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ARTICLE

THE ACCESS OF THE STUDENT WITH VISUAL IMPAIRMENT TO HIGHER EDUCATION: MICRODATA ANALYSIS OF THE NATIONAL HIGH SCHOOL EXAMINATION

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ABSTRACT: The Brazilian National High School Examination (called ENEM) is the main instrument of access to Brazilian Higher Education, and its results are also used by public policies for state-subsidized places. Thus, this study aimed to analyze the access to Higher Education of people with visual impairments (PwVi), to investigate factors related to academic performance in the ENEM large-scale assessment, through the analysis of microdata from the 2017 and 2018 editions. Based on the exploratory research methodology, with a quantitative approach, this study investigated the participation, socioeconomic and demographic characteristics, and the performance of PwVi in the exam compared to participants without disabilities, to identify vulnerabilities in the access of the PwVi to Higher Education. The results showed the low participation of PwVi in the exam, in addition to the fact that they have lower family income, older age, less female participation, and less concentration in the South and Southeast regions of Brazil to participants without disabilities. The performance analysis points out that the PwVi had similar results to people without disabilities, thus demystifying the concept of incapacity related to people with disability. However, the results varied according to the severity of the disability, signaling possible accessibility issues in the exam, thus jeopardizing participants with more severe visual impairment. It was concluded that the education policies of access to Higher Education, which use the ENEM score, do not apply to part of this population, excluded from the benefits of Higher Education subsidized by the State.

Keywords: special education, large-scale evaluation, digital accessibility, Brazilian National High School Examination, people with visual impairment.

O ACESSO DO ESTUDANTE COM DEFICIÊNCIA VISUAL À EDUCAÇÃO SUPERIOR: ANÁLISE DOS MICRODADOS DO EXAME NACIONAL DO ENSINO MÉDIO (ENEM)

RESUMO: O Exame Nacional do Ensino Médio (Enem) é o principal instrumento de acesso à Educação Superior brasileira, sendo seus resultados também utilizados por políticas públicas para ofertas de vagas subsidiadas pelo Estado. Assim sendo, objetivou-se, neste estudo, analisar o acesso à Educação Superior da pessoa com deficiência visual (PcDv), no intuito de investigar fatores relacionados aos rendimentos acadêmicos na avaliação em larga escala do Enem, por meio da análise de microdados das edições de 2017 e 2018 do exame. Com base na metodologia de pesquisa exploratória, com abordagem quantitativa, este estudo investigou a participação, as características socioeconômicas e demográficas e o desempenho das PcDv no exame em comparação aos participantes sem deficiência, com a finalidade de identificar vulnerabilidades no acesso das PcDv à Educação Superior. Os resultados evidenciaram a baixa participação de PcDv no exame, além de estes possuírem menor renda familiar, idade mais avançada, menor participação do sexo feminino e menor concentração nas regiões Sul e Sudeste em relação aos participantes sem deficiência. A análise de desempenho apontou que as PcDv tiveram resultados similares às pessoas sem deficiência, desmistificando, assim, o conceito de incapacidade relacionado à pessoa com deficiência. No entanto, os resultados variaram conforme a severidade da deficiência, sinalizando possíveis questões de acessibilidade no exame, prejudicando, desse modo, os participantes com deficiência visual mais severa. Concluiu-se que as políticas educacionais de acesso à Educação Superior, que utilizam a nota do Enem, não se aplicam à parte dessa população, excluída dos benefícios da Educação Superior subsidiada pelo Estado.

Palavras-chave: educação especial, avaliação em larga escala, acessibilidade digital, Enem, pessoa com deficiência visual.

EL ACCESO DEL ESTUDIANTE CON DISCAPACIDAD VISUAL A LA EDUCACIÓN SUPERIOR: ANÁLISIS DE LOS MICRODATOS DEL EXAMEN NACIONAL DE LA ENSEÑANZA SECUNDARIA

RESUMEN: El Examen Nacional de la Enseñanza Secundaria (ENEM) es el principal instrumento de acceso a la Educación Superior brasileña, siendo sus resultados también utilizados por políticas públicas para ofertas de vacantes subsidiadas por el Estado. Así siendo, el objetivo, en este estudio, fue analizar el acceso a la Educación Superior de personas con discapacidad visual (PcDv), con la intención de investigar factores relacionados con los rendimientos académicos en la evaluación a gran escala del ENEM, por medio del análisis de microdatos de 2017 y 2018 del examen. Con base en la metodología de investigación exploratoria, con enfoque cuantitativo, este estudio investigó la participación, las características socioeconómicas y demográficas y el desempeño de las PcDv en el examen en comparación con los participantes sin discapacidad, con el fin de identificar vulnerabilidades en el acceso de las PcDv a la Educación Superior. Los resultados mostraron baja participación de PcDv en el examen, además de que estos poseen menor renta familiar, edad más avanzada, menor participación del sexo femenino y menor concentración en las regiones Sur y Sureste, en relación a los participantes sin discapacidad. El análisis de desempeño señaló que las PcDv tuvieron resultados similares a las personas sin discapacidad, desmitificando así el concepto de incapacidad relacionado con las personas con discapacidad. Sin embargo, los resultados variaron según la severidad de la discapacidad, señalando posibles cuestiones de accesibilidad en el examen, perjudicando, de ese modo, a los participantes con discapacidad visual más severa. Se concluyó que las políticas educativas de acceso a la Educación Superior, que utilizan la puntuación del ENEM, no se aplican a la parte de esta población, excluida de los beneficios de la Educación Superior subsidiada por el Estado.

Palabras clave: educación especial, evaluación en gran escala, accesibilidad digital, ENEM, persona con discapacidad visual.

INTRODUCTION

Currently, according to the World Health Organization - WHO (2011), we have a population of more than one billion people with some type of disability in the world. Thus, in recent decades, several actions, international treaties, laws, and public policies, among other mechanisms, have been designed and implemented in favor of people with disabilities (PwD), to guarantee the right to equity and a life with dignity, independence, and autonomy (BRASIL, 1996, 2009a). The Brazilian Law for the Inclusion of Persons with Disabilities (LBI) - Law number 13,146, of July 6, 2015, defines, in its Art. 2, the PwD as the person with long-term impediments that due to barriers in access or obstacles in social interaction (for example barriers in communication, access to accessibility, access to information), can prevent "[. ..] their full and effective participation in society on an equal basis with other people" (BRASIL, 2015, p. 2).

Regarding education in Brazil, the LBI determines, in Art. 27, of Chapter IV – On the right to education – that: "Education is a right for PwD, ensuring an inclusive education system at all levels and lifelong learning" (BRASIL, 2015, p. 4). In this way, LBI ensures the PwD's right to education, including higher education. LBI also clarifies, in its Art. 28, that the public power must ensure, develop, monitor, and evaluate the inclusive education system, guaranteeing conditions of access and permanence (BRASIL, 2015). Thus, the monitoring instruments of the educational system must contemplate the participation and performance evaluation of people with disabilities.

In Brazil, the National High School Examination (*Exame Nacional do Ensino Médio* - Enem), created in 1998, is a very important university selection process, and its score is adopted for the selection of vacancies by all Higher Education Institutions (HEI) federal institutions, by other state public HEIs and several private HEIs, as well as by Portuguese universities (BRASIL, 1998; INEP, 2018c). Due to the importance of Enem for access to Higher Education, this study adopted the exam data as indicators of participation and performance of PwVi for access to Higher Education. In the 2018 Enem edition, for PwVi to take the exam, according to the National Institute of Educational Studies and Research Anísio Teixeira – Inep[1] (2018a), the following options for accessibility resources and specialized services were made available:

> exam in Braille, translator and interpreter of Brazilian Sign Language (Libras), video test in Libras (video with the translation of items in Libras), test with enlarged letters (18-size font and with enlarged figures), proof with the super-enlarged font (24-point font and enlarged figures), guide-interpreter for people with deafblindness, reader, transcriber, lip-reading, additional time, easily accessible room and/or accessible furniture [...]. (INEP, 2018a, p. 55).

Several studies have pointed to the evolution of PwD access in Higher Education since their entry into Brazilian universities has grown significantly in recent years (CABRAL; ORLANDO; MELETTI, 2020; MARTINS; LEITE; LACERDA, 2015; SANTOS, 2011; SILVA; MELETTI, 2014). According to data collected from Inep, between 2009 and 2018, the number of students with disabilities grew by 257% (CABRAL; ORLANDO; MELETTI, 2020). However, despite the expressive growth, the number of people with disabilities in Higher Education in Brazil is less than 1% of the vacancies offered (CABRAL; ORLANDO; MELETTI, 2020; DUARTE et al., 2013).

To compensate for inequality in university selection processes, a *positive discrimination* practice[2] used is the affirmative policy of quotas in private universities for students who graduate from public schools and black people. It was adopted by some universities for admission of PwD and became mandatory in federal universities, as of 2018 (CARRIERI; ESPÍNDOLA, 2012; GOMES; SILVA, 2003). However, a survey carried out in four federal universities that adopted the quota system for more than three years revealed that less than 1% of the quotas offered were occupied (CARRIERI; ESPÍNDOLA, 2012). It is essential to point out that admission through the vacancy reservation system included the

[1] Regarding educational indicators for monitoring performance, Inep is the body responsible for elaboration, by the application of ENEM and by the availability of the information of the participation and the result of the exam, as well as data on the socioeconomic profile of those enrolled (INEP, 2018a).

