



Educação em Revista

ISSN: 0102-4698

ISSN: 1982-6621

Faculdade de Educação da Universidade Federal de Minas Gerais

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ABANDONO DOCENTE NA REDE MUNICIPAL DE EDUCAÇÃO DO RIO DE JANEIRO1
Educação em Revista, vol. 37, e20527, 2021
Faculdade de Educação da Universidade Federal de Minas Gerais

DOI: <https://doi.org/10.1590/0102-469820527>

Available in: <https://www.redalyc.org/articulo.oa?id=399369188064>

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ARTICLE

TEACHER ATTRITION IN THE MUNICIPAL EDUCATION SYSTEM OF RIO DE JANEIRO¹KARINA CARRASQUEIRA²[HTTP://ORCID.ORG/0000-0002-6699-7814](http://ORCID.ORG/0000-0002-6699-7814)

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ABSTRACT: Teacher retention is a challenge faced by several education systems worldwide, and has impacts for school systems, schools, and students. This article aimed to investigate the factors associated with teacher attrition in the municipal system of Rio de Janeiro. It used databases from the Municipal Secretariat of Rio de Janeiro (SME-RJ) and the National Institute of Educational Studies and Research Anísio Teixeira (INEP) that allowed to follow, between 2012 and 2016, the trajectory of 3594 teachers who took office between 2009 and 2011. The analyses used logistic regression models to estimate the probability of the teacher leaving the system. The results indicate that younger and more highly educated teachers are more likely to leave the system. In addition, the profile of the student body, the experience of changing schools, and the pressures of a school accountability policy, which was in force during the period when the research was carried out, were also factors associated with the probability of the teacher leaving the system.

Keywords: teacher attrition, teacher trajectory, teacher career, basic education, logistic regression.

ABANDONO DOCENTE NA REDE MUNICIPAL DE EDUCAÇÃO DO RIO DE JANEIRO

RESUMO: A retenção de professores é um desafio enfrentado por diversas redes educacionais no mundo inteiro, e tem impactos para os sistemas escolares, para escolas e para os alunos. Este artigo teve por objetivo investigar os fatores associados ao abandono docente na rede municipal do Rio de Janeiro. Utilizou bases de dados provenientes da Secretaria Municipal do Rio de Janeiro (SME-RJ) e do Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (INEP) que permitiram acompanhar, entre 2012 e 2016, a trajetória de 3594 professores que tomaram posse entre 2009 e 2011. As análises utilizaram modelos de regressões logísticas para estimar a probabilidade de o professor abandonar a rede. Os resultados indicam que professores mais jovens e com maior nível de escolaridade apresentam maior probabilidade de abandonar a rede. Além disso, o perfil do alunado, a experiência de mudar de escola e as pressões de uma política de responsabilização escolar, que vigorava no período em que a pesquisa foi realizada, também se mostraram fatores associados à probabilidade do docente abandonar a rede.

¹ This work was carried out with the support of the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (Coordination for the Improvement of Higher Education Personnel) - Brazil (CAPES) - Funding Code 001.

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Palavras-chave: abandono docente, trajetória docente, carreira docente, educação básica, regressão logística.

ABANDONO DE DOCENTES EN LA RED MUNICIPAL DE EDUCACIÓN DE RIO DE JANEIRO

RESÚMEN: La retención de docentes es un desafío que enfrentan varias redes educativas en todo el mundo y tiene un impacto en los sistemas escolares, las escuelas y los estudiantes. Este artículo tuvo como objetivo investigar los factores asociados con el abandono de docentes en la red municipal de Río de Janeiro. Utilizó bases de datos de la Secretaría Municipal de Río de Janeiro (SME-RJ) y del Instituto Nacional de Estudios e Investigaciones Educativas "Anísio Teixeira" (INEP/MEC) que permitieron monitorar, entre 2012 y 2016, la trayectoria de 3594 docentes que iniciaron su carrera en el sistema público entre 2009 y 2011. Los análisis utilizaron modelos de regresión logística para estimar la probabilidad de que el profesor abandone la red. Los resultados indican que los maestros más jóvenes y más educados tienen más probabilidades de abandonar la carrera. Además, el perfil del alumno, la experiencia de cambiar de escuela y las presiones de una política de responsabilidad escolar, que estuvo en vigencia durante el período en que se llevó a cabo la investigación, también mostraron factores asociados con la probabilidad de que el maestro abandone la red.

Palabras clave: abandono de docentes, trayectoria docente, carrera docente, educación básica, regresión logística

INTRODUCTION

Research in the US indicates that about a quarter of new teachers leave the education system within 5 years of joining (BOYD et al., 2008; RONFELDT et al., 2011). Since education systems make investments to attract teachers and offer them professional development, a problem arises when the departure of newly hired teachers generates high rates of teacher turnover in schools. This is because, as Allensworth, Ponisciak, and Mazzeo (2009) argue, high teacher turnover jeopardizes the continuity of the school's pedagogical work, and several studies indicate that the stability of the teaching staff is a characteristic of effective schools.

Studies have found that for schools attended by children of lower Socioeconomic Status (SES) and lower performance on standardized assessments, teacher turnover rates tend to be higher (HANUSHEK et al., 2005; BOYD et al., 2008). If schools that serve a specific audience have higher teacher turnover than others, this variation can create inequalities among schools in a given education system (CLOTFELTER, LADD, & VIDGOR, 2010; MANSFELD, 2012). Thus, teacher dropout itself is not bad, but it becomes very harmful if those teachers are the most effective and are concentrated in schools with specific characteristics (BOYD et al., 2008).

Identifying a school network's ability/difficulty in retaining its teachers, the profile of the teachers who drop out most frequently, and the schools that lose the most teachers become important to inform strategies to increase teacher stability, avoid the loss of the most effective teachers, and ensure that schools with a higher concentration of vulnerable students do not suffer more frequently from teacher shortages.

