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Label to Help: The Effects of Special Education on Student Outcomes

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Abstract

This study examines the impact of special education on academic and behavioral outcomes for students with learning disabilities (LD) by using statewide Indiana data covering kindergarten through eighth grade. The results from student fixed effects models show that special education services improve achievement in math and English Language Arts, but they also increase suspensions and absences for students with LD. These effects vary across student subgroups, including gender, race/ethnicity, eligibility for free or reduced-price lunch, and English language learner status. The findings reveal both the significant benefits and unintended consequences of special education services for students with LD, highlighting the complex dynamics and varying effects of special education.

Keywords: special education, students with disabilities, school discipline, student achievement

Introduction

Numerous U.S. students receive special education services and the financial expenditure for these services is substantial. As of 2022, approximately 7.2 million students, representing 15% of the student population, participated in special education services in U.S. public schools (National Center for Education Statistics, 2022). Special education services accounted for nearly 34% of the federal K-12 education budget in 2021 (U.S. Department of Education, 2021). Extensive literature highlights consistent disparities in academic and non-academic outcomes between students with and without dyabilities (Cortiella & Boundy, 2018; Gilmour et al., 2019; Sullivan et al., 2014). This raises a c question: do special education services actually help students as intended?

Understanding the effects of special education services on student outcomes is critical, yet the empirical evidence is limited. Some studies indicate overall positive effects on academic achievement (Hanushek et al., 2002; Hurwitz et al., 2020; Schwartz et al., 2021), yet little is known about their effects on non-academic outcomes. Moreover, although the effects can considerably vary across student characteristics (Schwartz et al., 2021), yet most prior work overlooks effect heterogeneity. To gain a comprehensive understanding, we need evidence not only on academic achievement but also on non-academic outcomes, with a specific attention to possible heterogenous effects across student subgroups like gender and race/ethnicity.

This study utilizes a large longitudinal administrative dataset from Indiana, spanning the 2010-2011 to 2016-2017 school years, to explore the effects of special education on academic and non-academic outcomes. By employing a quasi-experimental design, this study estimates the impact of special education on math and English Language Arts (ELA) achievement, school discipline (i.e., in- and out-of-school suspensions and expulsions), and absences (i.e., number of

unexcused absences) for students with learning disabilities (LD). This study focuses on students with LD for three reasons. First, students with LD are the largest among students with disabilities (NCES, 2022). Second, students with LD are more likely to receive services after entering school (see Figure 1) and to be declassified later compared with other disability categories (e.g., blind, or deaf), enabling me to apply the intent-to-treat (ITT) student fixed effects approach (Schwartz et al., 2021). Third, because existing work highlights the stigma effects for students with LD (Shifrer, 2013; Shifrer, 2016), focusing on students with LD offers important information about the academic and non-academic outcomes of students with LD.

Using intent-to-treat (ITT) student fixed effects models (Schwartz et al., 2021), this study provides plausible causal estimates of the effects of special education on various student outcomes. By assuming that that the timing of receiving special education service is exogenous conditional on time-invariant student attributes, this study provides empirical evidence showing the impact of enrolling in special education services on academic and non-academic outcomes. Moreover, this study investigates whether the effects of special education differ across subgroups, including gender, race/ethnicity, English Language Learner (ELL) status, Free or Reduced-price Lunch (FRL) eligibility, and achievement level. Given that the probability of disability identification differs among the student subgroups (Frey, 2019; Hibel et al., 2010; Morgan et al., 2015), examining effect heterogeneity provides valuable insights into LD categorization and the educational experience of students with LD.

Special Education and Student Outcomes

For many years, students with disabilities faced no access to education in U.S. public schools (Yell & Bateman, 2019). However, a transformative moment arrived with the passage of the All Handicapped Children Act of 1975, which later became the Individuals with Disabilities

Education Act (IDEA). This landmark legislation mandated that schools provide services and support for students with disabilities. Subsequent legislation, such as IDEA 2004 and the Every Student Succeeds Act 2015, mandated schools to create tailored plans to meet the unique needs of students with disabilities (IDEA, 2022). The stated aim of these laws is to ensure that students with disabilities receive appropriate plans and necessary support to achieve educational success.