[2] "Positive discrimination can be defined '[...] as a temporary differentiation of legal treatment, with the aim of favoring a certain group over another, to compensate for a de facto preexisting inequality between them'" (MÉLIN-SOUCRAMANIEN , 1997 apud GOMES; SILVA, 2003, p. 137).

PwD, effectively, only in 2018 (BRASIL, 2012, 2017). Until then, there were specific initiatives from each university, through internal deliberations.

Inep provides detailed information on student participation in several large-scale exams through Inep's Microdata *(Microdados do Inep)* [3], such as the National Student Performance Exam (*Exame Nacional de Desempenho dos Estudantes* - Enade), the National Exam for the Certification of Youth and Adult Competencies (*Exame Nacional para Certificação de Competências de Jovens e Adultos* - Encceja), among others, as well as information about the performance of the participant in the Enem. Inep makes available the Enem microdata for each edition of the exam, which has a set of information, per participant, covering general information about the exam, data from the test location, the participant's characterization, the participant's school, the type of disability and specialized educational assistance (*atendimento educacional especializado* - AEE) – requested by PwD and people with disorders, and specific assistance – requested by pregnant and lactating women, among others – and the scores of objective questions and essays. To characterize the participant, the following information on the participant appears in the microdata: participant's place of residence and birth, age, gender, race-ethnicity, type of school, type of education, and data on completion of high school. The most recent versions of the Enem microdata (2017 and 2018) also have more detailed information and include socioeconomic level, with information on family income, and family education, among other self-declared information in the exam participant's registration.

Regarding the quality of the information in the Enem microdata, several studies have pointed out inconsistencies (BRIEGA, 2017; MELLO NETO et al., 2014; SANTOS, 2019; SILVA; MELETTI, 2014). In the study by Silva and Meletti (2014), which showed data limited to one municipality, the authors pointed out the reduction of the initial scope of the research due to the barriers found in the use of microdata, such as the discontinuity of information between editions of the tests, the lack of unique student identifier across assessments and inconsistencies in microdata information. In another study, the authors reported difficulties in analyzing family income, which was "[...] defined by arbitrary income range, varying from year to year" (MELLO NETO et al., 2014, p. 116). Junqueira, Martins, and Lacerda (2017) observed that the process for collecting information in the exam registration influences the quality of the microdata, such as the type of disability or the requested accessibility feature.

Related works presented studies with the analysis of the result of educational policies for the inclusion of PwD using participation indicators, profile analysis, and performance of people with disabilities obtained in large-scale evaluations (BRIEGA, 2017; JUNQUEIRA; MARTINS; LACERDA, 2017; OLIVEIRA; BARWALDT; LUCCA, 2020; SILVA; MELETTI, 2014). In the study by Silva and Meletti (2014), microdata from the Enem, the School Census, and the Prova Brasil were analyzed to assess the participation and performance of the Special Education target audience, specifically in the city of Londrina, Paraná, in 2007 and 2008. The authors addressed variables existing in the Enem microdata, such as type of disability or disorder, participation in the test, gender, race-ethnicity, age, and performance, comparing the results of participation and performance between candidates with different types of disability or pervasive developmental disorder (SILVA; MELETTI, 2014).

The study by Junqueira, Martins, and Lacerda (2017) analyzed the process of differentiated service available in Enem for PwD to take the exam and investigated the microdata, at the national level, of two editions of the Enem. The study results showed comparisons of the participation of the candidate with a disability in the exam compared to the other participants without a disability and between the subgroups of candidates with different types of disabilities. The authors pointed to an evolution in the number of PwD in the exam, but they pointed out the need to correct issues identified throughout the process of differentiated care for PwD, observed from the initial stage, with the elaboration of the items and the accessible test, until the performance and the correction of the exam, proposing the creation of an observatory with the participation of researchers and representatives of PwD, to monitor and improve accessibility in the exam (JUNQUEIRA; MARTINS; LACERDA, 2017).

[3] "Inep's microdata constitute the lowest level of disaggregation of data collected by surveys, assessments and exams carried out. The information can be obtained for reading through the SAS and SPSS software" (INEP, 2019a, n.p.).

Oliveira, Barwaldt, and Lucca (2020) used a predictive model and data mining techniques[4] based on Enem's microdata to analyze the performance of the candidate with a disability or disorder, in the 2018 edition of the exam. The exam analyzed the scores and possible characteristics that influence their performance: age, race-ethnicity, income, and type of school in high school (OLIVEIRA; BARWALDT; LUCCA, 2020). Briega (2017) addressed the participation of the deaf population in the exam and analyzed microdata from the 2010 and 2011 biennium, at the national level, when comparing the performance of this population with other participants with disabilities (BRIEGA, 2017).

The literature also shows bibliographic studies that addressed the Enem microdata, without specifically distinguishing or analyzing the population with disabilities in the exam. In this way, these studies reported the relationships between the socioeconomic and demographic characteristics of the candidate as variables that influence their performance and their access to Higher Education (MELLO NETO et al., 2014; PIRES, 2015; SANTOS, 2019). The study by Santos (2019) addressed the 2018 edition of the Enem and analyzed microdata at the national level. The results showed the effects of regional inequalities when identifying differences in the candidates' performance, varying mainly according to the region, family income, and the candidate's mother's level of education (SANTOS, 2019).

In another study, Pires (2015) presented the analysis of socioeconomic characteristics and test performance obtained from the microdata of candidates from the State of São Paulo, in the 2012 exam, when investigating two groups of candidates selected from information on family income and parental education. The study presented a descriptive analysis of the results, obtained by comparing samples, information on gender, age, race-ethnicity, type of high school (public or private), the paid activity of the participants, and reasons that led them to participate in the Enem. The results of the study indicate that the social origin of the participants is a preponderant factor in obtaining better results in the exam (PIRES, 2015). It is essential to emphasize that these studies did not intend to draw a deterministic cut, in the social bias, but rather to understand the variables and profiles that retain the best results, as they are historically favored by public policies, compared to other groups, and proposing changes to ensure inclusive educational actions and policies, given the importance of education for social mobilization and fighting inequalities (MELLO NETO et al., 2014; PIRES, 2015; SANTOS, 2019).

Based on these studies, we can assume the relationship between socioeconomic and demographic characteristics and exam performance, considering the Enem as the main instrument for accessing public higher education in Brazil and the exam score being used by public educational policies for access to Higher Education, such as the Unified Selection System (*Sistema de Seleção Unificada* - SiSU)[5], Student Financing (Fies) and the University for All Program (*Programa Universidade para Todos* - Prouni). Enem can enhance or alleviate the high level of Brazilian social inequality, by hampering or facilitating the distribution of income obtained when accessing Higher Education (TRAVITZKI; FERRÃO; COUTO, 2016). Thus, it is necessary to evaluate and rethink access to the education system (JUNQUEIRA; MARTINS; LACERDA, 2017; MELLO NETO et al., 2014; PIRES, 2015; SANTOS, 2019).

In this scenario, one way to understand the access of PwVi to Higher Education can be through the analysis of the Enem microdata. Analysis of the socioeconomic and demographic characteristics of the candidate with a disability who participates in the exam, the accessibility feature requested, the exam abstention rate, behavior during the exam, and other information in the microdata can reveal factors that impact exam performance and, consequently, access to Higher Education. Considering the results and limitations previously pointed out in existing research with the analysis of microdata (BRIEGA, 2017; JUNQUEIRA; MARTINS; LACERDA, 2017; SILVA; MELETTI, 2014) and the importance of studying in more detail the profile of candidates with disabilities who take the Enem, this study seeks to characterize who this target audience is and whether, in fact, people with disabilities, specifically those with visual impairments, are included in the exam.

[4] Data Mining technique: it allows "[...] to extract knowledge from large volumes of data, discovering hidden relationships, patterns and generating rules to predict and correlate data" (GALVÃO; MARIN, 2009, p. 687)

[5] Available at: <http://sisu.mec.gov.br/sisu>. Access on: March 30 2020.

This article is part of the research entitled Digital Accessibility in Selection Processes for People with Visual Disabilities (*Acessibilidade Digital em Processos Seletivos para Pessoa com Deficiência Visual*), which was approved by the Research Ethics Committee of the Federal University of ABC (UFABC) (CAAE number 37334514.0.0000.5594). The aforementioned research created studies that investigated accessibility in the Enem and the use of assistive technology for PwVi to carry out the large-scale evaluation (LERIA, 2016; LERIA; BENITEZ; FRAGA, 2021; LERIA et al., 2018a, 2018b).

The general objective of this study is to analyze the access to Higher Education of PwVi and to investigate factors related to academic performance in the large-scale evaluation of the Enem. As specific objectives, through a quantitative approach, this study investigated: a) the participation, accessibility conditions, and behavior of PwVi in the exam; b) the socioeconomic and demographic characteristics of Enem participants with visual impairments compared to candidates without disabilities; c) the performance of PwVi about participants without disabilities with identical socioeconomic and demographic characteristics.

