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Factors associated with the student performance in distance education undergraduate courses: analysis by multiple linear regression

Fatores associados ao desempenho dos alunos dos cursos de licenciatura em educação a distância: análise por meio da regressão linear múltipla

Factores asociados al desempeño de alumnos de cursos para formación de profesores en educación a distancia: análisis mediante regresión linear múltiple.

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Abstract: This article aimed to analyze the factors associated with the performance of students in distance education (DE) undergraduate courses at public and private Higher Education Institutions (HEIs) in Brazil. The study was developed based on microdata from the National Student Performance Exam (ENADE) and was grounded in the Theory of Educational Production Function (TEPF) and the establishment of the Open University of Brazil (UAB) as an educational public policy. A quantitative approach was employed, and data analysis was conducted using the multiple linear regression technique estimated by Ordinary Least Squares (OLS). The results showed that the average performance of students in public HEIs was superior to that of students in private HEIs. Furthermore, it was proven that academic performance was significantly influenced by personal characteristics, family and socioeconomic factors, peer effects, and peculiarities of the educational system. The results are relevant as they contribute to the design of the distance education system in the country, as well as provide social contributions by offering valuable information for the formulation of more effective public educational policies.

Keywords: distance education; academic achievement, educational production function theory.

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Resumo: Este artigo teve como objetivo analisar os fatores associados ao desempenho dos alunos dos cursos de licenciatura em Educação a Distância (EaD) de Instituições de Ensino Superior públicas e privadas no Brasil. O estudo foi desenvolvido a partir de microdados do Exame Nacional de Desempenho dos Estudantes (ENADE) e teve como fundamento a Teoria da Função de Produção Educacional (TFPE). Empregou-se abordagem quantitativa e a análise dos dados foi realizada por meio da técnica de regressão linear múltipla estimada por Mínimos Quadrados Ordinários (MQO). Como resultado verificou-se que o desempenho médio dos estudantes das IES públicas foi superior ao desempenho dos estudantes das IES privadas. Além disso, comprovou-se que o desempenho acadêmico foi significativamente influenciado por características pessoais, por fatores familiares e socioeconômicos, por efeitos dos pares e por peculiaridades do sistema educacional. Os resultados são relevantes, pois trazem contribuições para o delineamento do sistema EaD no país, assim como contribuições de interesse social, pois fornecem informações valiosas para a formulação de políticas públicas educacionais mais eficazes.

Palavras-chave: educação à distância; desempenho acadêmico; teoria da função de produção educacional.

Resumen: Este artículo tuvo como objetivo analizar los factores asociados al desempeño de los estudiantes de cursos de pregrado en la modalidad de Educación a Distancia (EAD) en Instituciones de Educación Superior de Brasil. El estudio se desarrolló con base en microdatos del Examen Nacional de Desempeño Estudiantil (ENADE) y se basó en la Teoría de la Función de Producción Educativa (TFPE). Se utilizó un enfoque cuantitativo y el análisis de los datos se realizó mediante la técnica de regresión lineal múltiple estimada por Mínimos Cuadrados Ordinarios (MCO). Como resultado, se encontró que el desempeño promedio de los estudiantes de las IES públicas fue mayor que el desempeño de los estudiantes de las IES privadas. Además, se demostró que el rendimiento académico estuvo significativamente influenciado por características personales, factores familiares y socioeconómicos, efectos de pares y peculiaridades del sistema educativo. Los resultados son relevantes, ya que traen aportes al diseño del sistema de educación a distancia en el país, así como aportes de interés social, ya que brindan información valiosa para la formulación de políticas educativas públicas más efectivas.

Palabras clave: educación a distancia; logro académico; teoría de la función de producción educativa.

1 Introduction

In Brazil, Law No. 9,394/96 establishes the Guidelines and Bases for National Education (LDBEN), which introduced Distance Education (EAD) as a teaching modality within the formal education system and as an alternative for offering educational services nationwide (Brazil, 1996). With the aim of expanding and decentralizing the provision of higher education courses and programs in Brazil, as well as stimulating teacher training in the country, the Ministry of Education (MEC), in collaboration with the National Association of Leaders of Federal Higher Education Institutions (ANDIFES) and state-owned enterprises, created the Open University of Brazil System (UAB) within the context of the Forum of State Enterprises for Education (Saldanha, 2018).

The UAB System contributes to expanding access to public universities, even in the most remote and isolated areas of the country, by facilitating initiatives that encourage federal, state, and municipal government partnerships, involving 133 Higher Education Institutions (HEIs). The goal is to contribute to the National Teacher Training Policy, with priority admission opportunities directed at professionals working in basic education (Coordination for the Improvement of Higher Education Personnel [CAPES], 2021).

The expansion of EAD and the quality of teacher education programs in Brazil deserve attention, as these programs are responsible for training professionals who will be in charge of the foundational and structural education of future generations (Bertolin, 2021). According to the Higher Education Census, 93.7% of new enrollees in EAD teacher education programs are in private institutions, while in public institutions, this modality accounts for 22.2% of new enrollments (National Institute of Educational Studies and Research [Inep], 2023).