In Brazil, there are few studies that have investigated the phenomenon of teacher dropout, most of them being qualitative (LAPO; BUENO, 2002, 2003; LEMOS, 2009; REBOLO, 2012; SOUTO, 2013; PAZ, 2013; XAVIER; BARBOSA, 2015; PEREIRA; OLIVEIRA, 2016, 2018; CARDOSO, 2018; CARLOTTO, CAMARA; OLIVEIRA, 2019). Still, studies conducted in the Brazilian context point to teacher turnover as a factor for the maintenance of educational inequalities between schools with students of different socioeconomic profiles (TORRES et al., 2008; KASMIRSKI, 2012; ALVES et al., 2013). In addition, schools that serve the most vulnerable population, in general, suffer more from losses and teachers' shortage.

This paper, which presents part of the results found in Carrasqueira's (2018) doctoral thesis, has as its main objective to investigate factors associated with teacher dropout. Specifically, this paper aims to: a) observe trends in teacher retention/dropout in the Rio de Janeiro education system and b) identify characteristics of teachers and schools most associated with dropout. To this end, this paper uses data provided by the Municipal Education Secretary of Rio de Janeiro and data obtained from the website of the Anísio Teixeira National Institute for Educational Studies and Research (INEP), with information about teachers, students and schools. The combination of these data sources made it possible, on the one hand, to observe the attrition of teachers during the period from 2012 to 2016 and, on the other, to perform multivariate analyses that associate this phenomenon with the characteristics of the teachers and the last school in which they were assigned.

This article, in addition to this introduction, is divided into 7 sections. The first two discuss international and national studies on teacher dropouts. The third section presents the rules of entry and tenure and the pressures of recent accountability policies adopted by the municipal system of Rio de Janeiro that may impact teachers' decision to leave the network. The next section addresses the methodological aspects of the study: research design, databases, variables, and statistical models used. In the fifth section, we will present and discuss the results of descriptive and multivariate analyses from the estimation of logistic regression models. Finally, the article draws some conclusions about the factors associated with leaving the network and the relevance of this type of study for the development of public policies on teacher retention and proposes perspectives for new studies on the subject.

FACTORS ASSOCIATED WITH TEACHER ATTRITION: INTERNATIONAL LITERATURE

Teacher attrition is characterized as the teacher's voluntary departure from the teaching career, thus disregarding factors such as retirement or death. In the present study, given the limitations of the data used, which will be described later on, we are looking at leaving the teaching profession exclusively as the teacher's exit from a specific public system and not necessarily from the career.

Research by Boyd et al. (2008), Allensworth, Ponisciak, and Mazzeo (2009), and Ronfeldt et al. (2011), in the US, found that most teachers leave within the first 5 years of their profession. West and Chingos (2009) found that within 5 years about 1/3 of new teachers have left the Florida network, more than the number of teachers who remained in the same school where they were initially assigned.

When teachers who leave a network are concentrated in a few schools, this phenomenon also generates a higher turnover of teachers in these schools. This data is relevant when research such as that of Ronfeldt, Leob, and Wyckoff (2013) and Atteberry, Leob, and Wyckoff (2017) indicates that teacher turnover generates negative impact for student learning. Classes that are exposed to teachers new to the profession, the education system, and the school perform significantly lower than classes with teachers already integrated into the school.

The factors that lead teachers to leave the profession are grouped by the literature on the topic as teacher characteristics (demographics, qualifications, experience, job satisfaction, self-efficacy), school-related factors (socioeconomic composition of the student, school climate, leadership, segment, school educational indicators, location), and system-related factors (salary, accountability policy pressures, novice teacher support programs).

Sass et al. (2012) conducted research in Texas using data from over 200,000 teachers who joined the state's public or charter schools from 1988 to 2010, in which they sought to identify factors associated with teacher turnover. The authors conducted survival analyses that indicated that teachers who enter the career at a very young age, who are male, black (African American), and foreign-born have higher risk rates of leaving the system compared to other categories.

As for the characteristics of Texas schools or educational system, the researchers first observed that the implementation of the accountability⁴ policy increased the risk of teachers leaving the profession. However, the study did not examine whether the pressures of such policies were followed by higher dropouts for less qualified/less effective teachers or for more effective ones. Added to this, school factors such as high school performance on external assessment systems, being a public (as opposed to charter) school, and being an elementary teacher had an impact by decreasing the teacher's risk rate of dropping out. Similarly, Ryan et al. (2017) investigated the impact of pressures generated by accountability policies on teachers' intention to leave. However, this study, conducted with teachers in three US states, did not find a correlation between teacher-reported pressures and an increase in intention to leave the profession - although it did find a relationship with intention to change schools.

Borman and Dowling (2008) conducted a meta-analysis of 34 U.S. surveys that sought to investigate factors associated with teacher attrition or retention conducted between 1980 and 2005. On the demographic characteristics of teachers, the meta-analysis indicated that women were more likely than men to drop out, as were ethnic minorities compared to whites, teachers who entered the profession younger compared to those who entered older, married compared to single, and teachers who had children compared to those who had no children at all.

In Italy, Barbieri, Rossetti and Sestito (2010) observed that younger women were more likely to drop out, but many of them returned to the system, which could represent only the time of maternity leave. In the same direction as this study, Allensworth, Ponisciak, and Mazzeo (2009) observed a very small difference between men and women who left the Chicago public system.

⁴ Accountability policies are a type of educational assessment policy that - although they may have different instruments and designs - have as common characteristics the systematic testing of student performance, the establishment of goals to be achieved and mechanisms of reward and/or punishment for schools, principals, teachers and (in some cases) students. For a more in-depth explanation of this type of policy and particularly the one implemented in the municipality of Rio de Janeiro, see Carrasqueira (2013).

Regarding teachers' education and experience, Borman and Dowling's (2008) meta-analysis found that teachers with graduate degrees were more likely to leave compared to teachers without graduate degrees. And that faculty with more than 5 years of experience also had higher chances compared to less experienced faculty. And although it was statistically significant, the results of the meta-analysis indicated that the chances of an elementary teacher leaving were only 1.02 times that of a secondary teacher. Similar results were found by Dupriez, Delvaux, and Lothaire (2016) in French-speaking Belgium, who observed novice teachers for 4 consecutive years. The authors found that secondary teachers, males, less qualified and less experienced teachers were more likely to leave the profession.

