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Article

Learning together: the effects of inclusion of students with disabilities in mainstream schools

EconomiA

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Suggested Citation: Krüger Dalcin, Aline (2023) : Learning together: the effects of inclusion of students with disabilities in mainstream schools, EconomiA, ISSN 2358-2820, Emerald, Bingley, Vol. 23, Iss. 1, pp. 1-24,
<https://doi.org/10.1108/ECON-05-2022-0005>

This Version is available at:

<https://hdl.handle.net/10419/329533>

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Learning together: the effects of inclusion of students with disabilities in mainstream schools

Learning
together

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Received 16 May 2022
Revised 4 June 2022
Accepted 4 June 2022

Abstract

Purpose – This article aims to analyze the impact that the inclusion of students with disabilities has on the achievement of their schoolmates and to analyze the impact that this inclusion has on the achievement of the students with disabilities themselves.

Design/methodology/approach – The author begins investigating how the inclusion of students with disabilities in regular schools affects achievement of schoolmates. To answer this research question, the author explores the natural variation in time in the number of students with disabilities and use data from National Exam of Upper Secondary Education (Enem). Then, the author investigates how the inclusion affects achievement of the students with disabilities themselves and uses propensity score matching methodologies and, again, data from Enem.

Findings – The results show that an additional percentage point in the proportion of students with disabilities would reduce schoolmates' writing scores by a 0.0031 standard deviation. In other subjects, the author finds weak or none evidence of a significant peer effect. In addition, using Propensity Score Matching methodologies, the results show that the mean scores are up to 44% of a standard deviation, which is higher among students with disabilities enrolled in regular schools compared to those who are enrolled in special schools. In summary, the evaluation is that inclusion policies achieve the goal of improving the performance of students with disabilities but such policies have a small and adverse side effect.

Originality/value – For this reason, the present study proposes to fill this gap in the literature by analyzing the impact of the inclusion of students with disabilities on both groups. In addition, this paper contributes to the empirical literature of peer effect with an analysis of the peer effect of students with disabilities per competency. Finally, the article is important given the existence of few articles in Brazil on the topic of education and people with disabilities.

Keywords Education, Disabilities, Inclusion

Paper type Research paper

1. Introduction

According to the National Demographic Census of 2010, there are approximately 4 million people or around 2% of the population with some serious disability (people that are unable to see, hear, move or with any intellectual disability) [1] living in Brazil. More than 900 thousand individuals with serious disabilities are aged 4–17 years, representing around 2% of the population in this age group. Among children and teenagers from 4 to 17 years old with some serious disability, the most common type of disability is intellectual disability, followed by motor disability, visual impairment and, finally, hearing impairment.

Access to basic education for this group is yet a great challenge for the country: according to the Demographic Census of 2010, 16% of the population who cannot hear at all is out of school, 16% of the population who cannot see at all is out of school; 23% of the population who cannot move at all is out of school and finally, 30% of the population with some



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Economia
Vol. 23 No. 1, 2022
pp. 1-24
Emerald Publishing Limited
e-ISSN: 2358-2820
p-ISSN: 1517-7580
DOI 10.1108/ECON-05-2022-0005

permanent intellectual disability is out of school. These numbers are very high, considering that only around 8% of the population without disability aged 4–17 years is out of school. According to a UNESCO study, in Brazil, 98.7% of individuals without disabilities between 15 and 29 have ever attended school, but that percentage drops to 89.2% for individuals with disabilities – a ratio of 0.9 disabled individuals to every nondisabled individual. The UNESCO study shows that Brazil is behind if compared with other South American countries for which data are available. The ratio for Uruguay is 0.95 and 0.97 for Colombia (UNESCO, 2018).

Policies to provide education for children and teenagers with disabilities were carried out until recently preferably through exclusive special education schools. This situation only changed when legislation began to require the inclusion of children with disabilities in the regular school system. The trajectory of Brazilian legislation on inclusive special education began in the 1980s with the Federal Constitution (Fávero Favero, Ferreira, Ireland, & Barreiros, 2009; Mauch & Santana, 2016). Articles 205, 206 and 208 of the 1988 Constitution affirm that “education, which is the right of all and duty of the State and of the family, shall be promoted and fostered with the cooperation of society, with a view to the full development of the person, his preparation for the exercise of citizenship and his qualification for work”, “equal conditions of access and permanence in school” and “specialized schooling for the handicapped, preferably in the regular school system” (Brasil, 1988).

Two decades later, in 2006, the United Nations (UN) declared the Convention on the Rights of Persons with Disabilities. In Brazil, this Convention was ratified in 2008, thus assuming constitutional status through Legislative Decree 186/2008 and Executive Decree 6.949/2009. The Convention establishes that “persons with disabilities can access an inclusive, quality and free primary education and secondary education on an equal basis with others in the communities in which they live” (Brasil, 2008). In the same year of ratification of the Convention, the Ministry of Education (MEC) launched the National Policy on Special Education in the Perspective of Inclusive Education. One aspect of both the Convention and the National Policy on Special Education in the Perspective of Inclusive Education is the defense that all students with disabilities, developmental disorders and high skills or giftedness should attend regular schools. Besides, the National Policy on Special Education in the Perspective of Inclusive Education indicates that, in addition to the common classes, these students should count on Specialized Educational Assistance, a service whose functions are to identify, elaborate and organize pedagogical and accessibility resources that eliminate the barriers to their full participation (Brasil, 2010; Mauch & Santana, 2016).

The data show that Brazilian education is actually moving towards inclusion in common classes. In other words, along with the evolution of the Brazilian legislation on inclusive special education, the evolution of percentage of students with disabilities, developmental disorders and high skills or giftedness enrolled in common classes instead of special classes or specialized schools also occurred. In 2007, according to the Brazilian School Census, only 46.8% of the students with disabilities, developmental disorders and high skills or giftedness in school studied in common classes; in 2021, this percentage jumped to 88.4%.

However, the mainstreaming of special education was carried out without any impact evaluation. Few studies in the literature evaluate the effects of such inclusion, which may be on students with disabilities or students without disabilities. The results of these studies should be taken into account by policymakers when deciding on the implementation of inclusion policies. If poorly conducted, such policies can produce unwanted effects and waste resources. In this scenario, the objective of this article is to provide results to assist the decision on the implementation of inclusion policies for children and teenagers with disabilities.

More specifically, in this paper, I begin investigating how the inclusion of students with disabilities in regular schools affects achievement of schoolmates. To answer this research question, I explore the natural variation in time in the number of students with disabilities

and use data from National Exam of Upper Secondary Education (Enem). The results show that the exposure to students with disabilities creates negative writing achievement externalities in grade-cohort at end of high school. In other subjects, I find weak or none evidence of a statistically significant peer effect. The results are heterogeneous in quantiles of the achievement distribution and in competencies around which the exam is organized. The negative effect is higher among students in the top percentiles of the grade distribution.

Then, I investigate how the inclusion affects achievement of the students with disabilities themselves. I use propensity score matching methodologies and, again, data from Enem. My results show that the mean scores are up to 44% of a standard deviation higher among students with disabilities enrolled in last grade of high school in regular institutions compared to those who are enrolled in special schools.

When designing public policy, policymakers need to consider studies that assess the impact of this policy. In the case of the policy of including students with disabilities in mainstream schools, they must take into account the impact on all individuals involved, that is, students with disabilities and their peers in regular schools. There are some studies on the peer effect of students with disabilities [2]. However, there is no study that assesses the impact on both groups. Only by analyzing the impact of the policy on both groups, we can conclude whether the policy is positive or not. For this reason, the present study proposes to fill this gap in the literature by analyzing the impact of the inclusion of students with disabilities on both groups. In addition, this paper contributes to the empirical literature of peer effect with an analysis of the peer effect of students with disabilities per competency. Finally, the article is important given the existence of few articles in Brazil on the topic of education and people with disabilities [3].