The democratization of access to HEIs through this modality must be accompanied by institutional policies, such as inclusion programs and affirmative actions. In addition to this expansion, there is a concern with ensuring the quality levels of higher education, adhering to the criteria established by the MEC. To this end, the HEI teaching evaluation system includes a mandatory triennial assessment known as the National Student Performance Exam (ENADE). Performance involves the dimension of action and assessment, being expressed through scores and ratings (Ferreira, 2015).

Understanding the results of the educational system, through student performance, is important for the development and management of public policies, allowing for the efficient allocation of resources and diligent action. In this sense, research exploring factors associated with academic performance, which is one of the metrics related to the quality of education, becomes relevant (Araújo, 2021). Furthermore, among educators, social scientists, and psychologists, there is unanimous agreement that the

elements favoring academic performance need to be better understood (Dazzani; Faria, 2009).

Studies aiming to identify factors associated with academic performance add socially relevant contributions, as they provide support for more effective policies (Araújo, 2021). Identifying the factors that contribute to student performance can support more efficient resource allocation, thus contributing to the population's qualification. It can also assist in directing resources to public educational policies and contribute to the design of the EAD system in the country, given the ongoing debate about whether or not the provision of online classes influences student formation (Araújo, 2021).

Evaluative studies on school effectiveness originated in the 1960s with the Coleman Reports conducted in the United States and the Plowden Report developed in England. Both revealed that the school and its resources had a limited effect on learning compared to factors such as family background, family size, and the family context (Broke; Soares, 2008). Regarding higher education evaluation, the contributions of Hanushek's studies (1979) motivated various research efforts on academic performance, focusing on students' personal characteristics, their family backgrounds, and the resources of academic institutions.

Since the majority of evaluative studies on academic performance in higher education in Brazil focus on the in-person modality (Santos, 2012; Ferreira, 2015; Miranda et al., 2015; Santana, 2023), there is a notable absence of studies on the Distance Education modality that address factors associated with student academic performance, comparing public and private institutions.

Thus, the objective of this study was to analyze the factors associated with the performance of students in EAD teacher education programs at public and private HEIs in Brazil, based on the Educational Production Function Theory (EPFT). Its contributions refer to the possibility of filling gaps in previous research by incorporating other variables that have yet to be explored in the literature into the analysis, with the potential for in-depth discussion to provide significant theoretical and practical contributions to the field.

2 Theoretical framework

2.1 Distance Higher Education in Brazil

In 1961, the Law of Directives and Bases of Education (LDB)—the first legislation addressing EAD (Mattos; Silva, 2019)—established in its Article 104 the organization of experimental courses and schools with their own curricula, methods, and terms (Brasil, 1961). In 1996, with the promulgation of the current LDB, Law No. 9394/96, EAD became possible at all levels and forms of education, allowing undergraduate and graduate courses, as well as in basic education (Mattos; Silva, 2019).

From 2005 to 2007, through decrees and ordinances, official documents marked public policies in EAD. In 2006, the Open University of Brazil (UAB) was created by Decree No. 5.800 (Brasil, 2006). UAB is a system focused on developing distance learning, aimed at democratizing access to teacher training courses and expanding the number of available higher education slots in the country. It comprises public institutions that offer undergraduate and graduate courses for segments of the population who have difficulty accessing conventional university education (Saldanha, 2018).

In 2009, additions were made to the LDB, allowing the use of EAD for initial, continuing, and teacher training. Between 2010 and 2016, the National Council of Education (CNE) analyzed several proposals to regulate the accreditation of non-educational institutions to offer specialization courses in both in-person and distance modalities. The CNE also established National Operational Guidelines for institutional accreditation and the offering of secondary education, vocational technical education, and youth and adult education (EJA) in distance learning, in collaboration with educational systems (Mattos; Silva, 2019).

In 2017, Decree No. 9.057 established new regulations for EAD, enabling the expansion of undergraduate and graduate courses at a distance in higher education institutions (IES). Additionally, the decree provided greater autonomy to institutions by allowing the accreditation of distance education programs without requiring prior accreditation for the offering of in-person courses (Brasil, 2017). After the decree's publication, the pace of creating new distance courses increased, and there was more flexibility in opening EAD hubs in the country (Nascimento, 2024). According to data from the 2022 Higher Education Census, the number of enrollments in distance undergraduate programs has substantially increased in recent years, having surpassed the historic mark of 3 million in 2022. On the other hand, the number of in-person enrollments has been decreasing since 2014, with the lowest figure recorded in 2021 in the past 10 years (Inep, 2023).

The current offering of EAD in Brazil results from both governmental and private initiatives aimed at implementing, expanding, and democratizing education over several decades, gaining momentum in the country with the publication of Decree No. 5.622, of December 19, 2005, which regulated Article 80 of the LDB and significantly boosted this modality (Brasil, 2005). For the first time, EAD took a prominent role in educational policies (Cruz; Lima, 2019). Policymakers at institutional and governmental levels have introduced EAD as a way to reduce the costs of educational resources, improve the educational system's capacity, reduce inequalities between age groups, and target educational campaigns at specific audiences (Moore; Kearsley, 2007).