The research reviewed by Borman and Dowling (2008) found that schools with a black or Latino majority and schools with a majority student body of low socioeconomic status increase the chance of the teacher leaving. Similarly, teachers in schools with low performance on external assessment systems are more likely to leave. However, research on teacher turnover indicates that working conditions, school climate, and principal leadership have a greater impact on a teacher's decision to leave the school and/or system than student characteristics (BOYD et al, 2011, LADD, 2011, GEIGER; PIVOVAROVA, 2018).

Boyd et al. (2011) investigated, in New York City, the impact of working conditions on a teacher's likelihood of dropping out in the first year. Ladd (2011), meanwhile, investigated, in the state of North Carolina, the impact of working conditions on novice teachers' intention to leave. In both studies, the most relevant variables were leadership and teacher participation in decisions.

Geiger and Pivovarova (2018) sought to understand the impact of working conditions in Arizona schools with high vulnerability students. The overall result of the research was that student characteristics did not appear to be significant in a teacher's decision to leave. For teachers in schools with a high percentage of poor students, a motivator for teachers to stay was having mentoring. Borman and Dowling's (2008) meta-analysis also noted that systems and/or schools where formal support and mentoring mechanisms existed for new teachers, the chances of dropping out decreased. The authors argue that in the US it is common for novice teachers to be assigned more difficult tasks and to receive fewer resources than veteran teachers.

Similarly, Kalogrides, Loeb, and Bêteille (2012) when researching class allocation of teachers in the Miami district observed that ethnic minority and female teachers were assigned more to low performing classes, in addition, novice teachers assigned to classes with behavior problems tended to leave the school, a fact that was not observed if the teacher was more experienced.

Ronfeldt and McQueen (2017) conducted a quantitative study with data from the US and investigated whether various types of support (seminars, mentoring, collective planning, management support, reduced hours, extra help) to novice teachers had an impact on teacher dropout. The authors found that all types of support decreased the chances of dropout relative to having no support at all. The mechanisms explaining such a relationship can be understood from the study by Buchanam et al. (2013), conducted in Australia with beginning teachers. Based on the teachers' reports in interviews, the researchers observed that novice teachers felt alone and overwhelmed.

In Chile, Ávalos and Valenzuela (2016) observed, through a questionnaire with 157 teachers who left teaching, that the main reasons for the decision to leave were, in order: dissatisfaction with the possibilities for professional development, low salaries, and dissatisfaction with school leadership. Qualitative research conducted through interviews with teachers in the US (GONZALEZ, BROWN & SLATE, 2008), Canada (SAUVÉ, 2012), Australia (BUCHANAN et al., 2013), and the United Arab Emirates (AL KAABI, 2005), reported that teachers who left schools indicated student disengagement and indiscipline as one of the causes. Other perceptions reported by these surveys were related to school climate and salaries, which were reported as unsatisfactory. Whereas in Borman and Dowling's (2008) study, financial factors are far more prominent than school factors. Lower salaries correspond to a high chance of teacher dropout, as does dissatisfaction with salary.

In general, international research has found similar factors even in quite different contexts. Leaving the profession is closely associated with feelings of dissatisfaction, whether with working conditions, with the school public, or with the school environment itself. In this sense, it is

understandable that younger professionals are more likely to leave, since older teachers have persisted to be disenchanted with the profession.

FACTORS ASSOCIATED WITH TEACHER ATTRITION: WHAT BRAZILIAN RESEARCH SAYS

In Brazil, most research on the topic has sought to identify, through qualitative methodologies, the factors that led teachers to abandon the profession (LAPO; BUENO, 2002, 2003; LEMOS, 2009; REBOLO, 2012; PAZ, 2013; SOUTO, 2013; XAVIER; BARBOSA, 2015). And, although we have many Brazilian studies on the profile of basic education teachers, there are few studies that sought to investigate, through quantitative analysis, the characteristics of teachers (CARDOSO, 2018), and working conditions (CARLOTTO, CAMARA; OLIVEIRA, 2019) associated with teacher dropout. In any case, all these Brazilian studies, presented great cohesion around the reasons that made teachers leave the profession and are in line with the international literature on the subject.

Regarding the reasons why teachers leave the profession, Lemos (2009) interviewed 34 second grade teachers who asked to leave the system in 2006. The teachers surveyed by Lemos worked in the state education system as "temporary" and, therefore, were not statutory teachers with guaranteed stability. Even so, the reasons given by these teachers in the interviews conducted by the author are in line with what we found in the literature as factors related to leaving the system. The main factor reported by most teachers was the depreciation of the profession, which despite being a rather abstract concept in general terms, was explained as a sense of professional discredit in which the teacher loses his or her authority in front of students, guardians and society, loses his or her work autonomy and is disrespected by the government that implements and discontinues policies without taking into account the work in the classroom and the needs of teachers (LEMOS, 2009).

Student indiscipline and violence, low salaries, and the school climate were the next most cited factors. We do not know if there is the possibility of voluntary mobility of these teachers to other schools in the system and, taking into account the context presented by Torres et al. (2008), it is to be expected that the teachers on the competitive examination migrate from schools with unruly students, in regions of social vulnerability and with a school climate that they consider bad, to schools with more favorable socioeconomic characteristics, more disciplined students and a school climate more favorable to learning. In this way, the vacant classes for temporary teachers would be precisely those that the statutory teachers did not want. Without the possibility of mobility, the temporary teachers' option would be to remain in these schools or to leave the education system. Lemos (2009) did not make this discussion, but points out that the number of permanent teachers who left the system in the year researched (2006) was very small, a factor that made him decide to interview the temporary teachers.

Souto (2013) investigated the reasons for quitting with mathematics undergraduates graduating from the Federal University of São João Del-Rey (MG) and found that of the 89 who answered the questionnaire, 34 did not practice the profession and 13 stated that they intended to quit. The main reasons for dissatisfaction with teaching were associated with low salaries and lack of interest and indiscipline among students. The author does not differentiate between the types of schools in which the teachers were or had been, focusing more on the factors that influence the decision to leave.