This article is divided into five sections after this introduction: [Section 2](#) presents the related literature; [Section 3](#) explains the methodology; [Section 4](#) introduces the data; [Section 5](#) reports the results and [Section 6](#) brings the final remarks.

2. Related literature

This paper relates to two strands in the literature. First, it is related to peer effect studies because it analyses the impact of inclusion of students with disabilities on the achievement of their schoolmates. The second literature related to this paper comprises studies that evaluate the inclusive special education or special education services because it also analyses the impact of inclusion of students with disabilities in regular schools on the achievement of the students with disabilities themselves.

Peer effect studies seek to estimate the influence of schoolmates' or classmates' characteristics, background or behavior on individual achievement. [Sacerdote \(2011\)](#) points that the most commonly estimated model in this literature is the linear-in-means model as follows:

$$Y_{is} = \mathbf{X}'_{is}\boldsymbol{\beta} + \mathbf{S}'_s\boldsymbol{\delta} + \varepsilon_i \quad (1)$$

where the individual outcome of the student i at school (or class or dorm) s (Y_{is}) is a function of the student's characteristics (\mathbf{X}_{is}) and the student's peer's average characteristics (\mathbf{S}_s). The term \mathbf{S}_s is a vector that can contain, for instance, peers' average score and the proportion of peer with certain characteristic (proportion of female peer, proportion of white peer, etc.). In this model, $\boldsymbol{\delta}$ represents the peer effects.

The model above gives us the average marginal effect, masking possible heterogeneity in the effects experienced by different types of students. In order to access the possibility of heterogeneous across types of students, researchers also estimate nonlinear models [4].

The greatest concern of peer effect studies is the self-selection, that is, the fact that the assignment of students to schools and classes are not random, which may make estimates

less reliable. As [Epple and Romano \(2011\)](#) point, one approach used to circumvent the self-selection problem is to exploit datasets in which the assignment of students is random for administrative reasons: for example, random pairing of college dormitory roommates or randomly assigned classes within schools.

In the absence of datasets in which peer group variation arises from random assignment, many studies take another approach and explore datasets in which peer group variation is natural, that is, whose causes are other than self-selection. For example, they explore variation in peer characteristics in time, across cohorts, within schools such as [Hoxby \(2000\)](#) and [Lavy and Schlosser \(2011\)](#), who explore the variation in gender composition and use school fixed effects to deal with potential self-selection across schools.

In the peer effect literature, usually a student can provide externalities for their peer through his/her characteristics. As mentioned above, [Hoxby \(2000\)](#) and [Lavy and Schlosser \(2011\)](#) study the peer gender composition effect. There is also evidence that peer racial composition is correlated with achievement. For example, the literature on “acting white” shows that some black students may underachieve in order to fit in with their peers. In this paper, I focus on the peer effect provided by students with disabilities.

Schoolmates and classmates with disabilities may affect children’s cognitive and noncognitive abilities through two types of mechanisms. First, there are the mechanisms that generate a positive effect: living with students with disabilities can positively affect the interpersonal skills of other schoolmates by increasing their awareness of individual differences ([Williams & Downing, 1998](#)); classes with children with disabilities generally receive additional resources, which can positively affect student performance ([Hanushek, Kain, & Rivkin, 2002](#)); indeed, classes with children with disabilities require support professionals, and the presence of more qualified adults can improve the performance of all students ([Cipani, 1995](#)).

Second, there are the mechanisms that generate adverse effects: students with disabilities are more undisciplined ([Daniel & King, 1997](#)) and receive more attention from teachers during classes compared to other classmates ([Downing, Eichinger, & Williams, 1997](#)). In these circumstances, classmates with disabilities may negatively affect the performance of those students not subject to disabilities. These arguments are in line with Lazear’s model (2001). In this model, the most relevant peer effects are those that spill over from “bad apple” students, that is, the worst students in terms of score or the most undisciplined ones. According to the model, these students can provide adverse externalities in the following ways: by bad behavior, distracting their peer or the teacher from school tasks; by wasting learning time from asking poor questions or by encouraging disruptive behavior among their peer.

The following papers empirically evaluate this relationship between having schoolmates or classmates with disabilities and the children’s cognitive or noncognitive abilities: [Hanushek et al. \(2002\)](#), [Farrel, Dyson, Polat, Hutcheson, and Gallannaugh \(2007\)](#), [Fletcher \(2009, 2010\)](#), [Friesen, Hickey, and Krauth \(2010\)](#), [Gottfried \(2014\)](#), [Ruijs \(2017\)](#) and [Balestra, Eugster, and Liebert \(2022\)](#). These studies do not present a clear picture. On the one hand, [Fletcher \(2009, 2010\)](#), [Gottfried \(2014\)](#) and [Balestra et al. \(2022\)](#) find a negative peer effect. In both studies, [Fletcher \(2009, 2010\)](#) document that having classmates with severe emotional or behavioral disorders decreases reading and math scores by over 10% of a standard deviation in kindergarten and the first grade. [Gottfried \(2014\)](#) finds that a greater number of classmates with disabilities in elementary school adversely affects children’s noncognitive abilities, decreasing up to 4% of a standard deviation of noncognitive scales. [Balestra et al. \(2022\)](#) find that one additional student with special needs in a class of 20 in a secondary school reduces test scores by 2.5% of a standard deviation. On the other hand, [Hanushek et al. \(2002\)](#) find a positive peer effect. [Hanushek et al. \(2002\)](#) find that an increase of 10 percentage points in the proportion of students with disabilities in the class increases the achievement of the other

students in 1.6% of a standard deviation in elementary school. Finally, [Friesen et al. \(2010\)](#), [Farrel et al. \(2007\)](#) and [Ruijs \(2017\)](#) find a statistically insignificant peer effect.

In Brazil, to my knowledge, the only earlier empirical investigation of the relationship between having classmates with disabilities and the children's cognitive abilities is [Guidetti, Zoghbi, and Terra \(2015\)](#). Using data from a panel of students from the city of São Paulo, gathered from Prova São Paulo, and the method of difference-in-differences, the authors estimate the effect of the presence of students with disabilities in class on the math performance of the students without disabilities. In general, they find no evidence of the existence of an effect. Only by quantile regression, they see that in some quantiles, there is an adverse effect on students without disabilities. These results suggest that the peer effect is heterogeneous in the distribution.

The inclusion of students with disabilities in regular schools also affects their own achievement by two types of mechanisms. On the one hand, the sense of inclusion and belonging to society can positively influence the cognitive and noncognitive skills of students with disabilities. On the other hand, nonspecialized support, insensitive classmates and the sense of exclusion may negatively affect their abilities ([Tapasak & Walther-Thomas, 1999](#); [Peetsma, Vergeer, Roeleveld, & Karsten, 2001](#)).

As [Odom et al. \(2005\)](#) observe, it is difficult to apply quantitative methods to research on special education since the relatively small number of students with disabilities requires large samples to have adequate statistical power to detect effects. Thus, there are rare studies that evaluate inclusive special education or special education services, and most of them are case studies or with qualitative approaches, such as [Tapasak and Walther-Thomas \(1999\)](#), and [Peetsma et al. \(2001\)](#). Exceptions are [Morgan, Frisco, Farkas, and Hibel \(2010\)](#) and [Salvini, Pontes, Rodrigues, and Silva \(2019\)](#). [Morgan et al. \(2010\)](#) use propensity score matching techniques to examine the effectiveness of American special education services. Their results indicate that the receipt of special education services has a negative or a statistically nonsignificant impact on reading or mathematics skills and a small positive effect on learning-related behaviors. [Salvini et al. \(2019\)](#) also use propensity score matching techniques. They evaluate the impact of the Brazilian Specialized Educational Assistance on age-grade distortion. Their results indicate a positive impact of the program for ten among thirteen groups of disability types.

3. Methodology

This paper has two different objectives. Each of the research questions has its specificities, requiring its own methodology. Thus, I use different methodologies to satisfy each of the objectives of this study. Next, I explain both empirical strategies.