Therefore, this research report shows in the second section, the methodology used. Then, in the third section, the results obtained are shown: the participation of PwVi in the exam, the analysis of the socioeconomic characteristics of PwVi and the person without disabilities (PwoD), and the comparison of performance between the groups. Then, in the fourth section, the discussion of the results; and, finally, the conclusions of this study.

METHODOLOGY

Exploratory research provides greater familiarity with a given problem to make it more explicit (GIL, 2002). According to Minayo and Sanches (1993, p. 247), the quantitative approach aims to bring "[...] observable data, indicators, and trends". The authors state that this approach, from the social point of view, must encompass large clusters of data, making them intelligible through variables.

Thus, in this exploratory study, we carried out research with a quantitative approach and with the analysis of statistical data from the large-scale educational evaluation of the Enem, using as a basis the socioeconomic and demographic characteristics of the visually impaired and non-disabled candidates who underwent the exam. The stages of the research project contemplated the following activities and methods: a) literature review with the analysis of related works that investigated the Enem microdata; b) documentary research of information from official Inep documents and Enem microdata; c) definition of the strategy for data investigation; d) elaboration and execution of routines for extracting samples; e) statistical analysis of the results.

Source and sample type

To obtain the data from the quantitative research, the study used the Enem microdata, available on the Inep website (https://www.gov.br/inep/pt-br/acesso-a-informacao/dados-abertos/microdados), which can be accessed through the "Enem" link and then by year of edition. In the study, we decided to analyze a biennium of the exam, with national coverage, allowing the statistical analysis based on robust samples, in addition to allowing the confirmation/comparison of the results between two consecutive editions of the exam. Thus, the 2017 and 2018 editions were chosen because they were the most recent ones that were available in March 2019, when the data were obtained. For the analysis, the following information was used: a) the participant; b) requests for specialized care; c) the resources to carry out the tests; d) objective evidence; e) the essay.

The type of sample used was "Stratified Sampling", which is characterized by the selection of a sample from each subgroup of the population that is to be investigated since the delimitation and characterization of the subgroups or strata can be based on the properties of the sample - such as gender or age (GIL, 2002). Thus, three samples were generated: the participant group with visual impairment (GP-PwVi); the group without disabilities (GP-PwoD); and the non-disabled participant group with the same profile as the visually impaired participant (GP-PwoD-control).

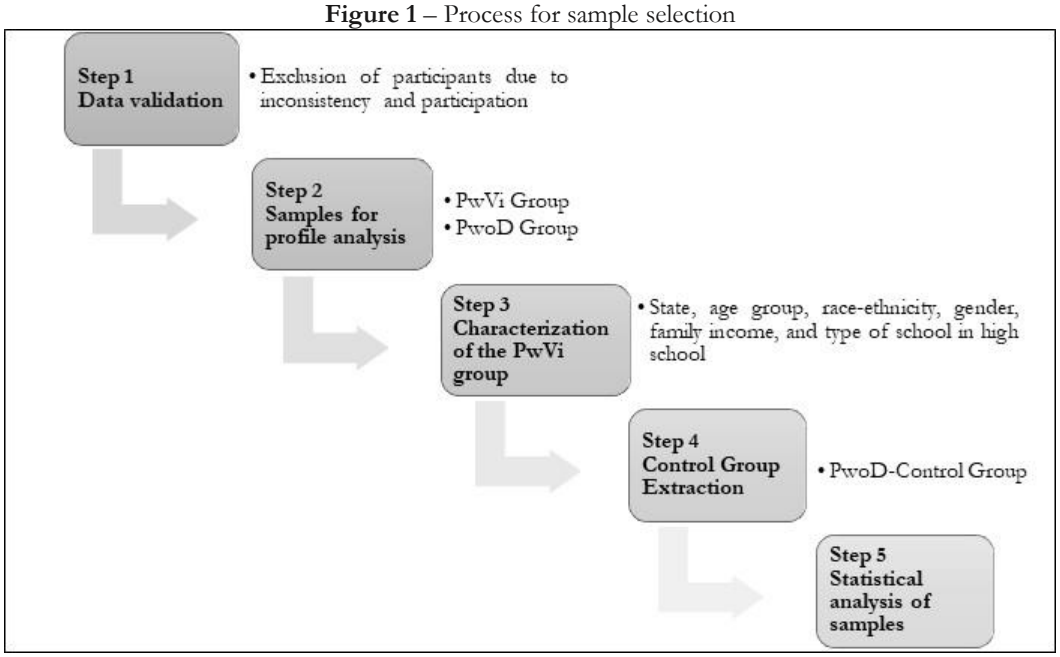
The GP-PwVi samples were used to direct the first objective of the research – to verify the conditions of this group to perform the Enem. The GP-PwVi and GP-PwoD samples were used to achieve the second objective of the research – to point out the similarities and differences in

socioeconomic and demographic characteristics between the two groups. Finally, samples from the GP-PwVi and the GP-PwoD-control were used to address the third objective – to verify whether or not there is a significant difference in performance between the PwVi and the other participants without disabilities when the subjects have identical characteristics.

Data collection procedure

Figure 1 shows the process steps for sample selection. First, in Step 1, we eliminated those enrolled who had the information investigated in the study with inconsistencies. Then, in Step 2, based on the set of valid information, participants from the GP-PwVi and GP-PwoD were selected for analysis of the participants' profiles. In Step 3, the possible combinations of six associated socioeconomic characteristics were identified and the participants of the GP-PwVi were quantified, with the combination of these identified characteristics. In Step 4, the GP-PwoD-control (control group) was created. By the drawing technique, participants from the GP-PwoD with the six combined socioeconomic characteristics equal to those of the GP-PwVi were selected. Finally, in Step 5, an analysis of the profile (GP-PwVi and GP-PwoD) and the performance between samples (GP-PwVi and GP-PwoD-control) with the same socioeconomic characteristics were performed.

Figure 1 – Process for sample selection



Source: Created by the authors.

Characterization of study samples and data analysis

To characterize the samples, we used exclusion criteria and selection of participants, as described in the following items.

- **Exclusion criteria for inconsistency**

Inep provides, together with the microdata, a document named "Dictionary of Variables" that has a description of the microdata information, defining the type of information (numeric or alphanumeric) and possible content or valid domains, for example for the variable "Gender", which is a numeric type with two possible values: 1 – male and 2 – female.

As a criterion for data validation, we adopted to eliminate those students enrolled with data different from the information domain, specified in the variable dictionary, for the following information used in the study: 1) status; 2) age group; 3) race-ethnicity; 4) gender; 5) income; 6) presence in the

Natural Sciences (CN) test; 7) presence in the Human Sciences test (CH); 8) presence in the Languages and Codes (LC) test; 9) presence in the Mathematics test (MT); 10) status of the participant's writing; 11) score of the Natural Sciences test; 12) Human Sciences test score; 13) Languages and Codes test score; 14) Mathematics test score; 15) essay test score; 16) low vision indicator; 17) blindness indicator; 18) deafness indicator; 19) indicator of hearing impairment; 20) deafblindness indicator; 21) physical disability indicator; 22) indicator of mental disability; 23) attention deficit indicator; 24) indicator of dyslexia; 25) indicator of dyscalculia; 26) autism indicator; 27) monocular vision indicator; 28) indicator of another disability or special condition; 29) monthly income (question Q006 of the socioeconomic profile questionnaire); 30) completion of high school (Q0026); 31) type of school (Q0027).

Therefore, 252 participants with inconsistent information from the microdata of 2018[6] and 329 referring to 2017 were eliminated[7]. Another inconsistency observed was in the information "type of education" (Youth and Adult Education – *Educação de Jovens e Adultos* EJA, regular education or Special Education), found with inconsistent information in the microdata of 2,030,665 enrolled in 2018 and 4,945,436 enrolled in the edition of 2017. In the study, as an outline for this situation, we decided not to use the information on the type of education in the analysis.

There was also a duplication of information on the type of school attended in High School, duplicated in the TP-Education fields and question 27 of the socioeconomic questionnaire (Q0027- What type of school did you attend in High School?). Also, the TP-Education information, for a large volume of subscribers (73% of the GP-PwVi sample in 2017 and 83% in 2018) was not reported (TP-Education equal to 1 - not informed). Thus, in the study, we chose to use information from the socioeconomic questionnaire (Q00027).

- **Participation selection criteria**

In the study, we excluded from the samples those enrolled according to the exam elimination criteria[8], as well as those who obtained a zero score on some objective tests and the participants (non-graduates and non-graduates[9](INEP, 2019a). Thus, the GP-PwoD were reduced by 40.71% (2018) and 45.25% (2017) and the GP-PwVi decreased by 38.37% (2018) and 46.83% (2017).

- **Criteria for selection of PwVi and PwoD groups**

We selected participants who were declared to be deafblind, with total visual impairment (blindness), partial visual impairment (low vision), and monocular vision. We observed the occurrence of several subscribers who declared to have more than one type of disability, including participants who were recognized with all types of disability. In this context, we decided to link the participant to the most severe disability, considering deafblindness as the most severe, due to the presence of double disability (visual and hearing), followed by blindness and, later, by low vision, based on the criterion of visual acuity defined in Brazilian legislation. Finally, the monocular vision was classified with the lowest degree of severity, because, although the person with this type of disability has the right to request specialized care, it was only classified as visually impaired in 2021 (BRASIL, 2004, 2021; WAISBERG; WAISBERG, 2015).