Paz (2013), trying to understand the constructed identities of mathematics teachers who remained in the profession, interviewed 9 teachers from the state system of Minas Gerais (5 from a school in the central region of Belo Horizonte and 4 from a school in a peripheral region of Belo Horizonte) and 11 teachers who left the teaching profession. Although the author does not go into this analysis, it is interesting to note that the school in the central region, considered a good/high performing school, is also, among the two schools in the study, the one that had a full staff of effective teachers and teachers with more time teaching. Another point to note, for the teachers who left (whose selection was by convenience and had taught in different education systems), is that there was no difference between the number of permanent teachers (6) and contract teachers (5) and the training of teachers who left was similar to that of teachers who were in office.

Rebollo (2012) and Xavier and Barbosa (2015) observed in more detail the process of disenchantment with the profession, through the reports of two teachers, one from São Paulo and the

other from Belo Horizonte, that led them to abandon teaching. For the authors, attrition does not occur abruptly. It is a constructed process. Lapo and Bueno (2002; 2003) already indicated, in their study in the 1990's, that attrition occurred in a process that started with small ruptures until it culminated with a total rupture. Such process is clearly observed in Rebolo (2012) and Xavier and Barbosa (2015) when female teachers report the constant leaves of absence, increasingly longer and more frequent. In both reports, it is observed the physical and mental weariness generated by students' indiscipline and violence (verbal and physical) and the feeling of helplessness in relation to the school management and the students' guardians. The lack of basic conditions for the exercise of their profession, low salaries, and unsatisfactory career path were also important in the teachers' decision to leave the public networks where they were working.

With regard to working conditions, Carlotto, Câmara, and Oliveira (2019) investigated, through a questionnaire applied to 376 teachers, 21 occupational stressors that could be associated with tendencies to attrition of teachers in early childhood and elementary education in a municipal system in the metropolitan region of Porto Alegre. Through linear regression, they observed that stressors related to the multiplicity of roles to play, conciliation between work and leisure and the relationship with the student were predictors of the intention to quit for those teachers.

In what regards the profile of teachers who quit, the monograph by Cardoso (2018) investigated characteristics of high school teachers with tenure who asked for resignation from the São Paulo state system, between the years 2009 and 2017. The author observed that female teachers, graduates of private colleges, in the 31-40 age range, and in schools in the interior of the state showed a higher percentage of attrition. Women and teachers in inner-state schools are the majority of teachers with tenure and, therefore, a higher percentage of dropouts was to be expected. As for the administrative dependence of the institution where they graduated (public or private) and the age bracket, the study does not allow us to compare the total number of teachers with tenure. It is worth noting that this work aimed only to present a profile of teachers who resigned from the network, not presenting results that would allow establishing trends or factors associated with attrition.

In his research Cardoso (2018) also applied a questionnaire to 28 Sociology teachers who left the São Paulo state system. According to the author's findings, the majority (24) had specific training to teach the discipline, more than half had a master's degree (14) or doctorate (8). It is interesting to note that of the 28 interviewees, 21 left the system within the first two years of joining, and 14 left within the first year. Regarding the reasons for leaving, Cardoso (2018) finds similar reports to those of other surveys conducted in Brazil and around the world: low salaries that force teachers to work in several schools or to have an extra occupation, precarious working conditions, lack of management support and collaboration from colleagues, indiscipline, violence, or lack of interest from students. In the same direction, other studies that analyze the working conditions of teachers in the Brazilian context concerning salary and career, although they do not focus on associated factors or reasons for attrition, argue that such conditions would imply both low demand for teaching and also the abandonment of the profession (BARBOSA, 2011; MASSON, 2017; LOUSANO ET AL., 2010).

In this sense, we see that studies in several different contexts reach very similar results, which reinforces the Brazilian findings. However, none of these studies conducted in Brazil set out to investigate patterns of dropout according to the profile of teachers, schools, and education systems. The research of Carlotto, Câmara, and Oliveira (2019) was the only one that proposed to conduct a correlation analysis. However, it did not have as a dependent variable the dropout itself, but the teacher's intention to drop out. All the other studies focused on searching for explanations for teacher attrition through life history reports, semi-structured interviews, or questionnaires with open-ended questions.

METHODOLOGICAL ASPECTS AND LIMITATIONS OF THE DATA

The Municipal System of Rio de Janeiro

The present study was carried out in the Municipal School System of Rio de Janeiro, which has less precarious working conditions for teachers when compared to other municipal schools in terms of salary, career path, and number of permanent teachers.

The main way to enter the teaching profession in the Rio de Janeiro Education System is through public selection. The vacancies are assigned by the Regional Education Coordinators (CRE) and the candidate, at the time of registration, chooses the CRE he or she wants. Once they have passed the selection process, the teachers are called in order of classification to choose their unit of assignment, from among the schools with open positions.

The career and remuneration plan for teachers in the municipality of Rio de Janeiro combines the time in service as a teacher in the system and the education attainment, and is proportional to the weekly working hours. According to data from INEP, in 2014, the gross pay for teachers in the municipal system of Rio de Janeiro was R\$ 3,270.26, with an average of 21.3 hours of work per week. Within the state of Rio de Janeiro, it was the 6th highest paid system, and was above the average of Brazil's municipal education systems which was R\$2,385.66. So although teachers' salaries are still short of their importance in society, the wages in Rio de Janeiro's municipal system is not among the least attractive.

In this context of public servants with tenure, the attrition is represented by two situations: (i) teachers who resigned; (ii) teachers who abandoned the position. The resignation is an official process in which the teacher gives up his/her position and his/her departure is promptly notified in the city's Official Journal. Abandonment of function, on the other hand, occurs when the teacher has 30 consecutive days of unjustified absences. In the databases we are using, we do not have these processes indicated, and because of this, we may have teachers who have abandoned their positions - in other words, who have been absent from work for more than 30 days without justification - but in the database they were assigned to their original school.