3.1 Impact of the inclusion on the schoolmates

The first objective of this paper is to analyze the impact of the inclusion of students with disabilities on the achievement of their schoolmates. In other words, I investigate how exposure to special needs students affects peers' achievement. I focus on peer externalities in grade cohort in a school due to the data limitations, following [Hoxby \(2000\)](#) and [Lavy and Schlosser \(2011\)](#).

For this first objective, my econometric model can be expressed in the following way:

$$Y_{ist} = \gamma D_{st} + \mathbf{X}'_{ist} \boldsymbol{\beta} + \mathbf{S}'_{st} \boldsymbol{\delta} + \alpha_s + \alpha_t + \alpha_e t + \varepsilon_{ist} \quad (2)$$

where Y_{ist} is the normalized sciences, humanities, languages, math or writing score of the student i at school s and year t , and D_{st} is the measure regarding children with disabilities in the last grade of high school at school s and year t . The term \mathbf{X}_{ist} is a vector with individual

control variables, which includes: sex, race, age, family's real income per capita and dummies for the mother's education. The term \mathbf{S}_{st} is a vector with the school grade averages of individual control variables (proportion of females, proportion of whites and mean age), and total and squared enrollment in the last grade of high school. The model also includes school and year fixed effects, α_s and α_t , respectively, and state linear time trends, α_{ct} .

In the absence of datasets in which peer group variation arises from random assignment, I explore the natural variation in time in the number of kids with disabilities. My identification assumption is that, conditional on observed characteristics, time and school fixed effects, the variation of individuals with disabilities within schools across cohorts is exogenous. In other words, the year-to-year change in the composition of individuals with disabilities in schools must be independent of time-varying unobserved characteristics that affect students' grades.

The main reason I assume that within-school variation of students with disabilities cohorts is random is that Brazilian allocation of students in public schools depends on geographical variables. The place of residence is one of the main determinants of the school in which he or she enrolls. It is plausible that parents might choose the neighborhood according to some schools' characteristics, which could potentially invalidate my identification assumption. I believe, however, that in Brazil – a developing country – this is unlikely to happen. Unlike developed countries, families of low income are the main users of the public school system, and they face high moving costs. Rich and middle class prefer to enroll their children in private schools.

There is no state or federal law that requires students to be enrolled in the nearest school to their residence. The allocation of students to schools is determined by the States. Year by year, the State Secretary of Education issue resolutions on what the allocation mechanism will be like. In the city of São Paulo, the largest public school system in the country, according to resolutions 33 and 34 of 2017 of the State Secretary of Education, for the academic year of 2018, each student could only apply for a place in an institution belonging to the microregion [5] in which he or she resides. Where there is no restriction of choice within a microregion, usually the proximity of residence to school is the first tiebreaker criterion among students as is the case in State of Rio de Janeiro (see resolution 5,777 of 2019 from State Secretary of Education). These facts reinforce my assumption that school choice – and the potential self-selection it implies – is small.

In addition, since I am controlling for school fixed effects, the school's characteristics that would be correlated with variation of students with disabilities would have to vary within schools in time. It is plausible to assume changes in the school's characteristics take a relatively long time to occur. This, together with the fact that I am looking at a seven-year period and the fact that students have very little choice with respect to school enrollment lend, strengthens the plausibility of my identification assumption.

I also try to test my identification assumption that within-school variation of students with disabilities cohorts is random. I regress the students' characteristics (race, gender and age) on the proportion of students with disabilities to check if this variable is a predictor. If the percentage of students is uncorrelated with students' characteristics, this would be suggestive evidence that cohort variation within a school is random. I present the results in Table 1. Each regression controls for school and time fixed effects, total enrollment (that is, number of students) in grade school and individual characteristics. None of the coefficients for the proportion of students with disabilities is statically significant.

3.2 Impact of the inclusion on the students with disabilities themselves

The second objective of this paper is to analyze the impact that the inclusion has on the achievement of the students with disabilities themselves. More specifically, this paper aims to

	(1) Sex (male = 1)	(2) Race (white = 1)	(3) Age
Students with disabilities (Share)	0.0359985 (0.0299)	-0.0210838 (0.0342)	0.1333362 (0.1032)
Sex (male = 1)		-0.0058588*** (0.0004)	-0.2011168*** (0.0018)
Race (white = 1)	-0.0082565 *** (0.0006)		-0.1370583*** (0.0019)
Age	-0.0372441*** (0.0003)	-0.01800106*** (0.0003)	
Enrollment	-0.0000285*** (0.0000)	0.0000031 (0.0000)	-0.0000685 (0.0001)
School fixed effect	↙	↙	↙
Time fixed effect	↙	↙	↙
No. of obs	4,568,946	4,568,946	4,568,946
F-test	1,396	492	1,655

Note(s): Standard errors in parentheses
 * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Source(s): Elaborated by the author

Table 1.
Balancing test – regular schools

calculate the average treatment effect on treated (ATT) for the students with disabilities who study in regular schools instead of special schools.

Defining Y_{1i} as the outcome (normalized sciences, humanities, languages, math or writing score) of student i if he is treated (regular school) and Y_{0i} as the outcome of that student if he is not treated (special school), the average treatment effect (ATE) can be expressed in the following way:

$$E[Y_{1i} - Y_{0i}] \tag{3}$$

The expression above tells me the average effect of the treatment considering individuals that have been treated and individuals that have not. I could also calculate the average treatment only on individuals that receive the treatment. This alternative form is the ATT. Defining T as an indicator variable that receives a value of 1 if the student is treated, the ATT can be expressed as follows:

$$E[Y_{1i} - Y_{0i} | T_i = 1] \tag{4}$$

Since I cannot observe the outcome of the student in both situations, I need to estimate the outcome that is missing. If I want to obtain the ATT, I have to find a valid estimate for Y_{0i} .

To calculate the ATT, I use propensity score matching methodologies. The propensity score matching methodologies are based on constructing a control group statistically similar to the treatment group regarding observed characteristics, or rather, regarding the propensity score of being treated, to avoid self-selection bias. Each member of the treatment group has a pair, or a few pairs, in the control group that represents the outcome that he would have obtained if untreated (counterfactual). When comparing the pairs, the only factor that differentiates the outcome is the participation or not in the treatment.

Some assumptions are required to use this method. First, $(Y_{1i}; Y_{0i}) \perp T_i | X_i$, that is, the potential outcome is independent of the treatment, conditional on the observed characteristics. Second, $0 < Pr(T_i = 1) | X_i < 1$, that is, there is no value of X for which it can be said with certainty that the student is treated or not. Combining these two assumptions, the following expression also holds:

$$(Y_{1i}; Y_{0i}) \perp T_i | P(X_i) \tag{5}$$

where the propensity score $P(X_i)$ is the probability of participating in treatment given the student characteristics. Then, the propensity score matching estimator for the ATT can be written as follows:

$$ATT_{PSM} = E_{p(x)|T=1}\{E[Y_1|T = 1, P(X)] - E[Y_0|T = 0, P(X)]\} \quad (6)$$

To estimate $P(X_i)$, I use a probit model and the following covariates: sex, race, age, family's real income per capita, dummies for the mother's education, dummies for Brazilian regions and dummies for type of disability (hearing or visual impairment, intellectual disability or autism, and physical disability). I also test the balancing property, that is, independent of being treated or not, students with the same propensity score must have the same distribution of observed characteristics. Table A2 in the [Appendix](#) shows the probit results, and Figure A1 in the [Appendix](#) shows the overlap between treated and control groups.

I use different matching criteria to assign students in the treatment group to students in the control group based on the propensity score: nearest-neighbor matching, stratification matching, radius matching and kernel matching. In nearest-neighbor matching, each student in the treatment group is matched to the student(s) in the control group with the most similar propensity score. In stratification matching, the impact of the treatment is the weighted average of the intervals impact. In radius matching, each treated student is matched to the untreated students only among propensity scores within a specific range. Finally, in kernel matching, I use a weighted average of all untreated students to construct the counterfactual match for each treated student.