Despite government efforts to consolidate the UAB System, the expansion process of higher education in Brazil is characterized by the advance of the private sector (Vieira, 2018). Starting in 2002, private institutions began to be accredited to offer EAD,

which had previously been provided by public institutions with the initial aim of training public school teachers through complementary courses (Sartori et al., 2017). According to Inep (2020), by 2019, students enrolled in distance courses represented 35% of the private higher education network.

EAD has become a profitable option for private institutions, as it can accommodate more students in the virtual learning environment, and the investments in teaching materials, infrastructure (such as classrooms, laboratories, and libraries), and human resources are lower (Cruz; Lima, 2019; Giolo, 2018). According to the 2022 EAD Census, among the variables that significantly impact the quality of EAD in Brazil are the human resources involved in content production, support activities for authorship, and teaching strategies and practices. Additionally, nearly 20% of public institutions, National Learning Services (Snas), and Non-Governmental Organizations (NGOs) lack fixed teams. In private institutions, this figure is less than 5% (Censo EAD.BR, 2022/2023).

Efforts to relax EAD regulations and facilitate its adoption by private institutions indicate an expansion favoring the educational market. This scenario contributes to the growth of a profitable educational space, restricting access to those with financial capacity (Silva, 2014). The focus on business interests raises concerns about the quality and sustainability of higher EAD in Brazil.

2.2 Performance in Distance Higher Education

Academic performance refers to the level of response a student is capable of based on what has been learned, meaning it is the product of various inputs (Araújo, 2021). "This result is presented individually, and its changes are related to the quality and quantity of inputs, which can be characterized by factors inherent to the individual, context, and school" (Santos, 2012, p. 19). The debate on quality in higher education has taken a central place on the educational policy agenda, especially due to the expansion in the number of higher education institutions, which results in different models of teaching and training (Andrade, 2011). Quality assessment instruments for education were introduced in Brazil in the 1990s and have since been improved to achieve efficiency in processes, aiming to meet objectives and quality standards (Santos, 2012, Araújo, 2021).

In 2004, Federal Law No. 10.861 was enacted, which established the National Higher Education Evaluation System (SINAES) to ensure the national evaluation of higher education institutions, undergraduate courses, and the academic performance of their students (Brasil, 2004). In addition to evaluating structural and pedagogical characteristics of institutions, SINAES assesses students' academic performance and other social and economic variables.

As an evaluation support, this system includes ENADE, one of its mechanisms for evaluating "the student's trajectory, based on learning potential (performance of incoming students), domain of the field, and professional competencies (performance of graduating students)" (Brito, 2008, p. 846). ENADE comprises a test (general knowledge questions), the student evaluation questionnaire for higher education (formerly the socioeconomic questionnaire), the course coordinator questionnaire, and the student's perception of the exam. Academic test scores not only indicate school quality but are also linked to family influences, peers, and other factors (Hanushek, 2021).

Evaluating students' academic progress is critical, as it is part of public policies aimed at understanding educational processes, not just for policymakers to establish indicators and rankings (Brito, 2008). With new social inclusion policies, it is essential for higher education institutions to have tools that allow them to understand the learning potential of incoming students (Caetano et al., 2015).

2.3 Theory of the Education Production Function (TEPF)

The production function is a conceptual construct used by economists to analyze firms' resource allocation decisions (Hanushek, 1987), in which a specific amount of products is produced for each set of inputs (Santos, 2012). This function, although widely used in the business domain, can also be applied in the context of education and higher education institutions (Klug, 2018). The production function "is a powerful pedagogical tool, as it provides a basis for describing efficient production, firms' appropriate responses to changes in technology or input costs, and so on" (Hanushek, 1979, p. 353).

Bowles (1970) and Hanushek (1987) argue for the application of this function in schools. According to them, the Educational Production Function (EPF) represents the relationship between the inputs (resources) of schools and students and an output measure (academic achievement). Santos (2012) considers a possible EPF where the academic performance (as a product) of students is explained by variables that influence it (personal characteristics, students' background, their families, and academic institutions) as inputs in this process. The author presents a broad version of the EPF, resulting from adaptations of studies by Bowles (1970), Summers and Wolfe (1977), Hanushek (1979), and Hanushek and Woessmann (2011):

$$T_{it} = f\left(F_i^{(t)}, P_i^{(t)}, R_i^{(t)}, I_i^{(t)}, A_i\right)$$

In this equation, the addition of the term *t* introduces time into the model; the term *i* indicates individual measurements; *T* represents the results of the educational production process (academic performance, generally measured by standardized tests); *F* stands for students' personal characteristics and backgrounds, as well as family

backgrounds; the factor *P* represents the peer effect; the term *R* refers to school resources or inputs; *I* represents the particularities of each educational institution and system; and, finally, *A* shows students' individual abilities. This study uses these variables to guide the proposed analysis.

In their studies within British secondary schools, Woodhall and Blaug (1968) discussed different ways of measuring educational outcomes to construct productivity indexes. When standardized tests are administered at the beginning and end of a course, the difference in scores offers an idea of the "added value" of the course, which can be used as an indicator of educational production. Moreover, variations in student performance can be associated with different input variables, allowing for the determination of the influence of certain factors on student performance.