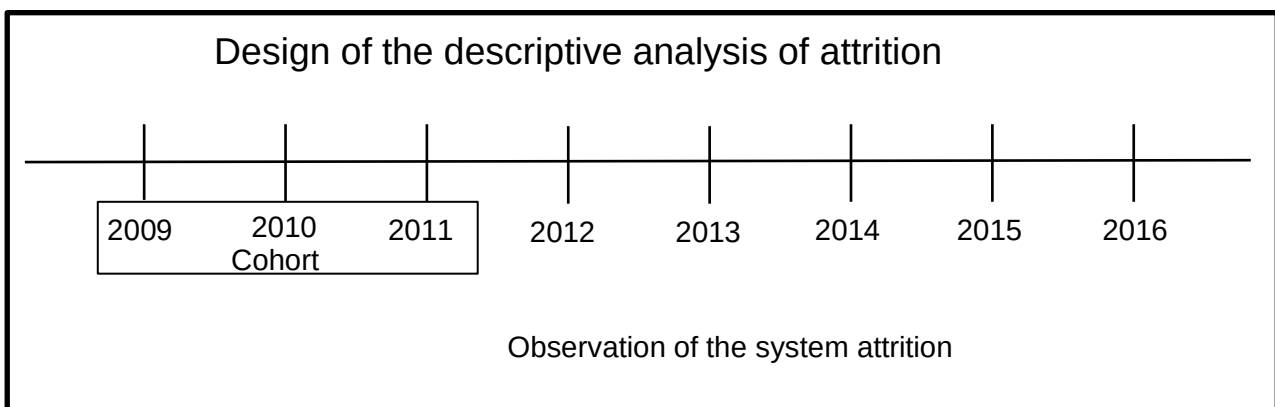
Data and cohort

The data used in this analysis were provided by the Coordenadoria de Recursos Humanos (CHR) of the Secretaria Municipal de Educação do Rio de Janeiro (SME-RJ). We also used data from the INEP School Census, IDEB results, results of the Annual Performance Bonus, and data from the Academic Management System of the municipality of Rio de Janeiro. Thus, it was possible to complement and relate data regarding teachers, students and school with more precision and less missing data.

The teachers we are observing in this paper are Teachers II, that is, teachers who taught in the first segment of elementary school (1st to 5th grade) and in early childhood education, and, therefore, were still in the pre-2013 job regime. As shown in Figure 1, we selected teachers who joined the local education system in the years 2009, 2010, and 2011 and observed early departures between the years 2012 and 2016.

Although ideally, we would have liked to observe dropouts from the time the teacher entered the network, the databases available only contained those teachers who were in the system at the beginning of 2012. Thus, it was not possible to track teachers who entered after 2012 and it was not possible to observe who left before 2012.

Figure 1: Design of the dropout analysis.



Source: Author, 2018.

Variables

Table 1 below presents the variables used in the analyses. The selection of these variables was based on the literature on the theme, discussed above. The variables were divided into two groups: teachers' characteristics and schools' characteristics. The teachers' characteristics are fixed at the moment of tenure, and the schools' characteristics are in relation to the last school in which the teacher was employed before dropping out. For teachers who did not leave the system, the last school corresponds to their assignment in November 2016.

Table 1: Description of the variables.

Variable	Variable Description	Format	Source
DEPENDENT			
Left the system	If the teacher left the system (1 = Left, 0 = Didn't leave)	Dummy	Magister
INDEPENDENT			
Age	Teacher's age at the date of taking office	Discrete Numerical	School Census
Education	Teacher's education (1 = Superior, 0 = Medium)	Dummy	Magister
Sex	Teacher's gender (1 = Female, 0 = Male)	Dummy	School Census
Number of changes	How many times he/she has changed assignments until the end of the follow-up	Discrete Numerical	Magister
Characteristic of the school			
Socioeconomic Status Index (INSE, in Brazilian Portuguese)	Indicator	Continuous Numerical	SGA
Index of School Complexity (ICG, in Brazilian Portuguese)	Indicator	Continuous Numerical	School Census
Basic Education Development Index (IDEB, in Brazilian Portuguese)	IDEB of the school for the 1st segment	Continuous Numerical	INEP
Annual Performance Bonus (PAD, in Brazilian Portuguese)	How many times the school won the PAD between 2009 and 2016	Discrete Numerical	SME

Source: own elaboration.

With regard to the profile of teachers, the following variables were used: education attainment, age, gender, and number of changes of assignment made during the observation period (2012-2016). To characterize the schools, the estimated models considered the following explanatory variables: the socioeconomic status of the students, school complexity, the number of times the school was awarded the Annual Performance Bonus (PAD), and the school's IDEB.

The socioeconomic status and school complexity are two indexes created, using factor analysis method, based on: the education attainment of the student's guardians, the color/ethnicity of the student and whether the student or the guardian participated in cash transfer programs (socioeconomic status)⁵; the number of enrollments, the number of stages and modalities of education that the school offers, and the number of shifts in which the school operates (school complexity).

⁵ According to Bartholo (2014) parental education, color/race, and poverty status are variables consistently used in national and international studies on school segregation, and are also used in research on educational inequalities. In the research from which this article originates (CARRASQUEIRA, 2018), we tested these variables separately and found no loss in using them

The Annual Performance Bonus was part of the now extinct school accountability policy that was practiced in the system during the research period. This award consisted of the payment of an additional salary (14th salary) to school staff members who met the IDEB and IDERio (Rio de Janeiro's version of IDEB) targets set by the Municipal Secretary of Education. This variable aimed to observe the association of accountability pressures and school dropout.

The dependent variable of our analysis, called "Left the network", is a dummy variable that categorizes teachers between those who left the network and those who stayed in the network. The variable was constructed using the Magister/SME databases, which contained, for each teacher, the entry and exit date of each assignment. When the teacher presents an entry date and no exit date, it means that he/she remained in the system until the end of the analyzed period, even if he/she has changed schools over time. When the teacher presents an exit date, but has no subsequent entry, it means that he or she left the system.

Table 2 exemplifies the possible types of movement observed in the base:

Table 2: Example of the three possible types of movement in the database.