Despite the legal protections enacted over nearly the past half-century, students with disabilities continue to exhibit troubling outcomes (Gilmour et al., 2019). Data from the National Assessment of Educational Progress (NAEP) consistently indicates lower math and reading scores for students with disabilities relative to their non-disabled peers (NAEP, 2017). Additionally, students with disabilities experience higher rates of suspensions and expulsions (Anderson, 2021; Sullivan et al., 2014; USCCR, 2019) and are more likely to have absenteeism issues compared with non-disabled students (Cortiella & Boundy, 2018; Gottfried et al., 2019). Although many factors, such as cognitive and non-cognitive impairments, can contribute to these disparities (e.g., Heckman et al., 2006; Rohde & Thompson, 2007), the designation of disability itself can also influence the gaps between students with and without disabilities.

While the disparities between students with and without disabilities are evident, the effects of special education on student outcomes for students with LD are unclear. On one hand, being identified as LD and receiving additional support, such as pull-out services and individualized plans, may help students overcome the learning challenges associated with LD. These tailored services can address specific learning needs, ultimately resulting in improved student performance (Hanushek et al., 2002; Hurwitz et al., 2020). On the other hand, the LD label may lead to negative consequences, such as decreased self-concept and lowered peer acceptance, as students may feel different or stigmatized due to their categorization (Gans et al., 2003; ValÅs,

1999). Furthermore, lowered expectations from parents and teachers for students identified as LD can contribute to adverse effects by creating self-fulfilling prophecies that hamper their growth (Shifrer, 2013).

Only a handful of studies examine the effects of special education services, limiting our understanding of how these services shape students with disabilities. Morgan et al. (2010), for instance, use a nationally representative U.S. dataset, the Early Childhood Longitudinal Study, Kindergarten Class of 1998/1999 (ECLS-K), to shed light on this issue. Their findings present a mixed picture, revealing that special education participation is associated with lower reading achievement but not significantly associated with math achievement, internalizing behavior, or externalizing behavior. Their study provides insights into the complex dynamics of special education and student outcomes across academic and non-academic domains, yet a causal interpretation of their results demands caution, given that their methodological approach–-propensity score matching–-relies on the assumption that there are no omitted confounding variables.

To obtain causal estimates, some researchers employ student fixed effects models that control for both observable and unobservable differences between students. A couple of studies that employ student fixed effects reveal that special education services have positive effects on student achievement (Hanushek et al., 2002; Hurwitz et al. 2020). Although these two studies provide useful empirical evidence, they do not delve into the potential effect heterogeneity across student subgroups.

More recently Schwartz et al. (2021) use a large longitudinal dataset from New York public schools to investigate whether the effects of special education services vary across different student populations. To address concerns of endogeneity related to entry and exit from

special education, Schwartz and colleagues employ an intent-to-treat (ITT) student fixed effects approach. This approach allows for estimating causal effects by controlling for individual student differences that remain constant over time, and it also enables researchers to capture the lasting effects beyond the year of service recipient. Their findings show that special education increases math achievement by 0.12 standard deviations and ELA by 0.10 standard deviations, and further reveal that these benefits are greater for females (0.06 standard deviations) relative to males and for Asian students (0.10 standard deviations) relative to Hispanic students.

The selection process for special education participation may contribute to the differential effects observed by gender and race/ethnicity. For example, if male students with minor disabilities receive special education services, the positive effects might be less noticeable for them, as they typically need these services the least. Conversely, if White students with only severe disabilities receive special education services, the benefits might be more pronounced, as they are the ones who need this assistance the most. Understanding the effect heterogeneity in special education is crucial for informing policy decisions. Schwartz et al. (2021) provide empirical evidence to help understand the heterogeneous effects of special education services on student outcomes. Nevertheless, expanding research beyond academic achievement is necessary to improve our understanding of the dynamics and provide useful information for informed policy decisions.

More evidence is needed, particularly because research on the effects of special education on non-academic outcomes is notably limited. While a growing body of evidence indicates that students with disabilities face challenges in areas such as school disciplinary outcomes (Anderson, 2021; Sullivan et al., 2013) and absenteeism (Cortiella & Boundy, 2018; Gottfried et al., 2019), rigorous studies focusing on non-academic outcomes are rarely available. One study

suggests that special education enrollment is associated with a reduced likelihood of disciplinary actions (Hurwitz et al., 2021), whereas another study fails to establish such associations (Morgan et al., 2019). However, because these studies lack robust causal research designs, the extent to which these links are causal remain unclear.