Previous studies on academic performance in higher education have been conducted based on contributions from the EPF Theory. Santos (2012) observed that individual and institutional characteristics, such as age, gender, ethnicity, dedication, marital status, siblings, income, parental education, participation in extension activities, and scientific initiation, affect the academic performance of accounting students. Ferreira (2015) also identified similar variables that impact the performance of accounting students, such as gender, income, marital status, ethnicity, type of high school, scholarships, study hours, scientific initiation, and tutoring.

Miranda et al. (2015) analyzed research in Business courses, highlighting that factors related to the student body, such as socioeconomic status, absenteeism, previous academic performance, and motivation, are the most explanatory of academic performance. Rodrigues et al. (2016) investigated the effect of individual and institutional characteristics on the ENADE performance of distance learning students, identifying significant variables such as gender, marital status, ethnicity, income, scholarships, high school type, study hours, and support center conditions.

Rocha, Leles, and Queiroz (2018) analyzed the existence of an association between the performance of graduating Nutrition students in the Enade and socioeconomic factors, academic trajectory, and the profile of the institution. The authors identified lower performance among Black students who work occasionally, have a family income of up to three minimum wages, have parents with no formal education, attended half of high school in public school and half in private school, received scholarships or funding, and did not enter higher education through affirmative action policies. The administrative category of higher education institutions was the main factor associated with ENADE performance. Students who entered through affirmative action policies performed better than those who did not. It was noted that adequate conditions in elementary and secondary education are essential to ensure equal competition for access to higher education.

In their research, Meurer and Pereira (2020) analyzed the relationship between high performance in ENADE and the training conditions of Accounting students, finding that satisfaction with the didactic-pedagogical organization and the infrastructure of educational institutions increases the probability of superior performance. Factors such as graduating from public higher education institutions, being male, having parents with higher education, and receiving free education also enhance performance. Araújo (2021) studied the effect of the teaching modality on the performance of accounting students and concluded that the modality alone is inconclusive but interacts significantly with characteristics such as age, course shift, ethnicity, and income.

In this study, ENADE will be used as the measure to assess the product of the EPF, as it is a "specific test," administered at the end of the academic trajectory of undergraduate students and equally taken by students across the country, respecting specific content, under the same environmental conditions (Araújo, 2021). According to Woodhall (1987), the economic techniques used to evaluate the relationship between inputs and outcomes allow for: comparing the efficiency of different methods to achieve the same goal through cost-effectiveness analysis; making comparisons between schools or educational systems with similar costs, identifying those that achieve the best results with a given amount of resources; and evaluating the productivity of education, viewed as the quality of education.

The use of the production function in the planning of educational policies aims to efficiently allocate available resources and provide HEIs the opportunity to verify whether the opportunity costs and expected benefits from implementing a particular policy are being met (Bowles, 1970).

The explanation of academic performance from the perspective of the EPF in this research is divided into variables related to personal characteristics, family and socioeconomic factors of students, and variables related to the educational institution. According to Araújo (2021, p. 33), "despite the synthesis in constructs, the study of the EPF does not present a taxative list of variables influencing student performance, as there are certainly other variables of influence that have not yet been identified and measured." Considering that the TEPF recognizes the relevance of institutional factors, student, and faculty characteristics as inputs for academic performance, this study proposes the following research hypothesis:

H1: The academic performance of distance learning undergraduate students is influenced by personal, family, socioeconomic factors, and peculiarities of the educational system.

3 Methodology

This article was developed with the objective of analyzing the factors associated with the performance of students in undergraduate EAD courses. To this end, micro-data from the 2017 ENADE provided by INEP, part of the Ministry of Education (MEC), were used (Inep, 2022).

In 2017, the total number of EAD students evaluated by ENADE was 114,607, of which more than 91% were in undergraduate teaching courses. Although the study sample consisted of 104,930 students, the final number of observations was 81,728 due to missing data for some variables, as shown in Table 1. The outcome variable, which represents the overall student performance on ENADE, had the fewest observations (83,914).

Regarding sample stratification, the percentage of students per course was as follows: 3.83% in Mathematics; 6.53% in Languages — Portuguese, English, and Spanish —; 0.45% in Physics; 0.58% in Chemistry; 3.29% in Biological Sciences; 65.92% in Pedagogy; 5.28% in History; 2.36% in Visual Arts; 2.65% in Geography; 1.96% in Philosophy; 5.10% in Physical Education; 0.46% in Computer Science; 1.05% in Music; and 0.58% in Social Sciences (INEP, 2017).

To fulfill the study's proposed objective, the dependent variable used was students' academic performance, measured by the total score achieved on the ENADE exam. The independent variables were divided into: i) **students' personal characteristics** (age, gender, self-declared race/ethnicity, weekly hours dedicated to the course/study); ii) **students' family and socioeconomic factors** (family income, whether enrolled in a professional or regular course, type of high school attended, father's education level, and mother's education level); iii) **peer effect** (marital status); iv) **peculiarities of the educational system** (administrative category of the institutions, whether private or public, and region of the course — 1: North / 2: Northeast / 3: Southeast / 4: South / 5: Midwest).