	Allocation 1	Entry 1	Exit 1	Allocation 2	Entry 2	Exit 2
Prof. A	School 1	01/01/09				
Prof. B	School 1	01/01/09	31/12/09	Escola 2	01/01/10	
Prof. C	School 1	01/01/09	31/12/09			

Source: own elaboration.

According to the example in Table 2, Prof. A remained in the same school during the entire follow-up period, Prof. B made a school change and remained in this new school until the end of the follow-up, and Prof. C left the system.

Table 1 presents the descriptive statistics of the variables used in the regression models estimating the risk of dropping out of the local education system.

Analysis

In a first step, we will present descriptive analyses looking at the proportion of teachers who left the local education system over the years. The intention is to understand the size of the phenomenon.

Next, we will use a logistic regression to estimate the probability of a teacher leaving the local education system considering characteristics of the teachers and the schools in which they are assigned. This type of regression is indicated for multivariate analyses - that is, those with more than one independent variable - estimating a dummy variable (in the case of the present research, left or did not leave the network). Our intention here was to identify factors associated with dropping out, and in this way, we estimated the impact of each variable on the probability of the teacher leaving or remaining in the local education system.

Table 1: Descriptive statistics of the dependent and independent variables.

Dependent Variable				
Left the network		Frequency	% Total	% Valid
1	Yes	507	14	14
0	No	3087	86	86
	Valid Total	3594	100	100
	No response	0	0	0
	Total	3594	100	100
Independent Variables - Teacher Characteristics				
Gender		Frequency	% Total	% Valid
1	Male	92	2,6	2,6
0	Female	3498	97,3	97,4
	Valid Total	3590	99,9	100,0
	No response	4	0,1	
	Total	3594	100,0	
Education		Frequency	% Total	% Valid
1	High School	1130	31,4	31,5%
0	Higher Education and Post-Graduation	2461	68,5	68,5%
	Valid Total	3591	99,9	100,0%
	No response	3	0,1	
	Total	3594	100,0	
Number of changes				
Frequency		Minimum	Maximum	Medium
3594		0	15	1,46
				Standard Deviation
				1,773
Age				
Frequency		Minimum	Maximum	Medium
3223		19	91	34,83
				Standard Deviation
				9,219
Independent Variables - School Characteristics				
Socioeconomic Status Index				
Frequency		Minimum	Maximum	Medium
3422		-2,77	2,88	-0,09
				Standard Deviation
				0,84
School Complexity Index				
Frequency		Minimum	Maximum	Medium
3464		-1,98	2,91	0,66
				Standard Deviation
				0,89
Annual Performance Bonus				
Frequency		Minimum	Maximum	Medium
3483		0	7	2,26
				Standard Deviation
				1,34
IDEB				
Frequency		Minimum	Maximum	Medium
2776		2,50	8,50	5,5
				Standard Deviation
				0,68

Source: own elaboration.

RESULTS

Teacher resignation is defined as a teacher leaving not only the school in which he or she is working, but also his or her position in the education system. In the case of our data, although we are calling it attrition, we may have cases of expected departures, such as retirement or death. Since we don't have access to the reason that led the teacher to leave the system, every departure is being considered attrition. This means that our results may be overestimated. However, since we only considered teachers who joined the local education system in 2009, 2010 and 2011, we assume that retirement would not be a frequent phenomenon in the focus cohort of the study.

In Table 2, we can see the proportions of teachers leaving year by year, taking as reference the teachers who were in the local education system in the previous year.

Of the teachers in the cohort who took office in 2009, considering those still active at the beginning of 2012, 5.26% left the network by the end of 2012. A pretty high rate, considering that for the other years and for the other cohorts, the dropout rates compared to the previous year were between 3.76% and 1.62%. For the three years of tenure, we have an average loss ratio of about 3% per year (3.3% for faculty who joined in 2009; and 2.9% for those who joined in 2010 and 2011).

Table 2: Proportion of exits by year over previous year, by year of entry into the local education system.

Proportion of loss per year in relation to the previous year ⁶					
	2012	2013	2014	2015	2016
2009	5,26%	2,78%	1,79%	3,27%	3,76%
2010	3,05%	2,99%	1,62%	3,54%	3,25%
2011	3,17%	2,84%	2,03%	2,85%	3,74%

Source: Magister. Elaborated by the author.

Table 3: Proportion of cumulative exits between 2012 and 2016, by year of entry into the local education system.

Cumulative Loss Ratio ⁷					
	2012	2013	2014	2015	2016
2009	5,26%	7,89%	9,54%	12,50%	15,79%
2010	3,05%	5,95%	7,47%	10,75%	13,64%
2011	3,17%	5,91%	7,83%	10,45%	13,80%

Source: Magister. Elaborated by the author.

In terms of the cumulative loss of teachers caused by teacher dropouts, table 3 shows that at the end of the observation period, the dropout rate was 14% of the total, and for the group that took office in 2009 the loss reached almost 16%, while for the other groups, the cumulative dropout rate was similar, staying around 13%. In other words, in only 5 years the local education system lost 14% of the teachers in our cohort. Comparing with results from other works, for the same period (2009-2017), Cardoso (2018) observed an average teacher resignation rate in the São Paulo state system of about 11% per year, with a cumulative rate of 35.9%. Pereira and Oliveira (2018) conducted analyses on the ability

⁶ For 2012, the ratio is to the total cohort for the corresponding tenure year.

⁷ For 2012 the loss is not cumulative, it is the ratio of the total cohort (teachers active at the beginning of 2012) to how many teachers left this year.

of municipal systems in Brazil to retain teachers using data from the School Census. In the 2015-2016 analysis they observed a rate of 0.77, meaning that 23% of teachers who were in an educational system in 2015 were no longer in that system the following year. In comparison to international studies, Geiger and Pivovarov (2018) reported a dropout rate of 24% for the year 2015 in the state of Arizona and an average annual Chicago public system dropout percentage of 11.7% between 2012-2015.

In the case of this research, we are observing only a small group of teachers in the local education system, and, therefore, the dropout percentage, considering all teachers, in the years observed may be higher. Stressing again that our analysis may be underestimated due to missing data in the database, we still have a situation that indicates that teachers who took office in 2009 abandoned slightly more than those who joined in 2010 and 2011. Since the difference is small, it may be a random fluctuation.