The Operational Guidelines for Specialized Educational Assistance in Basic Education conceptualizes the AEE target audience in three types: students with disabilities, global disorders, and

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[6] Inconsistent records in the year 2018, available at: <https://drive.google.com/file/d/120ssa8ZaHIlGQLzezOoJmbJP864hte1M/view?usp=sharing>. Accessed on: 7 Aug. 2021.

[7] Inconsistent records in the year 2017, available at: <https://drive.google.com/file/d/1yQPhokwvvnV9DNg9mQ80cgThufsYVKM5/view?usp=sharing>. Accessed on: 7 Aug. 2021.

[8] Criterion for elimination of the test, according to the public notice of the edition of the exam (INEP, 2018a) and identified in the microdata: TP_PRESENCA_CN= 2; TP_PRESENCA_CH= 2; TP_PRESENCA_LC=2; TP_PRESENCA_MT= 2 and TP_STATUS_REDACAO different from 1 (INEP, 2019a).

[9] Enrolled with completion status (TP_ST_CONCLUSAO) equal to: 3) I am attending and will complete high school after the year of the exam edition or 4) I have not completed and am not attending high school (INEP, 2019a).

high abilities/giftedness (BRASIL, 2009b). For this study, subjects who did not declare to be the target audience of the AEE were selected for the PwoD group, according to the Operational Guidelines.

Participants with socioeconomic characteristics equal to the participants selected in the GP-PwVi were selected from the GP-PwoD. To ensure representativeness among the samples, six associated socioeconomic characteristics were used, identified in the GP-PwVi as a delimiting factor for the sampling of the GP-PwoD-control: a) state; b) age group; c) race-ethnicity; d) gender; e) family income; f) type of school in high school. The combination of the six socioeconomic characteristics, defined in the study, totaled 63,504 possible different profiles.

Performance analysis

The performance analysis between the GP-PwVi and GP-PwoD-control samples was performed using statistical methods, comparing the performance obtained between the samples for each score of the five tests in the 2017 and 2018 editions of the Enem. Thus, a descriptive analysis was initially carried out based on the probabilistic distributions of test scores; and then the hypothesis test to verify whether or not there were significant differences between the scores of the two groups. For such comparison, we used the following methods: a) normality test – Kolmogorov-Smirnov and Shapiro-Wilk methods; b) Friedman test of two related samples; and c) Post-Hoc with Bonferroni correction.

Tools

In the study, the student version of Matlab®[10]. In the study, we used the student version of the Matlab® software to test the consistency and consolidate the information, to perform the characterization of the groups and the extraction of the samples, which are the first four steps of the sample selection process shown in Figure 1 The software was chosen because it can handle databases with a large volume of data, is suitable for testing consistencies and performing data characterization, with the complexity that was defined for the study. Additionally, it is a well-spread tool in the academic environment, facilitating the expansion of the study in future works.

For the statistical analysis and the hypothesis test (fifth step of Figure 1), we used the SPSS® software from IBM®; for the descriptive analysis of the samples, we used the consolidation of information and the creation of graphs, the Excel software. Regarding the computational equipment, we used a desktop computer with a dual-core processor, 4 Gigabytes of RAM, a 300 Mbyte hard disk, and a 17-inch screen.

RESULTS

We can consider that the process of evaluating the results of the Enem takes place in two phases: eliminatory and qualifying. In the first phase, those enrolled in the exam are eliminated due to behavior or failure to take the exam, as well as for having a zero score in the essay. In the qualifying phase, students are selected and classified based on the performance evaluation criteria, the participant's course intention, and the selection criteria of the programs that use the Enem scores for vacancies: SiSU, Prouni, and Fies.

To achieve the objectives of this study, participants who presented minimum conditions for the classification phase were selected for analysis, according to the criteria presented in the methodology section for a selection of the three groups of samples of the study: a) participants with visual impairment (GP-PwVi); b) participants without disabilities (GP-PwoD) and c) control sample with participants without disabilities with socioeconomic characteristics equal to PwVi (GP-PwoD-control).

The relevant results of the analysis of the samples for the biennium (2017 and 2018) are presented in the next sections. At first, an overview of PwVi´s participation in the exam is shown, with its requested resources, its behavior in the exam, and the general performance of the PwVi group and

[10] Disponível Available at: <http://www.matrixlaboratory.com/>. Access on: August 2 2021.

subgroups. Then, the socioeconomic characteristics of the visually impaired participants are analyzed, comparing them with those of the non-disabled group. Finally, an analysis of the performance of disabled and non-disabled participants with identical socioeconomic and demographic characteristics is presented.

Visually impaired participants in the Enem

The 2017 and 2018 editions of the Enem had, respectively, 9,921 and 7,422 visually impaired applicants, which represented 0.14% of those enrolled in the average of the two editions of the exam. After applying the sample selection criterion, characterizing the sample of PwVi who took the test, the number compared to those enrolled decreased by 46.83% (2017) and 38.37% (2018).

Table 1 shows the participation of PwVi and PwoD in the 2017 and 2018 exams, showing the number of registrants, the evasion of exam registrants, the registrants who took the Enem for training[11], as well as the participants who took the test (5,278 in 2017 and 4,574 in 2018), which are the object of analysis of this study. It is possible to observe that those enrolled with visual impairments have higher dropout rates due to abstention and elimination than those enrolled without a disability in the two consecutive years (5% in 2017 and 2.53% in 2018).

Table 1 – Participation of PwVi and PwoD in Enem (2017 and 2018)

Type of participation	2017 PwVi (n)	2017 PwVi (%)	2017 PwoD (n)	2017 PwoD (%)	2018 PwVi (n)	2018 PwVi (%)	2018 PwoD (n)	2018 PwoD (%)
Enrolled	9,930 [a]	0.14 [b]	6,690,199	99.39 [b]	7,422 [a]	0.13 [b]	5,481,508	99.42[b]
Excluded	4,652	46.84	3,027,341	45.25	2,848	38.37	2,201,783	40.17
Abstention	3,312	33.35	2,086,518	31.19	2,102	28.32	1,468,074	26.78
Eliminated	685	6.90	271,624	4.06	204	2.75	96,664	1.76
Training [c]	655	6.60	669,199	10.00	542	7.30	637,045	11.62
Participants	5278	53.15	3,662,858	54.75	4,574	61.63	3,279,725	59.83

a. The. Cases of pervasive developmental disorders and specific functional disorders were excluded from the samples.
b. Percentage of total enrollments.
c. Non-conclude and non-graduate participants.

Source: Prepared by the authors based on the 2017 and 2018 Enem microdata (INEP, 2019a)

Participants with visual impairment were declared in the registration as belonging to four different types of visual impairment. Thus, the following percentages of participation in the average of the biennium of the exam were presented: a) person with deafblindness (0.16%); b) PwVi-blindness (10.27%); c) PwVi-low vision (70.84%); d) PwVi-monocular (18.73%).

To help participants with visual impairments to take the test, considering the average of two years, the following accessibility and human support resources were requested: Braille test – 233 (4%); extended test – 770 (13%); over-extended test – 2,330 (40%); reading aid – 1,255 (21%); transcription assistance – 1,144 (19%); Libras translator – 11 (0.19%); lip reading – 5 (0.08%); interpreter guide – 4 (0.007%); Braille machine – 89 (1.5%); soroban – 48 (1%).

Table 2 shows the result of the performance by type of visual impairment, showing the averages of the scores of the PwVi group and the visual impairment subgroups, as well as the difference in the percentage of the subgroups' scores in the general average of the PwVi group.

[11] Participation for training: Participants who participated in the exam "to train their knowledge", popularly known as "trainers" (INEP, 2019a, n.p.). In this situation, the applicant has not completed high school and cannot apply for a university place.

Table 2 – Performance by type of visual impairment in the 2017 and 2018 Enem

Test and Sample	2017 Average	2017 Diff. (%) of PwoD to	2018 Average	2018 Diff. (%) of PwoD to
Natural Sciences				
PwoD (control) [b,c]	511.30	0.00%	490.81	0.00%
PwVi[b,c]	507.70	-0.70%	484.66	-1.25%
Brazil [d]	510.86	-0.09%	493.68	0.58%
Human Sciences				
PwoD (control)	523.56	0.00%	570.47	0.00%
PwVi	518.69	-0.93%	565.22	-0.92%
Brazil	518.83	-0.90%	568.10	-0.42%
Languages and Codes				
PwoD (control)	513.00	0.00%	522.61	0.00%
PwVi	502.77	-1.99%	511.03	-2.22%
Brazil	510.21	-0.54%	526.45	0.73%
Math				
PwoD (control)	511.37	0.00%	525.54	0.00%
PwVi	501.33	-1.96%	512.63	-2.46%
Brazil	518.76	1.45%	535.40	1.88%
Essay				
PwoD (control)	544.01	0.00%	503.20	0.00%
PwVi	535.60	-1.55%	477.90	-5.03%
Brazil	558.55	2.67%	522.79	3.89%

a. Percentage difference of each mean to PwoD in percentage, calculated as Diff. (%) = 100 (mean - mean PwoD)/(mean PwoD).
b. Consolidated general average of microdata (Enem synopsis).
c. Sample Size: PwVi = 5278 and PwoD = 5271 in 2017.
d. Sample Size: PwVi = 4574 and PwoD = 4554 in 2018.
Source: Prepared by the authors based on the 2017 and 2018 Enem microdata (INEP, 2019a).