The selection of variables used in the study was based on the relevant literature on the subject, as well as the availability of data that allowed for the research's design. The details of these variables are presented in chart 1 below.

Chart 1 – Description of the Variables Used in the Model

Variable		Description	Fonte	Embasamento Teórico
Dimension	**Variable**			
Dependent Variable	ENADE_Score	Overall student performance in ENADE.	INEP (2017)	Santos (2012); Caetano et al. (2015); Ferreira (2015)

Personal Characteristics	Age	Variable indicating the student's age when they took the ENADE exam, in years.		Santos (2012); Caetano et al. (2015); Ferreira (2015); Meurer and Pereira (2020)
	Gender	Dummy variable identifying the student's gender, where 1 is male and 0 is female.		Santos (2012); Caetano et al. (2015); Ferreira (2015); Rodrigues et al. (2016); Rocha, Leles, and Queiroz (2018); Meurer and Pereira (2020)
	Race/Ethnicity	Categorical variable representing the student's race/ethnicity: 1 for White, 2 for Black, 3 for Asian, 4 for Mixed race, 5 for Indigenous, and 6 for Not declared.		Santos (2012); Caetano et al. (2015); Ferreira (2015); Rodrigues et al. (2016)
	Study Hours	Variable representing the number of weekly hours dedicated to study, excluding class time. Categories: 1 for one to three hours; 2 for four to seven hours; 3 for eight to twelve hours; 4 for more than twelve hours.		Santos (2012); Ferreira (2015)
Family and Socioeconomic Factors	Family Income	Variable representing the total family income in minimum wages, where: 1 for up to one and a half wages; 2 for one and a half to three; 3 for three to four and a half; 4 for four and a half to six; 5 for six to ten; 6 for ten to thirty; 7 for more than 30 minimum wages.		Santos (2012); Ferreira (2015); Rodrigues et al. (2016)
	Housing	Categorical variable identifying where and with whom the student lives: 1 for living alone in a house or apartment; 2 for living with parents and/or relatives; 3 for living with spouse and/or children; 4 for living with others; 5 for living in a university dormitory; 6 for living in other types of individual or shared accommodation (hotel, boarding house, etc.).		Exploratory

	Number of Household Members	Variable representing the number of family members living with the student: 1 for none, 2 for one, 3 for two, 4 for three, 5 for four, 6 for five, 7 for six, 8 for seven or more.		Exploratory
	Financial Situation	The student's financial situation: 1. No income, and expenses are covered by government programs. 2. No income, and expenses are covered by family or others. 3. Has income but receives financial help from family or others. 4. Has income and does not need financial help. 5. Has income and contributes to the family's livelihood. 6. Is the main provider for the family.		Santos (2012); Ferreira (2015)
	Work	Student's work status: 1 for not working; 2 for working; 3 for working up to 20 hours a week; 4 for working 21 to 39 hours a week; 5 for working 40 hours a week or more.		Miranda et al. (2015); Ferreira (2015)
	Type of School	Type of school where the student completed high school: 1. Entirely in public school; 2. Entirely in private school; 3. Entirely abroad; 4. Mostly in public school; 5. Mostly in private school; 6. Part in Brazil and part abroad.		Exploratory
	High School Mode	High school mode attended: 1. Traditional; 2. Technical; 3. Teacher Training; 4. Adult Education (EJA); 5. Other.		Exploratory
	Family Member with Higher Education	Dummy variable identifying if someone in the family has completed higher education: 1 for yes, 0 for no.		Carmargo et al. (2016)

Peer Effect	Marital Status	Categorical variable representing the student's marital status: 1 for single; 2 for married; 3 for divorced; 4 for widowed; 5 for other.		Santos (2012); Ferreira (2015); Caetano et al. (2015); Rodrigues et al. (2016)
Educational System Characteristics	Administrative Category	Administrative category of the institution: 1 for Federal Public; 2 for State Public; 3 for Municipal Public; 4 for Private.		Santos (2012); Caetano et al. (2015); Ferreira (2015)
	Region	Region where the course is offered: 1 for North; 2 for Northeast; 3 for Southeast; 4 for South; 5 for Central-West.		Exploratory

Source: Prepared by the authors

Multiple linear regression, estimated using Ordinary Least Squares (OLS), was employed to determine the explanatory factors for students' overall performance on the ENADE exam. The purpose of the model resulting from the use of this technique is to predict changes in the dependent variable in response to changes in the independent variables, based on the magnitude of the effect of the explanatory variables (Daniels; Minot, 2020; Fávero, 2015; Hair *et al.,* 2005). The software Excel© and STATA 17 were used as tools for data adjustment and for the statistical analyses.

To meet the assumptions of OLS, the following tests were performed: i) VIF test, which resulted in the elimination of the variables type of housing and financial situation due to high collinearity; ii) Breusch-Pagan test, which revealed the presence of heteroskedasticity, leading to the use of robust errors in the estimates (Daniels; Minot, 2020); iii) Swilk test, which did not confirm that the residuals conformed to a normal distribution. This issue was mitigated by the robustness of the analysis, substantiated by the large sample size used in the study, as emphasized by Hair *et al.* (2005), who noted that in large samples, the effects of nonconformity can be overlooked.