Table 4 brings the results of the logistic regression that estimated teachers' attrition. We used the method of insertion in three blocks (Enter Method) the first model includes the characteristics of teachers, in the second, we added the characteristics of schools (except the IDEB), and in the third, we incorporated all variables. The IDEB was only inserted in the last model, since several schools do not have this indicator and, therefore, the analyses that include this variable present a considerable loss of cases.

Table 4: Models to estimating the probability of the teacher leaving the local education system

	Model 1	Model 2	Model 3
Teacher's characteristics			
Gender: Female	-0,796** (0,451)	-0,833** (0,435)	-0,999** (0,368)
Education: Higher Education	0,419** (1,521)	0,456** (1,578)	0,585** (1,795)
Age in years	-0,038** (0,962)	-0,037** (0,964)	-0,045** (0,956)
How many times have you changed assignments	-0,209** (0,811)	-0,202** (0,817)	-0,191** (0,826)
School Characteristics			
Socioeconomic Status Index		-0,163* (0,849)	-0,207** (0,813)
SchoolComplexity Index		0,086 (1,089)	-0,140 (0,870)
Annual Performance Bonus		-0,347** (0,706)	-0,460** (0,632)
IDEB			-0,104 (0,901)
Constant	0,279	0,888**	2,263
Number of valid cases in the analysis	3218	3049	2440
R ²	0,051	0,094	0,131

Note: ** significant at 1%; *significant at 5%.

The three models are consistent in terms of both the value and direction of the coefficients and the statistical significance of the variables, with the exception of school complexity, which changes

sign but does not show statistically significant parameters in the two models in which it was included. The results of model 3 indicate that being a woman decreases the chances of dropping out. One way to interpret the coefficient obtained in model 3 is the following: men are three times more likely to drop out compared to women. Having a college degree increases the chance of dropping out by 1.8 times compared to having only a high school degree. The addition of one year of age is associated with a decrease of about 0.05 times in the chance of the teacher leaving the local education system. Another way to observe the effect of age is to look at the probabilities predicted by model 3 for teachers aged 20, 30, 40, and 50: the probabilities of leaving are 25%, 18%, 12%, and 8% respectively.

Each time the teacher changed assignments the chance of leaving the local education system decreased by about 0.2 times. In terms of predicted probability, the teacher who did not make any migration has probability of 33% of leaving the system, while teachers who changed 1, 3, 6 and 10 times, have a predicted probability of 24%, 11%, 7% and 3%, respectively, of leaving the network.

With regard to school characteristics, we first highlight the significant effect of the student composition. An increase of 1 point in the school's INSE decreases by 0.2 times the chance of the teacher leaving the local education system. The predicted probabilities of leaving the system for a teacher assigned to schools with high (2.88), medium (0.09) and low (-2.77) INSE are 9%, 15% and 24%, respectively. The GCI and IDEB are not significant, but it is worth noting that in the model where the IDEB variable was inserted, the GCI changed sign, possibly because in this model schools that do not have IDEB and that are probably smaller and have lower GCI were automatically excluded. The number of times the school was awarded the PAD proved to be not only significant, but one of the variables with the greatest impact on dropout. Each time the school won the award was associated to a decreased in the probability of the teacher leaving the local education system by 0.4 times. In terms of predicted probability, in schools that won the PAD 0, 1, 4 and 7 times, we have, respectively, a 33%, 24%, 7% and 2% probability of the teacher leaving the system.

DISCUSSION

These results are in line with international research that indicated that teacher attrition was more related to teacher characteristics than to school characteristics. Younger teachers with higher education levels are more likely, when leaving the education system, to find another position in the labor market that offers more benefits. Age is the characteristic with the greatest convergence. All the studies discussed above that used this variable indicated that teachers who enter the teaching career at a younger age are the ones who leave the education system the most (BORMAN & DOWLING, 2008; ALLENSWORTH, PONISCIK & MAZZEO, 2009; BARBIERI, ROSSETTI & SESTITO, 2010; SASS et al., 2012).

Regarding education attainment, although the meta-analysis by Borman and Dowling (2008) observed that teachers with postgraduate degrees were more likely to leave the career than teachers with undergraduate degree, in the local education system we are investigating, few teachers have postgraduate degrees when they join the network (16.6 and the minimum education for the position is high school degree, teachers training modality). We can then assume that even in different contexts, less schooling decreases the chances of leaving the network. I would like to point out that during the descriptive analyses it was observed that the results for post-graduation were the same as for those who had only a bachelor's degree and, for this reason, we added these two categories together. The explanation lies in the attractiveness of the teaching career. Professionals with more qualifications are more likely to enter occupations with better salaries and better working conditions (LEME, 2012).

The gender issue may be related to the fact that the number of female teachers is much higher than male teachers in our cohort, or because we are researching professionals who have a guaranteed stability. For women, especially those with children, the possibilities in the labor market are still smaller than for men. The relationship between gender and dropout seems to depend on the education system context, and so each research study found a different result. Allensworth, Ponisciak, and Mazzeo (2009) found no significant difference between men and women in the Chicago public system when the proportion between the two categories was similar. Sass et al. (2012) reported that men drop out more in the Texas education system. The meta-analysis by Borman and Dowling (2008) found

a small difference related to the gender of teachers, with women being more likely to drop out. However, these studies were conducted more than 10 years ago.

The research discussed in the literature review did not set out to look at the relationship between mobility and teacher dropout. However, we can infer that the number of times a teacher changes schools may indicate a desire to remain in the education system, just by finding a school more suitable to their profile. It is important to note that although this study has the teacher as the unit of analysis, the indicator of teaching regularity (IRD) produced by INEP for the period between 2012 and 2016⁸ reports that, in this period, 33% of schools in the municipal education system of Rio de Janeiro had low or medium-low faculty stability, and only 4.3% of school units had high regularity. This evidence indicates that there is considerable teacher turnover in the network generated by dropouts and mobility, a phenomenon also observed by Carrasqueira and Koslinski (2019).