Asymptotically the results from different matching criteria should be the same, because, as sample size grows, I am closer to comparing only exact matches. However, the choice of matching criteria can make a difference in small samples. In small samples, I have usually a trade-off between bias and variance. For example, when I choose the method between nearest-neighbor matching and another matching criterion as radius matching or kernel matching, I face the following trade-off: using nearest-neighbor matching, the results yield lower bias, but with a higher variance, compared to kernel matching, where the results yield lower variance, but with a higher bias ([Heckman, Ichimura, & Todd, 1997](#)). Therefore, I use all the four matching criteria mentioned above so that I can compare if the findings with different matching techniques are consistent.

4. Data

The main source of my data is the Enem. Enem is a nonmandatory exam used as admission instrument to higher education and as an evaluation instrument of the school performance at the end of secondary education [6]. For my analysis, I standardize all test scores to ease interpretation and comparability with other studies. Besides sciences, humanities, languages, math and writing achievement, the data include socioeconomical questionnaires of the students.

I take data from several years – from 2012 to 2018. From these data, I use the following information about student characteristics: disability, sex, race, age, the family's real income per capita and mother's education. When the student is concluding the high school in the same year that is taking the exam, I am able to identify his or her school. Therefore, I take into consideration only students in the last grade of high school taking the exam.

The Enem database is the only Brazilian *public* database in which I can identify how the student performs and if he or she has any disabilities. There are the data from National Basic Education Assessment, a biannual assessment of math and languages learning for 5th and 9th-grade public school students. However, in these data I do not have the information whether the student has any disabilities.

I merge the Enem data with the Census of Basic Education School, an annual administrative dataset that presents information of all basic education institutions in the country, including the number of students with disabilities, developmental disorders and high skills or giftedness. Through the School Census, we are able to get a measure regarding

students with disabilities within grades within schools. Since Enem is a nonmandatory exam, we cannot obtain the exact number of students with disabilities concluding high school by institution through the exam data. I use this information about students with disabilities in my first empirical exercise, as well as the proportion of female students, the proportion of white students, the mean age of the students and enrollment.

In my sample, I keep only students of public schools. I exclude children in private schools, because the assignment of students to private schools is not random. For the same reason, I exclude children in federal schools [7] because they have an entrance exam. Differently, allocation of students in city and state public schools depends on geographical variables, and I believe that in a developing country, like Brazil, it is unlikely that parents choose the neighborhood they live according to some schools' characteristics.

I make different sample restrictions for each research question due to its specificities. To answer the first question, I restrict my analysis to students without disabilities in regular education schools. I classify a student as disabled if he or she has a hearing or visual impairment, an intellectual disability, a physical disability or multiple disability. Then, I exclude students with missing data and students with a test score equals to zero or family's real income equals to zero. I also drop outliers, what excludes approximately 5% of the previous sample: small grade cohorts (that is, grade-cohorts with less than 20 students); students younger than 16 years and older than 24 years (considering that the ideal age to conclude high school is 17); grade cohorts with a mean age over than 21 and grade cohorts with a proportion of students with disabilities over than 10% (which represent 0.2% of the sample).

With the restrictions made, my sample consists of 3,218,573 observations of students concluding the last grade of high school between 2012 and 2018. Table 2 reports annual descriptive statistics. Statistics show that the average percentage of students with disabilities in the last grade of high school have increased, rising from 0.43 to 1.18%. This increase is possibly due to the fact that Brazil has sought and still seeks to universalize access to basic education for disabled children. I use this variation to analyze the peer effects of the students with disabilities on achievement.

On Figure 1, I show the achievement distributions of students with disabilities (blue curve) and without disabilities (red curve) for each subject. I observe that the blue curve is more to the left than the red one, that is, students with disabilities perform slightly worse than students without disabilities. This score difference becomes more evident in languages and writing. From this figure, I can assume that a large proportion of students with disabilities have learning difficulties. The potential learning difficulties can affect negatively their peers, and, for this reason, I may expect an adverse peer effect.

To answer the second research question, I keep in the sample only students with disabilities aged from 16 to 24 years in urban schools. Again, I exclude students with missing data and students with a test score equals to zero or family's real income equals to zero. Thus, my sample then consists of 100 observations of students in the control group and 10,012 observations of students in the treatment group, as Table 3 shows. This Table also shows that on average students with disabilities in regular schools tend to perform better comparing to students with disabilities in special schools. I aim to calculate the ATT to investigate if this difference is due to our treatment variable, that is, enrollment in regular education.

5. Results

In this section, I describe my results. First, I present my findings for the impact of the inclusion of students with disabilities in regular schools on the achievement of their

Table 2.
Descriptive statistics
by year

	2012	2013	2014	2015	2016	2017	2018	Total
Sciences score (standardized)	-0.1963835 (1.058909)	-0.1464578 (0.988646)	0.1068983 (0.9954006)	-0.1111998 (0.950355)	-0.0765656 (0.9507412)	0.376714 (0.9670901)	0.1250012 (0.9615954)	0 (1)
Humanities score (standardized)	-0.2393474 (1.034285)	-0.3228828 (1.006006)	0.2181703 (0.9081943)	0.2650663 (0.9035953)	-0.0075182 (0.9200869)	-0.258598 (0.9942288)	0.4176188 (0.9944436)	0 (1)
Language score (standardized)	-0.2465982 (0.9954484)	-0.2731371 (1.075101)	0.13579 (0.9463851)	-0.0714931 (0.9873446)	0.2279789 (0.9446726)	0.0236821 (0.8982738)	0.2636168 (0.997405)	0 (1)
Math score (standardized)	0.0903299 (1.143974)	0.1660077 (0.9663063)	-0.2043075 (0.9981692)	-0.3412516 (0.9179684)	-0.1326917 (0.9135596)	0.2022201 (0.9473405)	0.3627279 (0.9188249)	0 (1)
Writing score (standardized)	-0.1665316 (1.040972)	-0.0454552 (0.9882135)	-0.1554123 (1.070946)	0.0998614 (0.8576058)	0.1357884 (0.8989167)	0.2404236 (0.9017657)	-0.1087838 (1.174349)	0 (1)
Share of students with disabilities	0.0042754 (0.0082058)	0.0049882 (0.0091037)	0.0058076 (0.0095657)	0.0069983 (0.010822)	0.0083347 (0.0118248)	0.0094874 (0.0130892)	0.0118454 (0.0141129)	0.0071603 (0.0112445)
Share of students with hearing or visual impairment	0.0020075 (0.0055916)	0.0021402 (0.0053777)	0.0021851 (0.0054309)	0.0024423 (0.0057738)	0.0027145 (0.0060562)	0.0028758 (0.0065806)	0.0031428 (0.0065563)	0.0024664 (0.0058938)
Share of students with intellectual disability	0.0015111 (0.0046945)	0.0020755 (0.0060796)	0.0027221 (0.0066245)	0.0036545 (0.0078959)	0.0047125 (0.0091012)	0.0055852 (0.0100105)	0.0075031 (0.0116347)	0.0037841 (0.0083121)
Share of students with physical disability	0.0008949 (0.003108)	0.0009686 (0.0032854)	0.0012109 (0.0036547)	0.0012811 (0.0037223)	0.0014175 (0.0038882)	0.0015896 (0.0042865)	0.0019533 (0.0047421)	0.0012997 (0.0038095)
Share of students with multiple disability	0.0001322 (0.0012941)	0.0001807 (0.0014641)	0.0002965 (0.0019015)	0.0003635 (0.0020947)	0.0004879 (0.00242)	0.0005415 (0.0025224)	0.000719 (0.0031357)	0.0003721 (0.0021525)
Share of males	0.6078198 (0.488237)	0.4001186 (0.4899226)	0.4033997 (0.4905801)	0.403461 (0.4906922)	0.4050606 (0.4909043)	0.405148 (0.4909213)	0.4097147 (0.4917817)	0.4333492 (0.4955378)
Share of whites	0.495131 (0.4999768)	0.475761 (0.4994134)	0.4700525 (0.4991028)	0.4224834 (0.493351)	0.4205812 (0.4935528)	0.4059229 (0.4910703)	0.3982133 (0.4895395)	0.4436541 (0.4968151)
Age	17.58127 (1.038909)	17.58044 (1.030815)	17.54631 (0.9762192)	17.54739 (0.97209)	17.54599 (0.9640627)	17.55839 (0.9223054)	17.60701 (0.8848799)	17.56895 (0.9757396)
Family's real income per capita	474.2539 (459.3715)	465.7901 (474.4016)	476.7307 (483.7478)	479.9758 (471.3229)	476.2195 (464.9888)	477.4776 (483.8908)	482.5811 (489.2554)	475.8065 (474.7578)
Mother's education: no education	0.0221673 (0.1472277)	0.0224401 (0.1481101)	0.0196489 (0.1387908)	0.0195957 (0.1389063)	0.0196169 (0.1386798)	0.0177206 (0.1319341)	0.017438 (0.1308969)	0.019943 (0.1388044)
Mother's education: 5th grade	0.4612045 (0.4984932)	0.4477958 (0.4972578)	0.4271814 (0.4946695)	0.3202963 (0.466592)	0.3114751 (0.4630969)	0.2874394 (0.4525688)	0.2810807 (0.4495274)	0.3673805 (0.4820914)
Mother's education: 9th grade	0.0845789 (0.2782544)	0.0866576 (0.2816265)	0.0898592 (0.2859803)	0.1895972 (0.3919826)	0.1897692 (0.3921188)	0.184995 (0.3882939)	0.1784409 (0.382884)	0.1410081 (0.348403)