The analysis of the performance of the PwVi group and the investigation of scores by type of visual impairment revealed lower performances of the PwVi subgroups with more severe disabilities, in the two consecutive years. We observed, when analyzing the differences between the scores by type of disability to the general score of the group, that the highest scores were obtained by the monocular PwVi, with a performance percentage ranging from 3.7% to 9.24% higher than the general average of the PwVi group, in the analyzes of the five tests in 2017 and 2018. The second-best performance was for PwVi-low vision, followed by PwVi-blindness and, finally, the person with deafblindness. Thus, it was evidenced that the performances vary according to the degree of severity of the disability, because the greater the severity, the lower the performance.

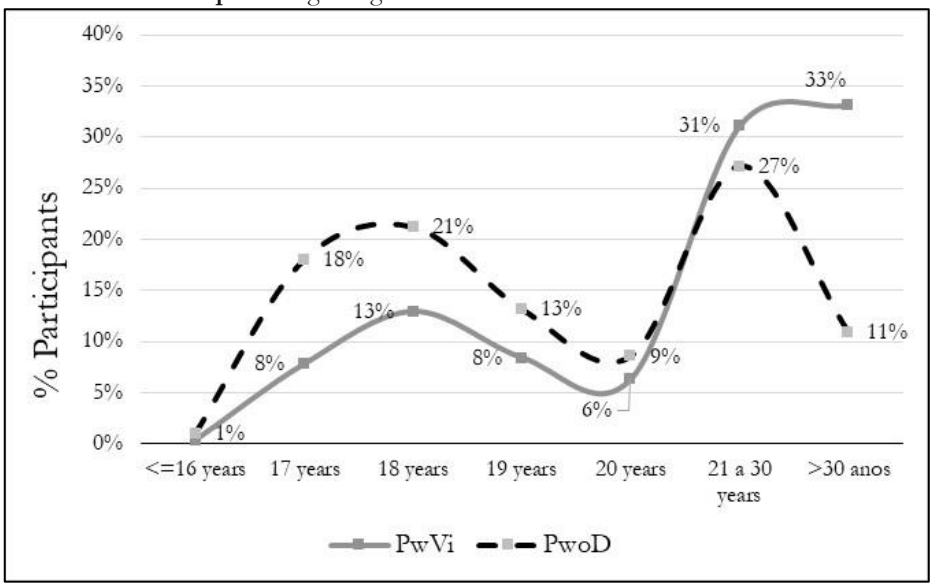
Characteristics of visually impaired and non-disabled participants in the Enem

Different studies report the relationship of dependence between the socioeconomic characteristics of students' school performance (MELLO NETO et al., 2014; PIRES, 2015; SANTOS, 2019). Based on the literature, this study analyzed the socioeconomic characteristics highlighted in previous studies, considering the following variables existing in the Enem microdata: a) state; 2) age group; 3) race-ethnicity; 4) gender; 5) family income; 6) type of school. The relevant results, identified in the comparison between the PwVi and PwoD samples, are presented below.

Regarding the age of the participant at the time of the examination, the results obtained indicate that the visually impaired population is older than the group without disabilities, which shows the same pattern of difference in the two years of the examination, with a percentage of 33% of PwVi aged 31 years or older compared to 11% of people without disabilities for the same age group. The highest concentration of participants without disabilities found in the analysis is up to 20 years old, which totals 61% and 62% in the 2017 and 2018 samples, while only 36% and 37% of visually impaired participants are in this age group in the year. Graph 1, below, shows the distribution by age group of the two groups, referring to 2018. It is possible to observe that the younger age groups have a lower

percentage of the visually impaired population and that the percentage increases in the groups with higher age.

Graph 1 – Age range of PwVi and PwoD in Enem 2018

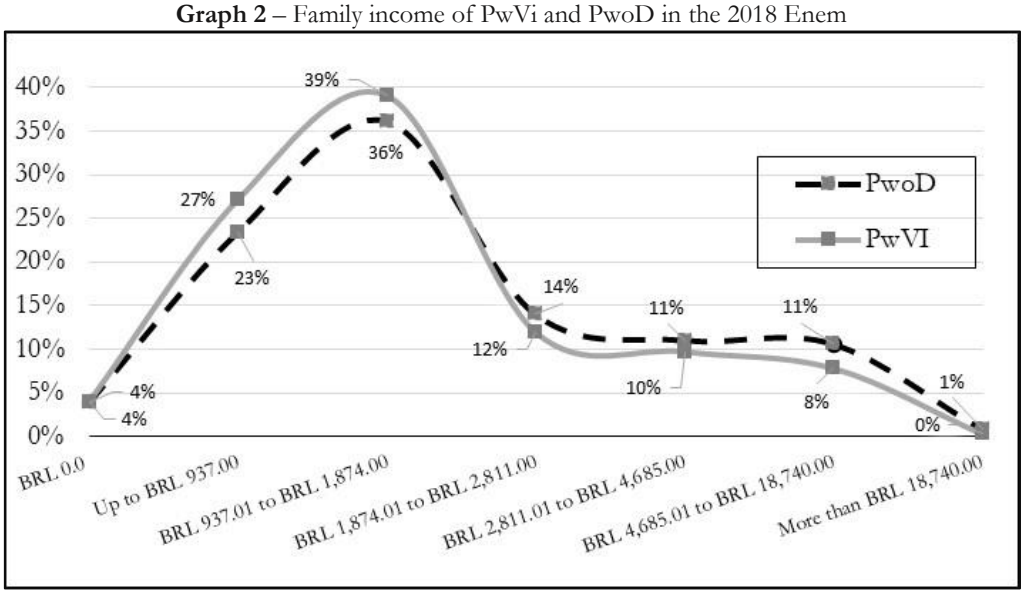


Source: Elaborated by the authors based on microdata from Enem de 2018 (INEP, 2019a).

The analysis of the gender variable shows a decrease of 5% and 6% in the female presence with visual impairment among the participants without disabilities in the 2017 and 2018 exams, respectively. The following percentages of participation in the biennium were identified: Enem 2017) PwVi – 53% female and 47% male; PwoD – 58% female and 42% male; Enem 2018) PwVi – 52% female and 48% male; PwoD – 58% female and 42% male.

Concerning family income, the comparison of the two populations shows that the visually impaired population has a lower family income, showing a higher concentration of visually impaired participants (70.82% and 70.18%) with a monthly family income lower than R $1,874.00 Brazilian reais than the population without disabilities (65.21% and 63.49%). Graph 2 shows the percentage of variation of participants in six income groups investigated in the study, highlighting a higher concentration of PwVi in the groups with lower incomes in the two editions of the exam.

Graph 2 – Family income of PwVi and PwoD in the 2018 Enem



Source: Elaborated by the authors based on the microdata of Enem de 2018 (INEP, 2019a).

The type of school attended in high school is an important variable to determine whether or not the participant has the right to the university quota in accessing higher education. Only students who studied in public schools, during the entire period of High School, are entitled to the university quota, and this information is the first to be consulted for the analysis of the quota grant.

The analysis of the type of school in the samples indicates a higher percentage of PwVi who studied throughout high school in a public school than people without disabilities in both editions of the exam. In 2017, 84.47% of visually impaired participants attended high school, entirely, in public schools, while the population without disabilities had a percentage lower than 80.55% with this item. The 2018 edition showed similar data in the analysis, with 80.61% PwVi compared to 76.47% PwoD.

No significant differences were identified between the samples, when analyzing the ethnic-racial characteristic, presenting the same pattern in the biennium, with the following averages between the percentages of the samples in the distribution of ethnic-racial characteristics declared in the Enem: Brown: 45.40% – PwVi and 46.63% – PwoD; White: 36.19% – PwVi and 35.65% – PwoD; Black: 13.92% – PwVi and 13.03% – PwoD; Asian: 1.87% – PwVi and 2.26% – PwoD; Indigenous: 0.51% – PwVi and 0.57% – PwoD; Not informed: 2.11% – PwVi and 1.86% – PwoD.

Regarding the distribution of samples among the states, a lower percentage of participants with visual impairment was observed to participants without disabilities in the South and Southeast regions, the two richest regions in Brazil. The distribution pattern was repeated in 2017 and 2018 with the following average percentage of distribution among the samples by region and by biennium: North: 13.74% – PwVi and 11.42% – PwoD; Northeast: 34.91% – PwVi and 33.63% – PwoD; Southeast: 33.42% – PwVi and 36.29% – PwoD; South: 9.66% – PwVi and 10.77% – PwoD; Midwest: 8.28% – PwVi and 7.90% – PwoD.