4 Discussion of results

In this section, Table 1 presents the results concerning the independent variables. Analyzing the variables employed in the model and their respective estimated coefficients, the personal characteristics of the students are variables that express characteristics inherent to the students themselves, whether internal or external (Ferreira, 2015). According to the results presented, the higher the average age of the students, the lower the average performance. This finding corroborates the studies of Uyar and Güngörmus (2011), Araújo (2021), and Meurer and Pereira (2020), which indicate that

a student's age has a negative influence on their performance; thus, the older the student, the lower the performance. Santos (2012) and Ferreira (2015) relate age to academic responsibility, an important factor in Distance Education. A possible justification for this may lie in the fact that older students tend to have more responsibilities than younger ones, as they may have a job and/or a family, thereby being unable to dedicate themselves as fully as they would like.

Table 1 - Summary of Variable Statistics Performance

Desempenho				
Variable	Observations	Variable Details	Coefficients	Standard Error
Age	104930	Years.	-0.123***	-0.006
Gender	104930	Male.	-	-
		Female.	-0.057	0.134
Race	88120	White.	-	-
		Black.	-0.467***	0.173
		Yellow.	-1.545***	0.314
		Brown.	-1.313***	0.103
		Indigenous.	-3.673***	0.770
		Not declared.	2.546***	0.365
Study Hours Outside the Classroom	88120	None.	-	-
		One to three.	2.805***	0.267
		Four to seven.	4.932***	0.272
		Eight to twelve.	6.186***	0.291
		More than twelve.	6.598***	0.305
Family Income	88120	Up to 1.5 minimum wage (up to R$ 1,405.50).	-	-
		From 1.5 to 3 minimum wages (R$ 1,405.51 to R$ 2,811.00).	2.968***	0.116
		From 3 to 4.5 minimum wages (R$ 2,811.01 to R$ 4,216.50).	5.904***	0.142
		From 4.5 to 6 minimum wages (R$ 4,216.51 to R$ 5,622.00).	7.903***	0.205
		From 6 to 10 minimum wages (R$ 5,622.01 to R$ 9,370.00).	11.023***	0.237
		From 10 to 30 minimum wages (R$ 9,370.01 to R$ 28,110.00).	13.516***	0.396
		Above 30 minimum wages (more than R$ 28,110.00).	14.262***	1.673
Employment Status	88120	Not working.	-	-
		Occasionally working.	-1.097***	0.196
		Working up to 20 hours per week.	-0.616***	0.166
		Working 21 to 39 hours per week.	1.670***	0.158
		Working 40 hours per week or more.	0.168	0.126

Desempenho				
Variable	Observations	Variable Details	Coefficients	Standard Error
Number of People Living with the Student	88120	None.	-	-
		One.	-1.234***	0.259
		Two.	-2.282***	0.250
		Three.	-3.032***	0.250
		Four.	-4.274***	0.258
		Five.	-4.863***	0.288
		Six.	-5.036***	0.360
		Seven or more.	-5.090***	0.395
Type of School Attended for High School	88120	Entirely public school.	-	-
		Entirely private school.	4.179***	0.193
		Entirely abroad.	2.103	1.712
		Mostly public school.	0.249	0.226
		Mostly private school.	2.079***	0.318
		Partly in Brazil and partly abroad.	7.352***	2.071
High School Modality	88120	Traditional high school.	-	-
		Technical vocational (electronics, accounting, agriculture, other).	2.407***	0.190
		Teaching vocational (Normal Course).	1.867***	0.137
		Youth and Adult Education (EJA) and/or supplementary.	-2.245***	0.147
		Other modality.	0.106	0.376
Family Member with a Higher Education Degree	88120	No family member has a higher education degree.	-	-
		At least one family member has a higher education degree.	0.266***	0.096
Marital Status	88120	Single.	-	-
		Married.	0.659***	0.110
		Divorced.	1.168***	0.206
		Widowed.	-1.210**	0.493
		Other.	2.085***	0.195
Administrative Category	104930	Private.	-	-
		Federal Public.	2.589***	0.187
		State Public.	4.632***	0.263
		Municipal Public.	3.415***	0.686
Region	88120	North.	-	-
		Northeast.	0.840**	0.309
		Southeast.	4.974***	0.252
		South.	4.162***	0.249
		Midwest.	2.112***	0.295
		Constant.	34.332***	0.484
		Observations.	81,728	
		R^2.	0.1500	
		Adjusted R^2.	0.1495	

Source: Research results. S.E.: Standard Error. Notes: ***Statistically significant at 1%. **Statistically significant at 5%.