(continued)

	2012	2013	2014	2015	2016	2017	2018	Total
Mother's education: high school	0.3211432 (0.4669162)	0.3285898 (0.4697009)	0.3433613 (0.4748313)	0.3566983 (0.4790255)	0.3618979 (0.48055)	0.3815933 (0.4857782)	0.3882478 (0.4873522)	0.3525566 (0.4777662)
Mother's education: university	0.110906 (0.3140161)	0.1143167 (0.3181969)	0.1199491 (0.3249023)	0.1138086 (0.3175789)	0.117241 (0.3217075)	0.1282517 (0.3343702)	0.1347925 (0.3415023)	0.1191118 (0.3239201)
Enrollment	204,494 (148,6243)	197,6939 (140,4412)	194,4534 (136,4923)	188,7995 (133,6788)	194,7791 (136,924)	191,3083 (138,9966)	190,1435 (144,092)	194,7227 (139,7989)
<i>No. of obs</i>	461,084	500,889	509,341	481,484	501,915	416,860	347,000	3,218,573

Note(s): The table shows the mean and standard error of the variables used in our investigation. The unit of analysis is the student. Disability, sex and race are dummies variables; consequently, the average of these variables indicates the proportion (between 0 and 1) of students with disabilities, male students and white students. Family income is in real values at 2018 prices. Mother's education is separated into five dummies variables: no education, 5th grade, 9th grade, high school and university. The average of these variables indicates the proportion (between 0 and 1) of students with mothers with each educational level. Enrollment is the number of students enrolled in the last year of high school at the student's school.

Standard errors in parentheses

Source(s): Elaborated by the author

Table 2.

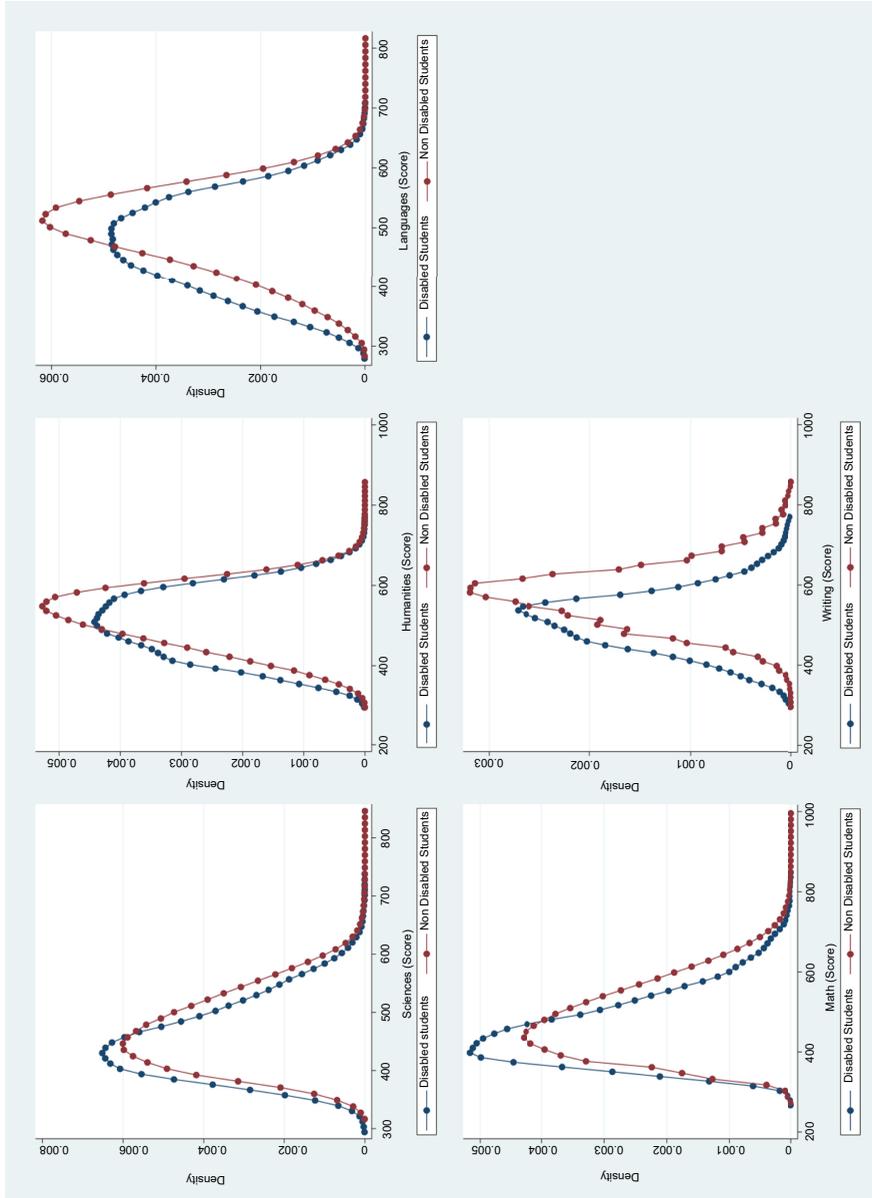


Figure 1.
Achievement
distribution of students
with disabilities and
without disabilities by
subject

Source(s): Elaborated by the author

	Control group (Students in special schools)	Treatment group (Students in regular schools)
Sciences score (standardized)	-0.3637374 (1.01213)	0.003633 (0.9992616)
Humanities score (standardized)	-0.439321 (1.048972)	0.0043879 (0.9985792)
Languages score (standardized)	-0.4064075 (0.9979914)	0.0040592 (0.9992363)
Math score (standardized)	-0.2511675 (0.8143009)	0.0025087 (1.001397)
Writing score (standardized)	-0.2282696 (1.152208)	0.00228 (0.9981657)
Share of students with hearing or visual impairment	0.73 (0.446196)	0.5402517 (0.4984021)
Share of students with intellectual disability	0.04 (0.1969464)	0.087495 (0.2825732)
Share of students with physical disability	0.24 (0.4292347)	0.4037155 (0.4906662)
Share of males	0.46 (0.5009083)	0.4994007 (0.5000246)
Share of whites	0.5 (0.5025189)	0.4722333 (0.4992533)
Age	19.19 (1.739006)	18.4964 (1.59921)
Family's real income per capita	478.2702 (444.1037)	471.3842 (495.6572)
Mother's education: no education	0.03 (0.1714466)	0.0250699 (0.1563453)
Mother's education: 5th grade	0.42 (0.496045)	0.3510787 (0.4773313)
Mother's education: 9th grade	0.15 (0.3588703)	0.1432281 (0.3503228)
Mother's education: high school	0.31 (0.4648232)	0.3406912 (0.4739653)
Mother's education: university	0.09 (0.2876235)	0.1399321 (0.3469339)
<i>No. of obs</i>	100	10,012