Analysis of the performance of visually impaired and non-disabled people in Enem

The performance analysis in this study compared and verified the hypothesis of significant differences between the scores of the PwVi and PwoD groups who took the test, considering, in these analyses, the four objective tests of the exam and the essay. Based on the finding that socioeconomic and demographic characteristics strongly influence participant performance in large-scale assessments, such as the Enem (MELLO NETO et al., 2014; OLIVEIRA; BARWALDT; LUCCA, 2020; PIRES, 2015; SANTOS, 2019; TRAVITZKI; FERRÃO; COUTO, 2016), this study sought to isolate the factors that could influence the outcome of the participant. In this way, the difference between the groups was exclusively the fact of being PwVi or not.

To this end, the socioeconomic and demographic characteristics of the GP-PwVi sample were initially identified. Then, the control sample was created, GP-PwoD-control, with the same number of participants and the same socioeconomic and regional characteristics identified in the PwVi group. Therefore, below, we present the analysis of performance in the exam carried out through the results of the four objective tests and the essay. At first, a descriptive analysis was performed comparing the results of the samples. Afterward, the hypothesis was analyzed to verify whether or not there is a significant difference between the results of the tests.

The results of the descriptive analysis, with the performance scores of people without disabilities and PwVi obtained in the study, the national average scores obtained in the Statistical Synopsis of the Enem,[12] and the performance difference in the PwoD control group, in percentage, are presented in Table 3.

[12] The statistical synopsis of Enem "[...] corresponds to a set of tables with information collected from those enrolled, through the Socioeconomic Questionnaire and the result of the application of the Exam. The information is organized by geographic region and federation unit" (INEP, 2018b, n.p.).

Table 3 – Performance of PwVi and PwoD in Enem 2017 and 2018

Proof and Sample	2017 Average	2017 Diff (%) from PwoD to	2018 Average	2018 Diff (%) from PwoD to
Natural Sciences				
PwoD (control) [b,c]	511.30	0.00%	490.81	0.00%
PwVi[b,c]	507.70	-0.70%	484.66	-1.25%
Brazil [d]	510.86	-0.09%	493.68	0.58%
Human Sciences				
PwoD (control)	523.56	0.00%	570.47	0.00%
PwVi	518.69	-0.93%	565.22	-0.92%
Brazil	518.83	-0.90%	568.10	-0.42%
Languages and Codes				
PwoD (control)	513.00	0.00%	522.61	0.00%
PwVi	502.77	-1.99%	511.03	-2.22%
Brazil	510.21	-0.54%	526.45	0.73%
Math				
PwoD (control)	511.37	0.00%	525.54	0.00%
PwVi	501.33	-1.96%	512.63	-2.46%
Brazil	518.76	1.45%	535.40	1.88%
Essay				
PwoD (control)	544.01	0.00%	503.20	0.00%
PwVi	535.60	-1.55%	477.90	-5.03%
Brazil	558.55	2.67%	522.79	3.89%

a. Percentage difference of each mean about PwoD in percentage, calculated as Diff. (%) = 100 (mean - mean PwoD)/(mean PwoD).
b. Overall consolidated average of microdata (enem synopsis).
c. Sample Size: PwVi = 5278 and PwoD = 5271 in 2017.
d. Sample Size: PwVi = 4574 and PwoD = 4554 in 2018.

Source: Prepared by the authors based on the Enem microdata (INEP, 2019a) and the Enem synopsis (INEP, 2018b).

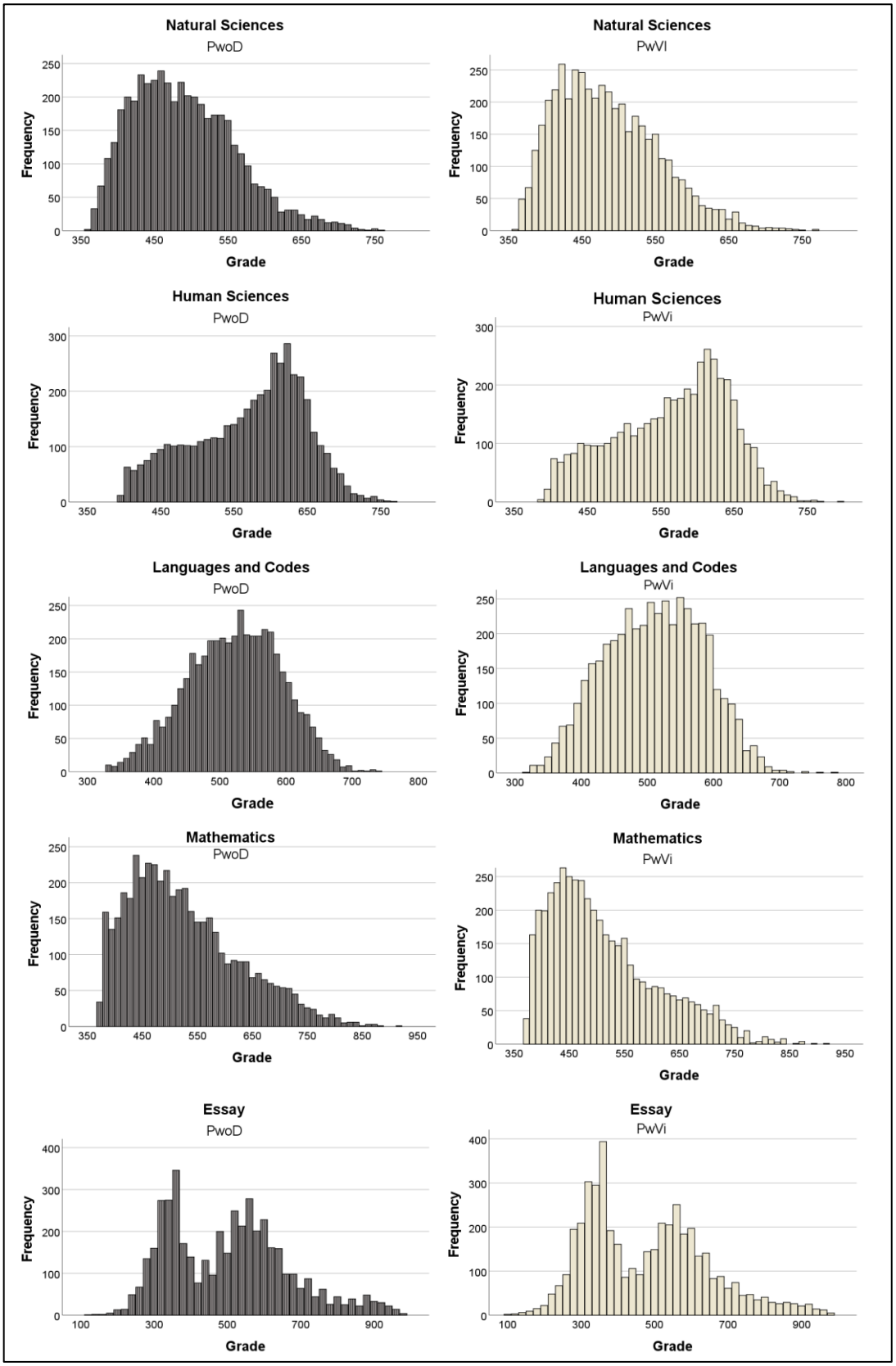
The comparison of the average scores of the two groups showed that the group without disabilities obtained the best scores in all assessments, in both years of the Enem. However, we observed that the difference between the averages, score by score, of the two groups presents a small variation in percentage, with values between 0.77% and 5.03% lower in the performance of PwVi about the score of PwoD (control group).

The Natural Science and its Technologies and Human Sciences and its Technologies scores showed the smallest differences in performance between the groups, ranging between 0.77% and 1.25%. In addition, the greatest variation was identified in the average score of the essay with 5.03%, lower for participants without disabilities. The analysis of the maximum score points to a better performance of PwVi in 2018, surpassing the maximum average in the objective tests and equaling the maximum value in the newsroom's score.

Concerning the performance results at the national level, considering the general average - arithmetic average of the five scores -, the two groups obtained results below the average, but with little difference, and presented the following general averages of the five scores: 2017: national average: 523.44 (PwoD: 520.65; PwVi: 513.22); 2018: national average: 529.28 (PwoD: 522.52; PwVi: 510.29).

Graph 3 shows the probabilistic distributions of the five scores for the 2017 and 2018 editions, with the performance of visually impaired and non-disabled participants. The analysis of the histograms with the performance in the tests demonstrates a pattern of similarity between the samples in all the scores, repeated in the biennium of the analyzed test.

Graph 3 - Probability distribution of 2018 grades



Source: Elaborated by the authors based on the 2018 Enem microdata(INEP, 2019a).

After the descriptive analysis, the hypothesis test was performed to verify whether or not there are significant differences between the scores of the two groups. Thus, initially, the hypothesis of

normality of the samples was verified through the methods of Kolmogorov-Smirnov and Shapiro-Wilk, being the hypothesis of normality rejected for all samples. Then, as the normality hypothesis was not satisfied, hypothesis tests were performed for non-parametric related samples and, finally, the Post-Hoc test to confirm the hypothesis.