Moreover, this high proportion of dropouts during their first assignment may be related to what Kalogrides, Loeb, and Bételle (2012) discuss: when assigned to a school or class with many students with behavioral problems, younger teachers left the education system more than more experienced teachers. This indicates that a teacher's first experience can be traumatic to the point of impacting on leaving the education system or even the career. This is in line with qualitative research that investigated the perception of teachers about the reason they left, both in Brazil (LAPO; BUENO, 2002, 2003; LEMOS, 2009; REBOLO, 2012; PAZ, 2013; SOUTO, 2013; XAVIER; BARBOSA, 2015) and in the US (GONZALEZ, BROWN & SLATE, 2008), Canada (SAUVE, 2012), Australia (BUCHANAN et al, 2013) and in the United Arab Emirates (AL KAABI, 2005): student indiscipline was the school factor most often cited by teachers.

The analyses indicated a strong association between the number of times a school won the PAD and dropping out of the education system. We can propose some hypotheses for such an association based on the studies discussed above. A first possible explanation would be that the financial incentive/wage bonus would help keep the teacher in the local education system. Qualitative studies indicate that the financial issue has an impact on the teachers' decision to leave the system. However, in the Brazilian context, we did not find studies focusing on the relationship between leaving and accountability policies. We found only one study that investigated the impact of financial incentive programs (Clotfelter, Ladd, and Vidgor, 2010), but they are of a different type than the one investigated in this paper. Furthermore, the wage bonus received is equivalent to a "14th salary," and may exert a symbolic impact (recognition of good work) rather than a financial incentive.

Another possible explanation for the strong association between dropouts and PAD would be that teachers in schools that do not earn the bonus may be under more pressure. Andrade, Koslinski, and Ceneviva (2018) show that the pressure of the accountability policy in the municipality of Rio de Janeiro had a large impact on the likelihood of principals leaving their post. However, a study conducted in the same context observed that principals of schools with low performance in external assessment systems - and who less frequently receive the award - feel this pressure more, compared to teachers who rarely feel pressured (CUNHA, 2015).

Finally, another explanation would be that the number of times a school has won the PAD is representing other characteristics of the school, such as school climate. For example, the study by Candian and Resende (2013), observed that the perception of a good school climate by students is associated with better results in external assessments, indicating that schools that provide a favorable environment for learning prove to be more effective. Boyd et al (2011) who directly investigated the relationship between working conditions, leadership, and school climate with teacher attrition, provide evidence that teachers' perceptions of these school characteristics may be the most relevant factors in a teacher's decision to leave a school, education system, or teaching career. The study by Geiger and Pivovarov (2018), especially, shows us that working conditions and/or school climate may have more relation to leaving than the student background characteristics. However, Brito and Costa (2010) argue that teachers' perception of the school climate impacts on the teaching work, which adapt their practices

⁸ This indicator calculates the stability for the school-teacher pair over a 5-year period, based on data from the School Census (INEP, 2015). Thus, the 2016 IRD considers the stability of teachers in schools between 2012 and 2016. The indicator is standardized to the range between 0 (total irregularity) and 5 (total regularity) and disclosed as an average at the school, municipality, state, region, or country level. There is no separation between segments, only by level of administration. .

according to their student composition, and may reproduce educational inequalities (BRITO & COSTA, 2010). In the same direction, Harker and Tymms (2004) argue that the effect of student composition is not necessarily limited to peer interaction and may reflect the interaction between student composition and teacher action, school climate, parental involvement, and teacher commitment among others. That is, students react to school structures/processes and their peers and schools, in turn, react to the student composition. Thus, the relationship between school climate and teacher dropout may be mediated by teachers' reaction to the socioeconomic characteristics and/or racial composition of students.

FINAL CONSIDERATIONS

This work brings an unprecedented contribution to the discussion of the theme in the Brazilian context, since it identified individual factors and those related to the school context that are associated with leaving the local education system through the use of a quantitative methodology. This unique contribution was possible due to the access to the databases of the Municipal Secretariat of Education, which allowed us to keep track of all the changes in assignments made by each teacher in the local education system.

In this way, we were able to verify that the teachers most likely to leave the municipal system of Rio de Janeiro are the youngest and most educated, indicating, like other Brazilian and international research, that the teaching career seems unattractive to younger and more qualified teachers. In the book on UFMG graduates organized by Las Casas, Cunha, and Queiroz (2019) it is quite evident that the professionals who remain as basic education teachers are, in general, children from families with low economic capital and who took teaching as a possibility of social mobility. Even so, the feeling of discredit of the profession is quite marked in some of the studies presented.

However, in addition to the low attractiveness of teaching, the student composition can also be important for teachers to leave the education system. The students' lack of interest, indiscipline, and violence are factors always cited by former teachers in Brazilian studies. The high impact of the PAD, however, brought to light the influence of school accountability policies and contextual factors of the school, little explored by research in Brazil.

However, it is worth noting that even given the limitations of the databases and the choice of sampling used in this study, the evidence found indicate a lower dropout rate in the municipal system of Rio de Janeiro, when compared to studies conducted in other Brazilian municipal systems. In this sense, future studies can focus their efforts not only on identifying school characteristics, such as school climate/ leadership, associated with dropouts, but also, based on broader characteristics of the education systems and their policies (salary, career plan, assignment rules for newly hired teachers, support or mentoring programs for teachers entering the education system, among others) that affect the conditions of the teaching work and, consequently, dropouts. The results of the proposed studies can better inform evidence-based educational policies focused on attracting and retaining more qualified teachers to the teaching profession.

Finally, it is also important that research in Brazil goes a step further and investigates the impact of teacher attrition on student learning, especially for those in situations of social vulnerability and low academic performance. Such studies may indicate that the pursue of policies aimed at retaining the most qualified teachers can have an impact not only on effectiveness, but also on equity within school systems.

* The translation of this article into English was funded by the Fundação de Amparo à Pesquisa do Estado de Minas Gerais – FAPEMIG – through the program of supporting the publication of institutional scientific journals.

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Submitted: 05/11/2020

Approved: 03/01/2021