Regarding "gender," the findings of the research indicated that there are no significant differences in grades. This contrasts with the findings of Santos (2012), Caetano et al. (2015), Ferreira (2015), Meurer and Pereira (2020), and Rodrigues et al. (2016), who found that male students performed better than female students, while Campbell (2007) demonstrated that female students exhibited better academic performance. Studies by Monroe, Moreno, and Segall (2011) and Rocha, Leles, and Queiroz (2018) found no significant differences between the genders. It is observed that empirical research on gender continues to diverge concerning the results obtained and whether this variable affects academic performance (Miranda et al., 2015; Ferreira, 2015). The context in which the student is situated may influence the behavior of these variables (Seow, Pan, & Tay, 2014). It is pertinent to state that further studies are needed to clarify these contradictions.

Concerning "color/ethnicity," it was identified that individuals self-declared as black, yellow, brown, and indigenous, on average, have lower grades than students self-declared as white. Similar results were found by Santos (2012), Ferreira (2015), Rodrigues et al. (2016), and Araújo (2021). When analyzing the effects of ethnicity, one must consider both the socioeconomic and personal issues of the students, given Brazil's historical process regarding social inequality and the disparities in opportunities that black, brown, and indigenous individuals have faced over the years and which still persist. Soligo (2021), in her study aimed at tracing the socioeconomic profile of students and the characteristics of institutions in the context of EAD through the lens of ENADE, alerts that only 5.87% of students entered the educational system through public policy based on Ethnic-racial criteria. In other words, despite the increase in inclusion policies (such as quotas and affirmative action), much remains to be done to reduce racial inequality in the educational system. Courses of varying prestige carry different tuition costs, leading to segregation among students of lower socioeconomic status and affecting the class of black and brown students (Barbosa, 2019). Finally, students who did not declare their color exhibited higher coefficients than white students.

With respect to the variable "study hours outside the classroom," the results indicated that students who dedicate 1 to 3 hours per week to studying outside the classroom tend to achieve better academic performance than students who do not allocate this additional study time. As expected, as study hours increase, the average student performance rises; that is, the more hours devoted to studies, the greater the likelihood of obtaining higher grades. It is observed that the difference between dedicating 8 to 12 hours and more than 12 hours weekly is not substantial, suggesting a saturation point. These results corroborate those found by Santos (2012), Ferreira (2015), and Rodrigues et al. (2016). The personal effort of the student is one of the

most significant variables influencing their performance in higher education (Ibrahim, 1989; Freitas, 2004).

Concerning the family and socioeconomic factors of students, the family income of the student was initially analyzed. It is important to note that in 2017, the Minimum Wage (SM) was R$ 937.00. The results demonstrate a positive effect of income on student performance, such that as income increases, student performance also improves. Santos (2012), Ferreira (2015), and Rodrigues et al. (2016) found similar results.

Regarding the variable "employment," it was shown to be statistically significant for those working up to thirty-nine hours per week. Students who "work occasionally" and "those with a workload of up to twenty hours per week" had lower grades compared to those who "do not work." In turn, students with "a work schedule of 21 to 39 hours per week" demonstrated higher chances of achieving high performance on ENADE. This last result corroborates the studies of Miranda et al. (2015), Ferreira (2015), and Meurer and Pereira (2020). Masasi (2012) found that working has a positive correlation with academic performance, and professional experience may provide students with prior knowledge, facilitating the learning process.

Concerning housing, distance education is a method that facilitates and enhances access to education for a broad range of individuals, allowing for simultaneous participation (Costa, 2019). Nonetheless, the variable "number of people living with the student" indicates that the greater the number of individuals residing with the student, the lower the probability of achieving higher grades. According to Soligo (2021), it is important to consider that there exists a profile of EAD students, characterized as a "young adult" who needs to carve out "space" in their daily life to dedicate some time to reading and completing assignments, and thus will have to "negotiate" with those closely tied to the family circle within the residential environment. (Litto & Formiga, 2012).

Regarding the variable "high school," students who completed all of their secondary education in public schools tend to have lower academic performance than those who completed this level of education, entirely or in part, in private schools. This result corroborates the findings of Rodrigues et al. (2016) and Ferreira (2015). There is a "close relationship between this variable and income, as those with more financial resources tend to study in private schools, thereby having greater opportunities to enter public higher education" (Ferreira, 2015, p. 97). Conversely, low-income students, who generally attend high school in public schools, tend to enroll in private higher education institutions, which may represent a lower level of opportunity (Ferreira, 2015).

The results obtained for the variable "type of high school" showed that students who attended traditional high school tend to perform better than those who attended high school in the Youth and Adult Education (EJA) and/or supplemental modalities. However, students who attended traditional high school tend to have lower academic

performance compared to those who attended technical or teaching vocational high schools. This result confirms the findings of Ferreira (2015) and contradicts the results found by Rodrigues et al. (2016), who identified the opposite, indicating that students who attended traditional high school tend to have superior academic performance compared to those who attended vocational or teaching high schools.

Regarding the "educational attainment of family members," in general, students with at least one family member who has completed higher education have a higher probability of achieving better performance than those students without any family members holding a higher education degree. Generally, studies on this topic show positive effects of parental education (Hanushek & Woessmann, 2011) on student academic performance, and the literature indicates that parental education is directly related to income-related issues (Mendonça & Barros, 1997).