Note(s): The table shows the mean and standard error of the variables used in our investigation. The unit of analysis is the student. Disability types, sex and race are dummies variables, and consequently the average of these variables indicates the proportion (between 0 and 1) of students with each disability type, male students, and white students. Family income is in real values at 2018 prices. Mother's education is separated into five dummies variables: no education, 5th grade, 9th grade, high school and university. The average of these variables indicates the proportion (between 0 and 1) of students with mothers with each educational level. Standard errors in parentheses

Source(s): Elaborated by the author

Table 3.
Descriptive statistics
by group

schoolmates. Next, I present my findings for the impact that the inclusion has on the achievement of the students with disabilities themselves.

5.1 Impact of the inclusion on the schoolmates

In order to investigate the potential adverse peer effect problem, I estimate my main econometric model. I present my first results in [Table 4](#). The table reports the effects of the exposure to peers with disabilities on standardized sciences, humanities, languages, math and writing scores. All regressions include individual covariates, grade averages, school and time fixed effects, and state time linear trends, and standard errors are clustered at the school level. Results show that students tend to perform a little worse in writing when in schools with a higher proportion of children with disabilities in their grade. In other subjects, I find weaker or none evidence of a statistically significant peer effect. The complete table with the coefficients of the control variables is in [Appendix](#).

I use three different definitions of the treatment variable. The first definition is the percentage of peers with disabilities; the second is the total number of peers with disabilities and the third is a binary variable that is one if there is at least one peer with disabilities in the school grade and zero otherwise. Results show that an additional percentage point in the proportion of students with disabilities would reduce, for high school thirdgraders, writing scores by 0.0031 standard deviation. From the other definitions, I have that an additional student with disabilities would reduce writing scores by 0.002 standard deviation, and the

Table 4.
Determinants of
student achievement
by subject – impact of
students with
disabilities

	Sciences	Humanities	Languages	Math	Writing
<i>A. First specification</i>					
Students with disabilities (Share)	-0.1006274 (0.0820)	-0.1188476 (0.0797)	-0.1145121 (0.0772)	-0.0096397 (0.0775)	-0.3113854*** (0.0939)
<i>B. Second specification</i>					
Students with disabilities (No.)	-0.0011167* (0.0006)	-0.0019536*** (0.0006)	-0.0021775*** (0.0006)	-0.0009833 (0.0007)	-0.0024322*** (0.0008)
<i>C. Third specification</i>					
Students with disabilities (0 or 1)	-0.0015811 (0.0019)	-0.0035798** (0.0018)	-0.0031052* (0.0017)	-0.0023721 (0.0019)	-0.0047773** (0.0021)
Individual controls	✓	✓	✓	✓	✓
Grade averages controls	✓	✓	✓	✓	✓
School fixed effect	✓	✓	✓	✓	✓
Time fixed effect	✓	✓	✓	✓	✓
State time linear trend	✓	✓	✓	✓	✓
No. of obs	3,218,573	3,218,573	3,218,573	3,218,573	3,218,573
Note(s): Standard errors in parentheses					
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$					
Source(s): Elaborated by the author					

presence of a student with disabilities would reduce writing scores by 0.005 standard deviation. All estimates regarding the writing score are statistically significant at the 5% level.

I find statistical significance in all the three specifications only in writing. I find weaker results in humanities and languages. More specifically, in these subjects I find statistically significant results at the 5% level in two of the three specifications. The size of the effect in humanities and languages is similar to that in writing, that is, an adverse effect between 0.002 and 0.004 standard deviation. In sciences, I find statistical significance in just one specification and at the 10% level, and finally in math, I find none evidence of a statistically significant peer effect.

The international literature does not present a clear picture of the effect provided by peer with disabilities: there are studies that find positive results (Hanushek *et al.*, 2002), there are studies that find negative results (Balestra *et al.*, 2022; Fletcher, 2009, 2010; Gottfried, 2014) and there are studies that find nonsignificant results (Friesen *et al.*, 2010; Farrel *et al.*, 2007; Ruijs, 2017). My results are negative or statistically insignificant. Comparing the size of my results with the size of negative results in the international literature, my results seem quite small. While Fletcher (2009, 2010) finds an effect of over 10% of a standard deviation, Gottfried (2014) finds a result of up to 4% of a standard deviation, and Balestra *et al.* (2022) find a result of 2.5% of a standard deviation, and I find an effect between 0.2 and 0.4% of a standard deviation.

On a broader view, my results are similar in magnitude to the ones found in gender or racial composition effect. For example, Hoxby (2000) finds that an additional percentage point in the proportion of females on Texas elementary schools would increase English and math scores by 0.1–0.2% of a standard deviation, and Lavy and Schlosser (2011) find that an additional percentage point in the proportion of females students on 5th grade in Israeli schools raises average math scores by 0.4% for girls and 0.2% for boys. In the literature on peer racial composition, Hanushek, Kain, and Rivkin (2009) find that a one percentage point increase in the fraction black is associated with own test scores that are roughly 0.002 standard deviation lower.

In my second empirical exercise, I estimate the same model breaking my treatment variable into four variables. I use objective disability categorizations in order to remove the variation from subjective disability designations, which are more likely to be endogenous. The categorizations are (1) hearing or visual impairment, (2) intellectual disability, (3) physical disability and (4) multiple disabilities. Among the four categorizations, just one presents significant results – intellectual disability. Therefore, the results in Table 5 show that students tend to perform a little worse in sciences, humanities and writing when in schools with a higher proportion of children with intellectual disability in their grade. The magnitude of the results is similar to those found in the first empirical exercise: an additional percentage point in the proportion of peer with intellectual disabilities tends to decrease scores by 0.3 to 0.4% of a standard deviation.