Regarding student absence outcomes, the only available evidence is from New York City public schools. Schwartz et al. (2021) use ITT student fixed effects and find that special education has no impact on attendance in that context. Although their findings are noteworthy, it is important to recognize that their results are from one context (New York public schools), and notably, they do not include school disciplinary outcomes. Therefore, additional studies are necessary to understand how special education affects various dimensions of student learning and development, especially in the domains of non-academic outcomes (Gloski et al., 2022). Research that encompasses diverse student populations in different contexts and a broader range of student outcomes is crucial to gaining a comprehensive knowledge of the effects that special education has on students with disabilities.

Ballis and Heath's (2021) recent study deserves attention, as it employs a causal reseach design to investigate the long-run impact of special education services. Using data from Texas, Ballis and Heath take advantage of policy change that resulting in a significant reduction in special education participation, while enables them to estimate the impacts of special education on educational attainment. They find students who are denied special education services are less likely to complete high school (by 51.9 percentage points) and enroll college (by 37.9 percentage points). The adverse effects of removing of special education services are more pronounced among students who are eligible to free or reduced-price eligibility and racial/ethnic minority students. While Ballis and Heath (2021) significantly advance our understanding by providing

causal estimates on the effects of special education participation on long-run student outcomes, available empirical evidence on special education remains limited.

This current study contributes to the existing literature on special education in three key aspects. First, I investigate the effects of special education on both academic and non-academic outcomes for students with LD. By incorporating a broader range of student outcomes, this study provides a comprehensive evaluation of the effectiveness of special education services beyond academic achievement. Second, this study sheds light on the differential effects of special education across diverse student populations. Given that the selection process for participation in special education likely varies by gender and race/ethnicity (Frey, 2019; Morgan et al., 2010), focusing on the effect heterogeneity is essential. Finally, this study addresses concerns of endogeneity by employing an intent-to-treat (ITT) student fixed effects approach (Schwartz et al., 2021), resulting in more precise estimates. The results of this study thus offer valuable information for policymakers and educational leaders.

Data and Sample

This study uses statewide administrative data from the Indiana Department of Education (IDOE) covering students in kindergarten through grade eight during the 2010-2011 to 2016-2017 school years. The dataset includes information on student characteristics, including gender, race/ethnicity, FRL, and ELL. The data also include student performance data in math and ELA from the Indiana Statewide Testing for Educational Progress Plus (ISTEP+), a mandated annual assessment for all state-certified schools measuring academic performance in these subjects. These test scores serve as indicators of academic achievement in this study. Additionally, the data contain school disciplinary records and absences, allowing for an examination of these non-academic domains as student outcomes.

Importantly, the data provide information on whether a student received special education service in a given year, along with the primary and secondary disability classifications for each student. The study uses the primary disability classification to identify students with Learning Disabilities (LD). IDOE data indicate that every LD student receives special education services. Students with LD are coded as 1 if identified and 0 if not.[1] The analytic models estimate the effects of special education on the academic and non-academic outcomes of students with learning disabilities (LD), the largest disability group in the United States (Schaeffer, 2020). Given that LD designation nearly all occurs after students enter the educational system, focusing on LD allows us to compare student outcomes before and after receiving these services, ultimately providing useful insight into how these services contribute to the overall success of students with LD.

The academic achievement outcomes are math and ELA test scores, which are standardized by subject-grade-year to have a mean of zero and standard deviation of one, allowing for comparisons across subject, grade, and year. Alongside academic outcomes, this study also focuses on non-academic outcomes, including school discipline (a dichotomous variable that measure whether a student received an in-school suspension, an out-of-school suspension, or an expulsion and absences (a continuous variable that measures the number of unexcused absences). Because math and ELA test scores are available only for grades 3 through 8, the student achievement models include students from third through eight grades. Meanwhile, school discipline and attendance models include kindergarteners through eighth graders.

[1] The IDOE data encompass 16 primary exceptionality categories, including (1) multiple disabilities, (2) orthopedic impairment, (3) blind or low vision, (4) deaf or hard of hearing, (5) emotional disability (full time), (6) emotional disability (other), (7) specific learning disability, (8) developmental delay, (9) language and speech impairment, (10) mild cognitive disability, (11) moderate cognitive disability, (12) severe cognitive disability, (13) deaf-blind, (14) autism spectrum disorder, (15) traumatic brain injury, and (16) other health impairment. This study focuses on (7) specific learning disability as LD.

