parameter, SD is the standard deviation of the estimate, Wald is the Wald statistic associated to the estimated parameter, Sig is the statistical significance for evaluating the null hypothesis that the population parameter is null, Exp (B) Is the exponential of the estimated parameter, and Exp (−B) is the exponential of the inverse of the estimated parameter.

Table 6
Evaluation results.

Variable	Time spent to graduate	Risk of dropouts
Curriculum of 9 semesters (in relation to '8 semesters')	INCREASES time	REDUCES the risk
Curriculum of 10 semesters (in relation to '8 semesters')	INCREASES time	REDUCES the risk
Marital status ('single' basis)	–	–
Gender ('male' basis)	**INCREASES time**	**INCREASES the risk**
Age at admission (estimated)	–	–
School of basic education ('public' basis)	–	–
Race ('white' base)	–	–
Academic performance coefficient (APC)	REDUCES time	REDUCES the risk
Drop a course (basis 'at least one drop a course')	INCREASES time	**INCREASES the risk**
Curriculum of 9 semesters (in relation to '8 semesters')	INCREASES time	REDUCES the risk

Note: Notes in bold indicate that the variable had influence on one of the two analyzes (Kaplan–Meier and Cox regression).

point average), of the first semester was a strong predictor of possible future dropout in a business school in the United States.

These results suggest that poor student performance may be the cause and effect of this situation. That is, the unmotivated student fails or gets low grades and, given the negative performance, feels more unmotivated and is more likely to drop out of the program. Therefore, pedagogical policies of approaching students and reversing eventual negative performances can avoid dropouts. For instance, during the Management program, there are many courses that are not core to the field, especially in the initial semesters. Sometimes, these courses have a mathematical nature, which sometimes negatively influences students' performance. Such courses should be a constant focus of motivational actions so that the students obtain positive results and continue in the program, being able to evaluate the best positioning of these courses throughout the program.

Higher education institutions cannot effectively manage individual or pre-program characteristics, but they can help students improve their decision making and academic performance in the program (Yue and Xuanning, 2017). Therefore, corrective actions must also be taken to avoid failed course (whose effects are the same as discussed in the previous paragraph) and requests for dropping a course. The results pointed to an increase in program time when students cancel courses. Conversely, it is interesting to note that requests for dropping a course can reduce the risk of program dropouts.

We may think that such influence is because the requests for dropping a course can persuade the students not to get discouraged and better plan the next steps in the program, making them sometimes more responsible and committed. So, it may also lead us to believe that dropping a course may only be a postponement of a future dropout. Therefore, we emphasize that the student should be better advised to plan their time in the course, establishing deadlines and scheduling dropping a course when necessary. This planning should be supported by the coordination of the program through regular projects and actions of support, along with guidance to the students.

Final remarks

In this article, we explore some antecedents of higher education dropouts, retention, and graduation. Studying these phenomena has implications from strategic and operational perspectives. From the strategic perspective, there is the relevance of public policies for access to higher education, as well as the development of actions by the universities to attract and to maintain students in the undergraduate programs. From an operational perspective, there are claims from Department heads, so that teachers review their teaching and assessment strategies.

The results of previous studies, in contexts other than the Brazilian context, are similar to those obtained in this study, despite a few differences in certain variables. This situation shows that it is possible for dropouts and retention to have similar

characteristics, even in different cultural and social contexts. Our study is innovative in that it is the construction of evidence of the most consistent relationships, given the methodological path followed, and, more importantly, it identifies that the number of semesters of a program has a relevant influence in this process. However, we noted that the "gender" variable has different results to the previously-mentioned studies. We found that there are peculiarities for this variable, in the process of graduating and dropping out, that can be better understood from qualitative studies, in order to give adequate depth to the theme. Such a situation indicates that there is a need for further study on this subject.

In this study, the main reflections concern the potential impact that the results can have on public policies for public higher education. These results might influence the action of social inclusion, for instance, through quotas and fellowships, and that they may also influence the university management, from an economic-financial and pedagogical perspective. We understand that thinking about university management within the scope of programs is not only about controlling and rationalizing expenses, but also, developing pedagogical projects that are aligned with the expected results. With the results presented, it is possible to have an initial comprehension of the cost per student, on the cost of dropouts and retention, and on the strategic pedagogical actions that can bring effectiveness in the education of people in higher education.

As a suggestion, we defend the creation of actions to raise awareness of the financial and social losses that the dropouts and the delay in the time of graduation cause to the state, and consequently to society. This awareness should be directed to the entire academic community, especially students, showing the individual values spent by each of them per month so that it is not only possible to measure values in the transparency of resource management, but also, to collaborate in understanding the values invested by the state in higher education.

From a pedagogical point of view, we highlight the possibility of including leveling actions in the curricular matrix of the program, as early as its first period, computed as a mandatory workload with the objective of aligning the leveling, which today, is generic and optional to the real needs of education of the future graduated students. This seems to have a positive effect on improving students' performance in quantitative content subjects. Such a measure, in our view, contributes to a decrease in dropouts motivated by failed courses, as well as contributing to the reduction of the student's graduation time, considering that, when well prepared, the student takes less time to graduate.

One of the points that support this suggestion is the fact that, in the researched program, the average time of graduation is greater than that desired and predicted in the pedagogical project of the program. Therefore, if the student is already expected to spend more time in the university, possibly incorporating the leveling would naturally increase the program time. In addition, this time may be lower than the one already presented by the performance improvement that leveling can bring, since, in the results, it was evident that the higher the student's academic performance coefficient, the lower the risk of dropout and the time spent of graduation.

Finally, we suggest the action of department heads in the clarification of the curricular matrix of the student, the possibilities and the regulatory limits of failed courses and requesting the dropping of a course, and helping the students with the planning of the entire program in the initial semesters. We understand that the student who plans his/her program in the time frame established in the pedagogical project of the program tends to be more successful at graduation. In addition, lectures and events that increase the student's involvement with the program can contribute positively for graduation.

As a limitation, we can point out that this study presented was restricted to one program. Although the results seem to converge with what is observed, according to the authors' experience in other institutions with similar characteristics, we understand that the analyzed phenomena can be better understood with similar studies in other graduate and undergraduate programs (such as Accounting or Economics) and other institutions (such as private universities).

Conflicts of interest

The authors declare no conflicts of interest.

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