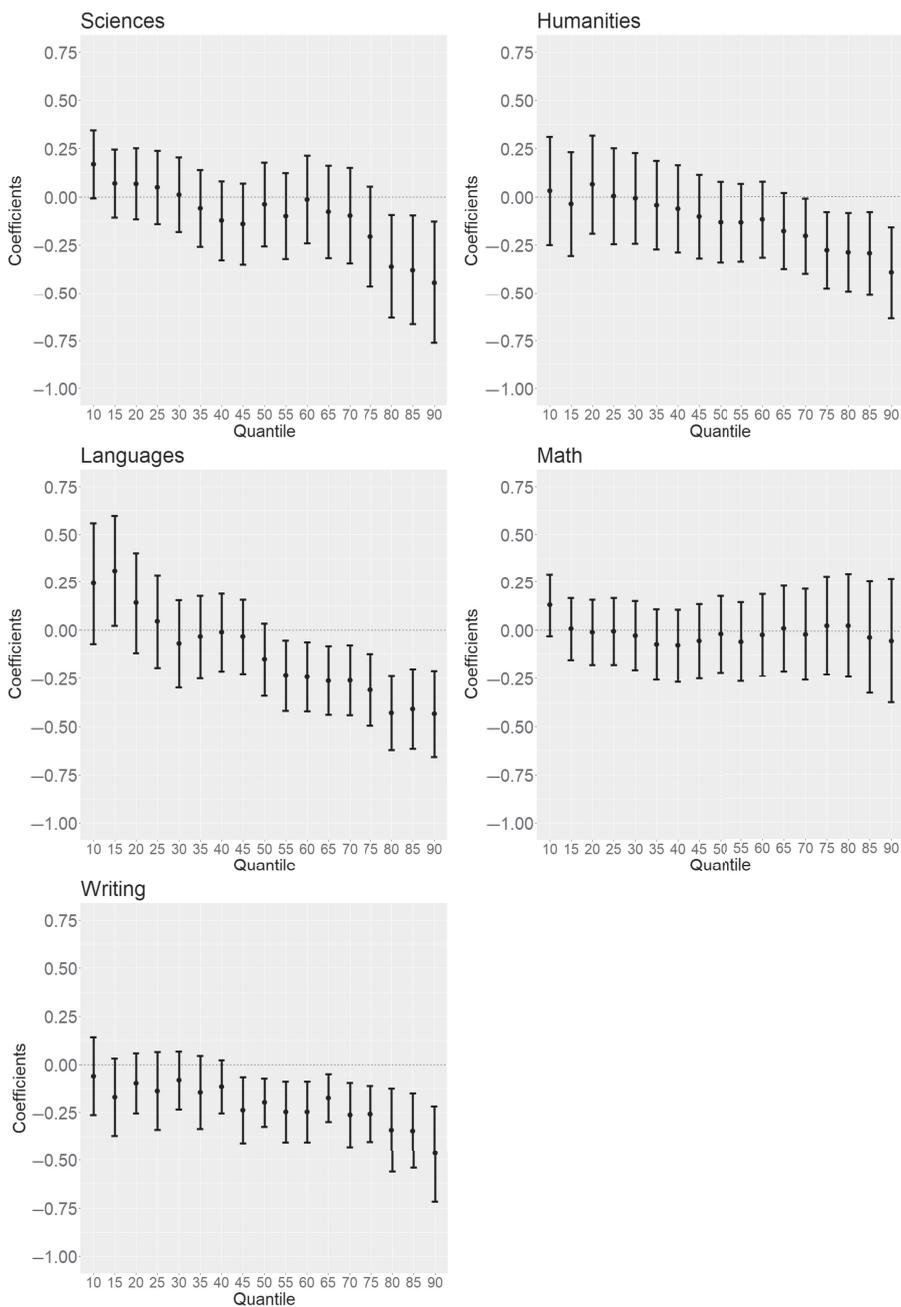
Taking both empirical exercises into account, I find that most of the net negative impact of students with disabilities is small or statistically insignificant. It is possible to conjecture that in Brazil the mechanisms by which schoolmates with disabilities negatively affect children's cognitive abilities are almost entirely compensated by the mechanisms that affect positively. This conclusion corroborates the earlier empirical investigation of the relationship between having peers with disabilities and the children's cognitive abilities in Brazil Guidetti *et al.* (2015).

The previous empirical exercises give me the average marginal effect. It is plausible that, while the average peer effects of students with disabilities are small, the effect on specific quantiles of the achievement distribution can be larger and more significant. In order to access the possibility of heterogeneous across the achievement distribution, I do a third empirical exercise using unconditional quantile regression approach developed by Firpo, Fortin, and Lemieux (2009). The results are shown in Figure 2, which plots quantile treatment

Table 5.
Determinants of
student achievement
by subject – impact of
students with
disabilities by type

	Sciences	Humanities	Languages	Math	Writing
Students with hearing or visual impairment (Share)	0.1389787 (0.1508)	0.1704178 (0.1441)	-0.1184997 (0.1410)	-0.0283790 (0.1448)	-0.0498473 (0.1676)
Students with intellectual disability (Share)	-0.2515441** (0.1110)	-0.3068784*** (0.1100)	-0.11196301 (0.1069)	0.0446380 (0.1012)	-0.4486445*** (0.1290)
Students with physical disability (Share)	-0.1298608 (0.2295)	0.0406439 (0.2189)	-0.0440258 (0.2099)	-0.2261535 (0.2112)	-0.3206117 (0.2442)
Students with multiple disability (Share)	0.2880111 (0.3877)	-0.0427433 (0.4012)	-0.0981748 (0.3904)	0.2718823 (0.3783)	0.2684932 (0.4572)
Individual controls	✓	✓	✓	✓	✓
Grade averages controls	✓	✓	✓	✓	✓
School fixed effect	✓	✓	✓	✓	✓
Time fixed effect	✓	✓	✓	✓	✓
State time linear trend	✓	✓	✓	✓	✓
No. of obs	3,218,573	3,218,573	3,218,573	3,218,573	3,218,573
F-test	2,380	4,473	2,966	3,318	1,760

Note(s): Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$
Source(s): Elaborated by the author



Source(s): Elaborated by the author

Figure 2.
Quantile effects of
peers with disabilities

effects and the respective 95% confidence intervals for different percentiles of the achievement distribution. I find that high-achieving students are more strongly affected by the proportion of students with disabilities than the low-achieving ones.

More specifically, I find that the peer effect is statistically insignificant at the bottom percentiles. The effects at top percentiles, in turn, are negative and statistically significant. Only in math, I do not see any significant result. [Castro & Villacorta \(2020\)](#) show that the productivity of schooling and inputs are a complement to the children's learning only if their complexity exceeds the children's skills. Thus, a possible explanation to my result is that teachers reduce the pace of teaching so that students with disabilities, with greater learning difficulties, can understand the subject, harming students with learning facility.

5.1.1 Competency assessment. The Enem is composed of 180 multiple-choice questions – 45 questions per subject – plus an essay. All questions are prepared following a reference matrix of competencies and skills. Each question must assess a single skill within a competency. The reference matrix allows us to see in which particular competency and skills the students have struggled more and where they have succeeded. I will use this reference matrix (shown in [Appendix](#)) to investigate further the heterogeneous effects of exposure to disabled students.

Even though I found statistically significant negative peer effects of disabled students on some subjects, I do not know which assessed competencies are responsible for these results. If I knew more specifically which competencies are being affected by exposure to disabled students, I could be able to think about and design policies to correct this adverse peer effect. To achieve this goal, I will regress a measure of student performance *by competency* within a subject. The subject I have chosen is writing because it was the subject where we have found the strongest effects in our earlier empirical exercises (see [Tables 4 and 5](#) and [Figure 2](#)). My measure of student performance by competency for writing is the student's standardized score in each competency [\[8\]](#). The complete table with the coefficients for all subjects is in [Appendix](#).

I present the results in [Table 6](#). The table shows the estimated coefficients for each competency in writing of the share of disabled students in the grade. The writing exam evaluates five competencies, and of those five, the peer effect of disabled students is negative and statistically significant in only three of them (W2, W3 and W5). The magnitude of the results is similar to those found in the earlier empirical exercises: an additional percentage point in the proportion of peer with intellectual disabilities tends to decrease scores by 0.3 to 0.4% of a standard deviation.

What draws attention to this result is that the W1 and W4 skills, in which the results were not significant, are related to the knowledge of formal written and linguistic mechanisms respectively. The W2, W3 and W5 skills are related to broader and more abstract skills, such as “to understand the writing proposal and apply concepts from various areas of knowledge to develop the theme”, “to select, report, organize and interpret information, facts, opinions and arguments in defense of a point of view” and “to prepare intervention proposal for the problem addressed, respecting human rights”.

5.2 Impact of the inclusion on the students with disabilities themselves

In the previous section, I analyze the effect of including students with disabilities in mainstream schools on their nondisabled peers. For a complete analysis of the inclusion policy, I also need to analyze the effect on students with disabilities themselves. Then, in this section, I present my estimated results of the effect of inclusion on students with disabilities themselves.