The dataset in this study includes 997,877 unique students, with approximately 13% receiving special education services at least once during the study period. Among the students receiving special education services, 34% are identified as having a learning disability (LD), the largest disability group in Indiana. Table 1 presents summary statistics for all students and students with LD. Certain student subgroups are more likely to be identified as LD. For example, Black students are overrepresented, whereas Asian students are underrepresented among students with LD. Male students and FRL eligible students are also overrepresented. These descriptive statistics underscore that mere average comparisons of outcomes among students based solely on their special education status are insufficient to assess the causal effects of special education on students with LD. To isolate the impacts of special education services on student outcomes, it is essential to employ a causal research design.

Figure 1 displays the percentage of students with LD by gender and race/ethnicity groups across grade levels, covering students from kindergarten through eighth grade. This figure reveals that nearly all LD classifications occur after students begin school. Additionally, male students are more likely to be classified as having a LD compared with their female counterparts. The percentage of LD identification typically rises as students advance through the grades, for both male and female students, although these is a slight decline between seventh and eighth grades for female students.

Across all race/ethnicity groups, the percentage of LD identification increases as students progress through higher grades. However, it becomes notably higher for Black students after grade 3. The percentages are relatively comparable for Hispanic, White, and other race/ethnicity groups, whereas they consistently remain much lower for Asian students across all grade levels.

These patterns of overrepresentation of LD for Black students and underrepresentation for Asian students align with findings from existing literature (Hibel et al., 2010; Morgan et al., 2015).

Empirical Strategy

This study uses the Indiana data panel to produce causal estimates of the impacts of special education on student outcomes. The key component of the identification strategy is the inclusion of student fixed effects, which control for time-invariant observable and non-observable differences between students. By including student fixed effects, this study compares student outcomes when a student with LD receives special education services and when the same student does not. This approach effectively mitigates concerns about selection effects into special education status, as it allows each individual student to serve as their own control. The identification strategy relies on within-student variations in special education status changes within the study period, particularly focusing on students classified as having a LD who receive special education services.

The treatment-on-the-treated (TOT) specification using the student fixed effects model effectively accounts for all time-invariant differences between students. Nevertheless, the results from the TOT model, which compares student outcomes in years with special education service and without, are likely to be downwardly biased (Schwartz et al., 2021). For instance, if the effects of special education services extend beyond the year of participation, the TOT specification will not capture the longer-term impacts. Moreover, if factors such as family background or school characteristics influence a student's declassification status, treating student outcomes after declassification as non-treatment outcomes could lead to biased estimates.[2]

[2] The primary findings remain consistent across both TOT and ITT approaches, but the results show that the TOT student fixed effects estimates yield slightly smaller estimates than those from ITT student fixed effects. Appendix Table 1 presents the results from TOT models.

To overcome the limitations of TOT specification, this study employs the ITT student fixed effects approach following Schwartz et al. (2021). The ITT student fixed effects model enables a comparison of student outcomes before and after they receive special education services, including years without services.[3] Although the ITT student fixed effects approach alleviates concerns about selection into LD, it is important to acknowledge that if LD categorization occurs systematically based on time-varying unobservable characteristics, this approach could still introduce bias to the estimates. The ITT model is specified as follows:

$$Y_{isgt} = LD_{isgt}\theta + X_{isgt}\beta_1 + \pi_i + \delta_s + \gamma_g + \alpha_t + \varepsilon_{isgt} \quad (1)$$

In equation (1), Y_{isgt} denotes an outcome (math or ELA achievement, school discipline, or absence) for student *i* in school *s*, grade *g*, and year *t*. LD_{isgt} is set to one (1) if student *i* was classified as having a learning disability in year *t* or any subsequent year, and zero (0) otherwise. By employing the ITT specification, the model addresses the endogeneity of exiting from special education. Consequently, the parameter θ estimates the effects of special education services on students with LD.

X_{isgt} is a vector of time-varying student, school, and teacher controls, which includes free or reduced-price lunch (FRL) eligibility, English Language Learner (ELL) status, school level achievement, enrollment, percentage of students eligible for FRL, percentage of Black students, and percentage of Hispanic students. Additionally, teacher controls, such as teacher gender, race/ethnicity, teaching experience, and education attainment, are included to account for the

[3] One limitation of employing student fixed effects is that estimates solely rely on "sometimes LD" students. That is, students who always receive special education services, referred to as "always LD" students and "never LD" students, are not considered in the estimations, despite their contribution to enhancing the precision of the estimates. To delve into the factors related to "sometimes LD" status, this study examines the links between student characteristics and "sometimes LD" status. The findings from the supplementary analyses in Appendix Table 2 suggest that the estimates based on the sample that female, FRL, ELL, and racial/ethnic minority students are slightly overrepresented.

influence of factors associated with the teachers assigned to the students. The term π_i is the student fixed effect, which is a key component of the identification strategy. Additionally, δ_s, γ_g, and α_t is the school fixed effect, grade fixed effect, and year fixed effect, respectively. ε_{isgt} is the idiosyncratic error term. To address within-school data dependence, this study clusters the standard errors at the school level throughout the analysis.