Due to the intra-subject factor of the sample, since the same participants were evaluated in the different subjects, we decided to perform the two-factor analysis of variance of the Friedman Test, verifying the related samples two by two. The hypothesis test was confirmed with a Post-Hoc test using Bonferroni's correction for multiple comparisons, which shows that there are significant differences in performance between the PwVi and PwoD groups in the Mathematics, Languages, and Essays, while there are no significant differences in performance between the groups for the scores of the tests of Natural Sciences and Human Sciences. The results, both significant and non-significant, remained in the two years of the exam (2017 and 2018). Table 4 presents the results of the hypothesis test.

Table 4 – Hypothesis test of significant difference between PwVi and PwoD scores

PwVi and PwoD sample scores by year	Sig.	Adj. Sig.[a]
2017		
Natural Science and its Technologies	.046	1.000
Human Sciences and its Technologies	.004	.185
Languages and Codes and their Technologies	<< 0.001	<< 0.001
Math	<< 0.001	<< 0.001
Essay	0.000006	0.000266
2018		
Natural Science and its Technologies	.006	.274
Human Sciences and its Technologies	.017	.773
Languages and Codes and their Technologies	<< 0.001	<< 0.001
Math	<< 0.001	<< 0.001
Essay	<< 0.001	<< 0.001

Legend: Sig. = Significance; Adj. Sig. = Significance Adjustment.
Notes: Friedman's two-way analysis of variance by rank and pairwise comparisons.
Each row tests the null hypothesis where the Sample 1 and Sample 2 distributions are equal.
Asymptotic (two-sided test) significances are displayed. The significance level is .050.

a. Significance values were adjusted by Bonferroni correction for various tests.
Source: Elaborated by the authors based on the 2018 Enem microdata (INEP, 2019a).

DISCUSSION

To discuss the results obtained, the general objective of this study is resumed: to analyze the access to Higher Education of PwVi, and to investigate factors related to academic performance in the large-scale evaluation of the Enem. Thus, in this study, the socioeconomic and demographic characteristics of participants with visual impairments were analyzed in two editions of the Enem (2017 and 2018), and the performance of this population of participants without disabilities with the same characteristics, covering the variables of state, age range, race-ethnicity, gender, family income and type of school in high school. It should also be noted that this study did not intend to create social determinism, but to understand the variables that can influence the achievement of better results, compare them to the results of the literature and investigate their reflexes between groups with different conditions to gather information for inclusive actions and for the reassessment of inclusive policies to guarantee educational access for all.

The analysis carried out in this study significantly advanced the discussion, since previous studies that analyzed the Enem microdata (MELLO NETO et al., 2014; PIRES, 2015; SANTOS, 2019) and the studies on the participation of PwD in the Enem (BRIEGA, 2017; JUNQUEIRA; MARTINS; LACERDA, 2017; OLIVEIRA; BARWALDT; LUCCA, 2020; SILVA; MELETTI, 2014) did not

perform statistical analyzes of the six variables used in this study, simultaneously and with national coverage. Likewise, the mentioned works did not compare the performance between groups of PwD and PwoD, guaranteeing equality of characteristics (socioeconomic and demographic), isolating, more effectively, the variable "disability" between the samples. Finally, previous studies also did not have a specific focus on the analysis of the visually impaired participant in the exam, as was done in this study. Thus, the results revealed that the PwVi who took the exam had lower family income, more advanced age, lower female participation in the exam, higher percentage of students in public high school, and a lower percentage of origin from the South and Southeast regions compared to non-disabled participants.

The 6% higher concentration of visually impaired participants with lower monthly family income (less than R$1,874.00 Brazilian reais), as well as a lower concentration in the South and Southeast regions (richer regions), are factors that should be investigated. In addition, the oldest age with only 36.5% of PwVi was 20 years old or younger at the exam, compared to 61% of people without disabilities in the same age group and the 11% higher concentration of PwVi over 30 years old. In this context, with the simultaneous occurrence of three factors (income, age, and region) that profoundly impact inequality in access to education in Brazil (PIRES, 2015; SANTOS, 2019), it can be said that the very characteristics of visually impaired participants negatively influence the performance of the test, regardless of whether the participant is visually impaired.

Regarding the female participation with visual impairment, there was a decrease of 5% to 6% in the female presence with visual impairment about PwoD, identified in the biennium of the Enem edition. The double disadvantage of the female population with disabilities due to discrimination based on disability and gender was highlighted, despite the orientation of the Salamanca Convention (UNESCO, 1994), which prioritized actions for the educational inclusion of women with disabilities. In this sense, the results of the study contribute to a possible discussion, by targeting gender education proposals with the empowerment of students and strategies to increase the participation of visually impaired women in Higher Education and Enem, given the evidence of the need for efforts to comply with the Convention's guidelines and the existence of few studies with quantitative data on students with disabilities about gender in the literature (PEREIRA, 2016; UNESCO, 1994).

The results of the study also showed a higher percentage of participants from public schools of PwVi about PwoD, which indicated a possible positive result of the implementation of AEE in the public network. Public schools, in general, have conditions to guarantee the permanence of these people, unlike private schools, due to the functional resource room (for example, in the State of São Paulo) and multifunctional (as in the case of municipal schools in São Paulo) to offer the AEE. Offering this service for PwVi guarantees writing in Braille, through Braille machines, as well as the use of assistive technology and the computer that put them in the same conditions as people without disabilities to demonstrate their knowledge and performance (BRAZIL, 2010, 2014).

Although the results of the study have some of the information used by the affirmative policy for granting university quotas, such as type of school, ethnic-racial characteristics of the participants, and type of disability (BRASIL, 2012, 2017), it was not possible to assess access effective from PwVi to Higher Education through quotas, since, in the Enem microdata, SiSU data was not included, informing whether the participant won or not the vacancy, nor was the university quota used. As of 2019, data from SiSU started to be made available by Inep, for consultations with institutional and scientific purposes, but with restricted access to the Inep unit in Brasília. Thus, there will be an opportunity to carry out future work with more comprehensive information on access to Higher Education, encompassing the "[...] classification in the chosen course, the score, the competition modality, and the type of quota in which it falls" (INEP, 2019b, n.p.), as well as information about the HEI that offered the vacancy.

As for the refined analysis of the performance carried out in this study - which sought to equalize the socioeconomic and demographic variables between the samples (PwVi and PwoD) and to ensure that the only difference between the groups was the condition of being a PwD or not, it pointed out. that there are no significant differences in performance between the scores of the Natural Sciences and Human Sciences tests and that the differences in the other tests are small, as indicated in Table 3, which presented higher values for the group without disabilities, varying, in the biennium of the exam,

with the following differences in percentages: Languages and Codes: 1.99% (2017) and 2.22% (2018); Mathematics: 1.96% (2017) and 2.46% (2018); Essay: 1.55% (2017) and 5.03% (2018).

Thus, in line with the prejudice of disability and ableism linked to the Brazilian student with disabilities, found even in the recent proposal to change the National Policy on Special Education - Decree number 10.503 of September 30, 2020 (BRAZIL, 2020), which proposes segregated education for PwD, or in the speech of the Brazilian President about Inclusive Education, the results of this study showed that there are no significant differences in performance in two scores in the assessment of skills and abilities, proposed in the Enem exam in two consecutive years. The performance outcome assessment, therefore, endorsed the principle that

> [...] any individual is capable of learning, even those with limitations or disabilities. No diagnosis or label adequately describes a person's abilities or difficulties. Individuals of normal intelligence, and even those considered geniuses, may have severe deficiencies in specific areas, and those considered late may have a lot of potential in some areas (ROSE, 2012, p. 31).

Furthermore, in another analysis carried out in this study, described in Table 2, to investigate performance by type of visual impairment, it was found that the variation in the scores of the subgroups had a different influence on the overall result of the PwVi group. In addition, it was found that the results vary according to the degree of disability severity, indicating the best results for participants with milder types of disabilities (monocular vision and low vision). In this sense, considering the definition that disability is in the interaction of PwD and the barriers encountered that can prevent their effective and full participation in society with equal conditions to other people (BRASIL, 2015), we concluded that the accessibility of the resources available to perform the exam is adequate or sufficient for only part of the participants, which varies according to the severity of the disability.

To reflect on the accessibility and performance of the exam by PwVi, it should be noted that the Enem selection process is tiring, with extensive tests, which evaluate four areas of knowledge through 180 multiple-choice questions and an essay, carried out in two exam days, with a duration of six hours and 30 minutes and six hours, in the case of PwVi who have an additional hour to perform the exam. In this scenario, any small difficulty in using the accessibility resources available for the test, either in accessing the content by reading with human assistance or in using the enlarged test or in Braille - in understanding the image description or the content of the test -, or, even, any difficulty in expressing their knowledge in the transcription of the essay and in completing the answer, added, question by question, in the long duration of the test, strongly impairs the performance of the candidate (LERIA et al., 2018a).

When comparing accessibility in the Enem in the different editions of the exam, Inep's effort to improve accessibility as well as access to the test for PwVi was recognized (JUNQUEIRA; MARTINS; LACERDA, 2017; LERIA et al., 2018a), presenting an accessibility differential between other large-scale assessments (such as Enade and Encceja), since, in the 2020 edition, the use of the Screen Reader software was made available in the test (INEP, 2020). However, some authors have pointed out the existence of accessibility barriers for PwVi to take the Enem with the resources currently available for the exam, such as failures in reading the reader, intensified in reading in a foreign language and in scientific notations, as well as difficulties in handling the adapted material (JUNQUEIRA; MARTINS; LACERDA, 2017; LERIA, 2016; LERIA et al., 2018a; SILVA, 2014).