Also in Table 1, it is possible to observe the results regarding the variable "marital status," which aimed to capture the effects of peers on student performance. The results indicated that single students in EAD tend to perform better than widowed students, but exhibit lower academic performance compared to married and divorced students. These results were also found by Ferreira (2015), Santos (2012), and Rodrigues et al. (2016), opposing the findings of Masasi (2012), which demonstrated that marital status does not directly affect student academic performance. Miranda et al. (2015) warns of the divergences found in international literature regarding the variables of gender and marital status, hindering conclusive analysis.

Finally, addressing the particularities of the educational system, concerning the variable "administrative category," the results indicate that in the EAD modality, the average performance of students from public institutions of higher education tends to be superior to that of students from private institutions. This result contributes to those found by Caetano et al. (2015), Ferreira (2015), Meurer and Pereira (2020), and Araújo (2021). Santos (2012) found no significance for affiliation with public institutions in 2002, but found such significance in 2003 and 2006.

A close relationship can be observed among the variables "family income," "high school" (public or private school), and "administrative category" (graduation from public or private institutions). Students with higher family income tend to attend high school in private institutions and subsequently enroll in public higher education institutions. Consequently, they tend to perform better than those with lower income who did not have the same opportunities.

Furthermore, concerning the variable "region," students from the South and Southeast regions tend to demonstrate superior academic performance compared to students from other regions, while the North region is noted for the lowest academic performance. Similar findings were reported by Santos (2012), Ferreira (2015), and Araújo (2021). A possible inference can be explained by Soligo (2021) in her study of the

socioeconomic profile of students and the characteristics of institutions in the context of distance education. The author noted that in regions where it is understood that there are more needy students, paradoxically, there are fewer EAD students; that is, in the Northeast, Midwest, and North regions of Brazil, demonstrating the persistence of significant regional inequalities in the country.

Finally, it is observable in Table 1 that the R^2 (model fit) was 0.1500, indicating that the variables used in the study explain 15% of the variations in students' grades on ENADE. It must be acknowledged that this result does not reflect a high predictive adjustment. By incorporating some variables that have been less explored in the literature (Table 1), the study aims to provide relevant theoretical and practical contributions to the field and, in this aspect, makes a trade-off with lower predictability. These variables provide relevant information for educational policymakers and offer an overview of the performance of existing policies, revealing weaknesses and aspects that should be considered, even though they are not, strictly speaking, the ones offering the best predictions, which is not the primary focus of this study.

5 Final Considerations

In order to encourage academic and political debate regarding access to quality higher education and the increasing availability of distance learning, this study aimed to analyze the factors associated with the academic performance of students in teacher education courses offered in both public and private higher education institutions in Brazil, supported theoretically by the FPE model. To achieve this, multiple linear regression was employed, estimated by Ordinary Least Squares.

Regarding the results of this study, personal, familial, socioeconomic factors, and peculiarities of the educational system showed a significant relationship with academic performance, thereby confirming the study's hypothesis. It was concluded, based on the statistical tests conducted, that the grades from public HEIs tend to have a higher average performance compared to those from private HEIs.

In addition to the characteristics of the institution, other factors directly influenced student performance, among which the student's age, family income, family background, geographic region of the HEI, the student's work hours, and study hours are particularly noteworthy. These elements are relevant as they highlight that the characteristics of HEIs cannot be overlooked; however, they are insufficient to ensure effectiveness in the teaching-learning process.

The distance learning model was created for working individuals; nevertheless, the Brazilian educational model is built under the premise of exclusive dedication.

Consequently, the greatest gap for theoretical and practical advancements in the sector is the confirmation of the influence of occupational workload on the quality of higher education. The results of the multiple regression analysis indicated that students who need to work more than 20 hours per week have higher chances of achieving high performance on ENADE in the EAD modality. The act of working (in the case of teacher education courses, having to teach, perform teaching internships, or work within the educational system) may have a positive relationship with academic performance, and professional experience can provide students with prior knowledge, facilitating the learning process.

Another finding pertains to the variable "number of people living with the student," which demonstrated that the greater the number of individuals residing with the student, the lower the likelihood of attaining higher grades. Lastly, some divergences were found that have already been noted in the international literature regarding the variables "gender" and "marital status," hindering conclusive analysis. Therefore, further studies are necessary concerning these variables.

EAD has been seen as a privileged modality for promoting democratization and expanding education, as well as for driving social transformation through education. However, it is essential to analyze the results of this policy concerning the quality of education and the promotion of equity in access to higher education, in order to foster social justice and contribute to the reduction of inequalities in their multiple forms.

For future research, it is suggested to include studies on variables such as: motivation, aptitude for the field, anxiety levels, sleep hours, learning styles, technological resources, classroom infrastructure at EAD support centers, digital teaching resources, materials provided to students, extension activities, research activities as learning strategies, recommendations for books, chapters and/or handouts, academic qualifications, pedagogical training, professional experience, and faculty work regimes, which, in some cases, are not addressed in the ENADE questionnaire but are highlighted in the literature as determinants of academic performance.

Additionally, it is crucial to conduct research investigating the relationship between receiving scholarships or funding, admission through affirmative action policies, and academic performance, as understanding the context of these students provides socially relevant contributions, supplying foundations for more effective public policies.

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