To examine effect heterogeneity, the models include the interaction terms between LD_{isgt} indicator and various student subgroups, including gender, race/ethnicity, FRL eligibility, ELL status, and school level. The coefficients of these interaction terms offer information about whether the associations between special education services and student outcomes vary across different subgroups of LD students. By focusing on potential effect heterogeneity, this analysis enhances our understanding of how special education services affect specific subgroups of students with LD.

Results

The Effects of Special Education on Academic and Behavioral Outcomes

Table 2 presents the average effects of special education on student outcomes using ITT models. Columns 1 through 6 show substantial positive effects of special education on academic achievement. For students with LD, special education services increase math and ELA achievement by 0.259 and 0.080 standard deviations of student test scores. The results remain fairly consistent without school fixed effects and other controls in both math and ELA models. The math estimate is larger than that (0.259 vs. 0.117) from Schwartz et al. (2021), whereas the ELA estimate closely corresponds (0.080 vs. 0.102).

In contrast to the effects on academic outcomes, special education services negatively affect non-academic outcomes for students with LD. As displayed in Columns 7 through 12 in

Table 2, special education services lead to a 1.8 percentage point increase in the probability of receiving suspensions and expulsions, and along with a 0.104 day increase in the number of unexcused absences. These findings remain consistent whether or not school fixed effects and other controls are included. [4]

The Heterogenous Effects of Special Education on Student Outcomes across Student Subgroups

Table 3 presents the effect heterogeneity of special education services across student characteristics. Columns 1 through 5 show that the effects of special education on math achievement vary by gender, race/ethnicity, and ELL status. Specifically, the positive effect of special education on math achievement is larger for female students (0.124 SD) relative to male students, for students eligible for FRL (0.017 SD) relative to non-FRL eligible students, and for ELL relative to non-ELL students (0.073 SD). Additionally, Black (0.070 SD), Hispanic (0.097 SD), Asian (0.191 SD), and other race/ethnicity (0.107 SD) students benefit more from receiving special education services than White students. Similarly, the effects on ELA are heterogenous (Columns 6 through 10). Specifically, female students (0.030 SD), ELL (0.122 SD) students, Black (0.045 SD), Hispanic (0.110 SD), Asian (0.388 SD) students, and middle school students (0. 075 SD) experience greater positive effects compared with White students.

Next, this study turns to the heterogeneous effects on non-academic outcomes. Table 4 shows that the effects of special education on school discipline vary among student subgroups for students with LD (columns 1 through 5). The results show that the adverse effects on school

[4] I also employ student-level clustering and teacher-level clustering for standard error estimation instead of the school-level clustering used in the main models to check whether clustering strategies alter the main findings. The results from these alternative analyses are presented in Appendix Table 3, which shows that the main findings remain consistent regardless of the clustering strategies. Additionally, considering the potential effects of grade retention on students (Hwang & Koedel, 2023; Schwerdt et al., 2017), which could influence the results of this study, I exclude students who had repeated a grade in the models. Appendix Table 4 shows that the main findings remain robust even when students who repeated a grade are excluded. These results continue to corroborate the findings of this study.

discipline are greater for FRL (1.4 percentage points) relative to non-FRL students, and for Black students (2.9 percentage points) relative to White students. Conversely, the adverse effects are smaller for females (3.2 percentage points) relative to males, for ELL (2.0 percentage points) relative to non-ELL students, for Asians (3.1 percentage points) relative to White students, for middle school students (3.5 percentage points) relative to elementary school students.