[Table 7](#) reports the propensity score matching estimates of the ATT [\[9\]](#). I consider four alternative matching criteria to check the robustness of my findings. Results show that students with disabilities tend to perform better in humanities and languages when enrolled

Writing	W1	W2	W3	W4	W5
Coefficients	-0.0780277 (0.0777)	-0.3372187*** (0.0925)	-0.3503166*** (0.0908)	-0.0665532 (0.0865)	-0.3476877*** (0.1013)
No. of obs	3,218,573	3,218,573	3,218,573	3,218,573	3,218,573
F-test	2,010	1,623	1,772	1,644	1,333
Individual controls	✓	✓	✓	✓	✓
Grade averages controls	✓	✓	✓	✓	✓
School fixed effect	✓	✓	✓	✓	✓
Time fixed effect	✓	✓	✓	✓	✓
State time linear trend	✓	✓	✓	✓	✓

Note(s): Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Source(s): Elaborated by the author

Table 6.
Determinants of student achievement by competency – impact of students with disabilities

in regular schools rather than special schools. For these subjects, the differences between the treatment and control groups are all statistically significant at 1%, except when using nearest-neighbor matching. When I use nearest-neighbor matching, the results are significant but at 5%.

More specifically, the point estimate results show that the mean score on humanities is between 33 and 46% of a standard deviation higher among students with disabilities enrolled in regular schools compared to those who are enrolled in special schools. The magnitude of the result depends on the matching technique used. The nearest-neighbor matching yields a result equal to 36% of a standard deviation; the stratification matching, 35%; the radius matching, 33%; and the kernel matching, 46%. Similarly, the mean score on languages is between 29 and 48% of a standard deviation higher among the treated students. For the other subjects, the results are only significant when using kernel matching, but, when I use the other matching criteria, the results are all insignificant.

The results convey the trade-off between bias and variance in small samples. Using nearest-neighbor matching the variance is large, making the result significant only at 5%. However, when I use kernel matching, I find the smallest variance, making the results significant at 1% for almost all subjects. However, in this method, the bias tends to be larger.

I conclude that there is evidence of a positive impact of the inclusion of students with disabilities in regular schools on their achievement in humanities and languages. For these subjects, I find results of considerable size using all alternative matching criteria. For the other subjects, sciences, math and writing, I do not find consistent evidence.

Thus, it is possible that students with disabilities enrolled in regular schools develop a sense of inclusion and belonging to society that influences noncognitive skills and, hence, cognitive skills. It is possible that this impact on cognitive skills is more visible in subjects like humanities and languages compared to math and exact sciences. It is also possible that this result is due to peer effect, that is, a student with disability in a regular school may have classmates with better achievement.

Comparing with the results on peers, it seems that the net effect of inclusion is positive. While inclusion negatively affects peers, it positively affects students with disabilities themselves in a much greater extent.

Table 7.
Propensity score
matching estimates of
the ATT

Matching	Sciences	Humanities	Languages	Math	Writing
Nearest-neighbor matching (with replacement)	-0.001 (0.151)	0.251 (0.156)	0.240 (0.149)	0.035 (0.122)	0.062 (0.172)
Stratification matching	0.172 (0.106)	0.312** (0.125)	0.254** (0.105)	0.179* (0.100)	0.080 (0.128)
Radius matching (0.001)	0.126 (0.128)	0.327** (0.133)	0.231* (0.126)	0.149 (0.103)	0.097 (0.146)
Epanechnikov kernel matching (bandwidth = 0.06)	0.362*** (0.094)	0.441*** (0.108)	0.408*** (0.085)	0.248*** (0.086)	0.2222** (0.104)

Note(s): Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$ and *** $p < 0.01$
Source(s): Elaborated by the author

6. Final remarks

This paper has presented empirical evidence that students with disabilities tend to perform better when enrolled in regular schools rather than special schools, but students in general tend to perform a little worse when in schools with a higher proportion of children with disabilities in their grade. In summary, my evaluation is that inclusion policies achieve the goal of improving the performance of students with disabilities but such policies have a small and adverse side effect.

I believe that this paper provides an essential contribution to the still small literature that evaluates the effects of the inclusion of students with disabilities in regular schools. I have shown that the negative peer effect of students with disabilities on their peers comes mainly from students with intellectual disabilities and concentrates on specific subjects: writing, humanities and languages. The effect tends to be higher on students on the top percentiles of the grade distribution. Moreover, I have identified through which competencies within a subject the negative effect comes. Comparing the size of these results with the size of negative results found in international studies, my results seem quite small. However, on a broader view, my results are similar in magnitude to the ones found in gender or racial composition effect.

I have also shown that the positive effect of the inclusion on the students with disabilities seems again more widespread in humanities and languages. The magnitude of the effect found on students with disabilities is much greater than the effect found on peers, which leads me to conclude that the net effect of inclusion is positive and the inclusive school is the better choice.

It is important to emphasize that this work faces many limitations both regarding the methodology and the available data and sample. For the methodology to be valid, I need to believe in the hypothesis that the place of residence is one of the main determinants of the school in which the students enroll. In addition, even making the estimates based on observable characteristics and on the common support region, a bias may still remain, due to unobserved variables that simultaneously affect the choice for a mainstream school and the result.

Regarding the available data, I am not able to observe the student's class and, therefore, I focus on peer externalities the in grade cohort in a school, what can lead to an underestimated effect. The number of students with disabilities is small, what can generate not adequate statistical power. Moreover, Enem is a nonmandatory exam; consequently, there may be a selection bias.

Finally, I believe that living with students with disabilities can positively affect the interpersonal skills of other schoolmates by increasing their awareness of individual differences. Unfortunately, due to the available data, the focus of this paper was on cognitive skills. Thus, to continue this line of research, I suggest that the effects of the inclusion on noncognitive abilities be evaluated.

Notes

1. According to the Demographic Census of 2010, there are more than 45 million people (around 24% of the population) with some disability (visual, hearing or locomotor impairment or physical or intellectual disability). 18.8% of the Brazilian population has visual impairment, disregarding people who solve their difficulties using glasses (0.3% cannot see at all, 3.2% have great visual impairment, and 15.3% have slight visual impairment). 5.1% of the Brazilian population has hearing impairment, disregarding people who solve their difficulties using hearing aid (0.2% cannot hear at all, 0.9% have great hearing impairment and 4.0% have slight hearing impairment). 7.0% of the Brazilian population has locomotor impairment (0.4% cannot move at all, 1.9% have great locomotor impairment, and 4.6% have slight locomotor impairment). 1.4% of the Brazilian population has some intellectual disability. The sum of these percentages is higher than 24.0%, because there are people with more than one disability.

2. See, for example, Hanushek *et al.* (2002), Farrel *et al.* (2007), Fletcher (2009, 2010), Friesen *et al.* (2010), Gottfried (2014), Ruijs (2017) and Balestra *et al.* (2022).
3. See Guidetti *et al.* (2015) and Salvini *et al.* (2019).
4. See Hoxby and Weingarth (2005), Cooley (2009), Hanushek and Rivkin (2009), Lavy, Paserman, and Schollosser (2011), Imberman, Kuglers, and Sacerdote (2012), Burke and Sass (2013).
5. The city of São Paulo is divided into 13 microregions.
6. The fact Enem is nonmandatory raises self-selection concerns. To address this problem, I run the main model restricting the sample to schools where the participation in Enem exam is 80% or higher. Results are consistent with the full sample results by showing statistical significance in all the three specifications only in writing. I bring some of these results in Annex B.
7. To calculate the impact of the inclusion on the students with disabilities themselves, the addition of students in federal schools increases our sample in the control group by 25% (from 100 to 125 students). As my sample of students in special schools is small, this increase is quite significant. Thus, I bring in Annex C the results considering students from federal schools.
8. My measure of student performance by competency for sciences, humanities, languages and math is the student's percentage of correct answers in questions involving the analyzed competency. The writing score is calculated differently from the other scores. The essay total score is equal to the sum of the scores in each of the five competencies. The score of each competency ranges from 0 to 200; consequently, the writing score goes from 0 to 1000. Total scores in other subjects are calculated based on the item response theory, and there are no grades per competency. Therefore, for my analysis by competency in subjects with objective tests, I use a different variable, the accuracy rate.
9. For kernel matching, the standard errors are calculated by bootstrapping.

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Appendix

The Appendix file for this article can be found online.

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