As a result of studies carried out through academic research in partnership with government organizations in the United States of America, the replacement of the traditional pencil and paper test for computer-based assessments accessible to all, respecting the concept of universal design, was implemented. Such actions indicated results obtained in more than two decades of research, which ensured the participation of 99% of people with disabilities in large-scale US state assessments (THURLOW, 2014; THURLOW et al., 2010; THURLOW; KOPRIVA, 2015). Therefore, we can conclude that the offer of better conditions of accessibility in the exam will bring better results and conditions of equity for the PwVi to carry out the test.

LBI guides accessibility for PwD in university selection processes, guaranteeing the right to use computers and assistive technology, according to the choice and preference of the disabled participant (BRASIL, 2015). However, in the 2020 edition of Enem, Inep made available the first digital

version of the exam (named Enem Digital), with part of the test being carried out through the use of the computer, but it did not allow the participation of people with disabilities and "[...] did not provide accessibility features for this version of the exam" (INEP, 2020, p. 87). According to LBI, such restriction is configured as a technological barrier[13], considered discrimination on grounds of disability, due to the refusal "[...] of reasonable adaptations and provision of assistive technologies" (BRASIL, 2015, n.p.).

Considering the resources available in large-scale international assessments that adopted computer-based and assistive technology tests, and the results presented in this study, there is still a long way to go to make the Enem accessible, especially for PwVi. with more severe types of disability, such as advanced low vision and blindness, and for people with deafblindness. In this way, it is recommended, in future academic works, to carry out a case study, with the participation of Inep, PwVi, and Brazilian government support, using global and accessible technological solutions, to carry out large-scale evaluations using a computer and assistive technologies, customized for the local specificities of the assessment and the Brazilian population (such as language; access to assistive technology; Enem exam model; regional factors; among others).

In terms of the presence of PwVi in Enem, despite advances in the access of PwD to Higher Education, with the growth of PwD enrollments in Brazilian universities pointed out in the literature (CABRAL; ORLANDO; MELETTI, 2020; MARTINS; LEITE; LACERDA, 2015; SANTOS, 2011; SILVA; MELETTI, 2014), the results of this study showed that the participation of PwVi in the exam represented only 0.14% of those enrolled in the Enem in the 2017 and 2018 editions.

In the absence of research presenting quantitative information on the access to Higher Education of PwVi, we decided to use information from the 2010 Demographic Census to analyze the participation of PwVi in Enem, with due reservations made later. According to the 2010 Demographic Census by the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística* - IBGE), 18.6% of the Brazilian population is declared to have some type of visual impairment. In addition, the Census considered the degree of severity of the disability and pointed out that 3.4% of the population declared that they could not see or have great difficulty seeing (IBGE, 2010). When comparing the percentage (0.14%) of those enrolled with visual impairments in the 2017 and 2018 editions of the Enem, with the percentages calculated in the 2010 Demographic Census (18.6% or 3.4%), we can see that the participation of PwVi in the exam is extremely low.

It should be noted that the comparison of information from this study with the Demographic Census does not bring precise results, since, in the Census, the sampling stratum was formed by the population between 15 and 64 years old, which differed from the age group of the Enem participants. In addition, there is a difference between the Census data collection periods (2010) and the Enem microdata used in the study (2017 and 2018). Even with this caveat, the comparison illustrates the great difference between the percentages of PwVi in the Brazilian population and their limited access to Higher Education through the Enem.

The study by Cabral, Orlando, and Meletti (2020) analyzed the number of enrollments of students with disabilities in Brazilian universities – without presenting information by type of disability – and indicated an approximate 257% increase in the number of enrollments of PwD between 2009 and 2018. However, the vacancies occupied by PwD were mostly in private universities (65.4% of enrollments in 2018). In addition, the same study showed that PwD occupied, on average, 0.47% of total university enrollment in 2017 and 2018. Considering that, among PwD, approximately 78% correspond to PwVi (IBGE, 2010), we can estimate that 0.37% (78% of 0.47%) of university enrollments (2017 and 2018) were occupied by PwVi. Based on these percentages, we can infer that most university enrollments were not obtained through Enem, since the filling of vacancies by PwVi (0.37%) was approximately 267% higher than the percentage of participation (0. 14%) of PwVi in the 2017 and 2018 editions of the Enem identified in this study.

The low presence of PwVi in the exam and behavior during the exam, with evasion rates by abstention and elimination higher than those enrolled without disabilities (6.9% in 2017 and 2.73% in 2018), identified in the study, may also be an indicator of lack of accessibility in the exam or lack of

[13] Technological barriers, according to Art. 3 of Law number 13.146/2015, are those that "[...] make it difficult or prevent people with disabilities from accessing technologies" (BRASIL, 2015, n.p.).

information about accessibility in the Enem, before the exam, due to the little dissemination of the resources available to carry out the exam, the barriers to accessing the Enem participant's website, the lack of simulations of the exam with accessible resources, the lack of support for the choice of resources, among other factors pointed out in the literature and that involve the process of making large-scale assessments accessible and thus must be reassessed (JUNQUEIRA; MARTINS; LACERDA, 2017; LERIA et al. ., 2018a; WITMER et al., 2018).

The advanced age of the participant with a disability in the exam, a variable that presented the greatest gap comparing the groups, probably the result of the delay in the school of PwD in Brazil pointed out in the literature (FRANÇA; RIOS-NETO, 2012), and the low participation of PwVi in Enem, they illustrate the situation of exclusion of this public in the access to Higher Education. We suggest that, in future studies, the transition process between High School and Higher Education should be addressed in a more directive way with PwVi such as through an effective Individualized Educational Planning (PEI – *Plano Educacional Individual*), centered on the transition from Secondary Education to Higher Education and in carrying out the selection processes. Thus, research is recommended to investigate the effective implementation and good practices in AEE integrated with the school's pedagogical proposal.

FINAL CONSIDERATIONS

This study aimed to analyze the access to Higher Education of PwvI to investigate factors related to academic performance in the large-scale evaluation of the Enem. Based on the analysis of related studies, which showed that the socioeconomic and demographic conditions of the participants are related to their performance in the Enem, this study confirmed the results of previous research and deepened the analysis by specifically investigating the profiles and performances of participants with disabilities. visual compared to participants without disabilities who took the Enem. Thus, the intention was not to outline a social determinism or to prioritize a specific group by type of disability, but rather to understand its characteristics and, in the comparison between the profiles and the results of the groups in the exam, to identify the vulnerabilities in the access to the PwVi to Higher Education. In this way, we sought to gather information to collaborate in the advancement of research on the topic, in the accessibility of the exam, in the formulation of inclusive actions, and in the reassessment of educational policies for access to Higher Education, subsidized by the State, based on the Enem score.

The comparative analysis of the performances between the two groups that sought to systematically isolate the condition of being or not being PwVi, equating six socioeconomic and demographic characteristics in the selection of samples, showed that there is no significant difference in performance between the two exam scores and that, in the other three scores, the differences are small, in two consecutive years, refuting the ableism and other prejudices that involve PwD. However, when analyzing the performance of the subgroups by type of visual impairment (monocular vision, low vision, blindness, and deafblindness), we observed that the best results are related to the mildest type of disability, which indicated that the accessibility made available to perform the examination is insufficient or inadequate to eliminate barriers to access for PwVi with more severe disabilities. The results also revealed the low participation of PwVi, representing 0.14% of the total of those enrolled, illustrating the limited access of PwVi to Higher Education through Enem. Furthermore, these participants had lower family income, older age, lower female participation, a higher percentage of students in public high school, and a lower percentage of origin in the South and Southeast regions than participants without disabilities.

We concluded that only a small portion of visually impaired students manage to take the Enem exam and those who can, possibly, find accessibility problems in the test, when they have some type of more severe disability, which compromises their result in the exam and their access to Graduation. Thus, the educational policies of access to Higher Education that use the Enem score do not apply to part of this population, excluded from the benefits of Higher Education subsidized by the State, due to the exam barriers.

It is worth mentioning the conditions in which this study was carried out: an analysis restricted to the Enem microdata and a limited amount of related works. Thus, the need for future work is indicated to advance the inclusion of PwVi in this complex process of access to Higher Education.

Research and inclusive actions are recommended to increase participation and reduce the late age of high school completion. Thus, studies are suggested to identify and strengthen good AEE practices and actions for the development and application of the PEI, focused on the transition to Higher Education, as well as actions to disseminate the accessibility resources available in the exam, create conditions for mock accessible exams and prepare for the exam. Studies are also recommended to analyze the Brazilian reality and adapt it with accessible technological solutions, based on international advances, ensuring the use of computers and assistive technologies. Finally, we recommend allowing the completion of the Enem in conditions of equity with the other participants, as ensured by Brazilian legislation.

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DECLARATION OF CONFLICT OF INTEREST

The authors declare that there is no conflict of interest with this article.

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