Columns 6 through 10 in Table 4 show that the effects of special education on absence vary across student subgroups, indicating that the adverse effects are smaller for Black (-0.218 days) and Hispanic (-0.155 days) students with LD relative to White students with LD. The adverse impact is greater for middle school students (0.342 days) than elementary school students. However, I find no evidence that the effects on absence vary by student gender, FRL, or ELL status. Appendix Figure 1 shows the varying effects of special education services on student outcomes across student subgroups.[5]

Discussion

This study uncovers the trade-offs associated with special education services for students with LD. The results show that special education has positive effects on academic achievement, aligning with previous research and underscoring the benefits of receiving such support (Hanushek et al., 2002; Hurwitz et al., 2020; Schwartz et al., 2021). By contrast, special education appears to have negative effects on school discipline and absences for students with

[5] I also runs models that focus on various service settings of special education—including regular classrooms, resource rooms, separate classrooms, and other settings—given that the effects of special education may vary across various service settings.[5] The reference group in the models is non-LD status. The majority (73%) of students with LD study in general education (regular) settings, 13% in resource rooms, 6% in separate classrooms, and 8% in other service settings. Although columns 1 and 4 in Appendix Table 5 offer suggestive evidence that a more inclusive setting may be slightly more beneficial for students with LD, the results do not show clear evidence that service settings significantly moderate the effects of special education on students with LD. Due to the potential influence of endogenous factors, such as school resources, teacher perception, and parental involvement in determining service settings, caution is warranted in drawing direct causal interpretations of service settings for students with LD.

LD, raising concerns considering their already elevated rates of exclusionary school discipline (Anderson, 2021; Sullivan et al., 2013) and absenteeism (Cortiella & Boundy, 2018; Gottfried et al., 2019).

The results further spotlight the heterogeneous effects of special education on student outcomes among different student subgroups. The positive achievement effects of special education are more pronounced for female students than male students, which aligns with the findings of Schwartz et al. (2021). However, unlike Schwartz and colleagues who find the heterogenous effects by gender in math but not in ELA, this current study shows significant gender effects for both subjects.

In addition to gender, the effects of special education for students with LD vary by student race/ethnicity. The positive effects of special education are larger for Black, Hispanic, and Asian students than for White students. My findings align with Schwartz et al. (2021) for Asian students but differ from their results for Black and Hispanic students. This study does not definitively explain the result differences, yet the varying likelihood of receiving special education services across subgroups may contribute to this disparity. For instance, the benefits could be more prominent for girls due to the possibility that only those with severe disabilities are receiving services (Schwartz et al., 2021). Further investigation into effect heterogeneity across subgroups is crucial for a clearer understanding of these diverse impacts.

The results show heterogeneous effects not only on academic achievement but also on non-academic outcomes. The negative effects of special education on school discipline are greater for male, FRL-eligible, and Black students with LD. These student subgroups face higher risks of receiving exclusionary school discipline (Hwang et al., 2023; Wallace et al., 2008), which is associated with unfavorable student outcomes, including decreased achievement and an

increased likelihood of involvement with the criminal justice system (Hwang, 2018; Monahan et al., 2014; Mittleman, 2018). This effect heterogeneity underscores the dual vulnerability of students with LD in these subgroups.

The pressing question is why special education services increase school disciplinary actions and absences. This study lacks the necessary data to explore the mechanisms underlying these findings, yet existing research may offer some insights. For example, the LD classification might lower self-esteem, as students with LD are categorized differently from their non-LD peers and receive different educational programs. This labeling can alter self-perception and influence how others, including peers, teachers, and parents, perceive them (Bear et al., 1993; Frederickson & Furnham, 2004). These changes in perception can affect their sense of belonging and interactions with others, possibly causing behavioral issues. Additionally, the LD label might lead to lower expectations from both teachers and parents, which could create self-fulfilling prophecies that ultimately hinder positive student development (Shifrer, 2013, 2016).

This current study offers valuable insights into the effects of special education on students with LD, but it is important to address its limitations. First, although using ITT student fixed effects helps estimates the effects, if enrollment in special education is influenced by time-variant factors such as changes in family environments or parental involvement in school, this could bias the estimates. Additionally, although the study utilizes a large administrative dataset to offer empirical evidence, the generalizability of the findings to other contexts remains uncertain due to differing special education practices across states (Scull & Winkler, 2011; Schaeffer, 2020).

Despite these limitations, this study provides important empirical evidence on the effects of special education services for students with LD, highlighting both the benefits and challenges. In

terms of academic achievement, the additional support that accompanies LD classification successfully fulfills its intended goals. However, the adverse effects on non-academic outcomes, particularly among male students, students from low-income families, and Black students, bring to light potential hidden costs and unintended consequences that may arise from different identification, treatment, and categorizations. Educators and policymakers should be attentive to these complexities to minimize any negative effects on these vulnerable students who already face multiple challenges in schools.

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Table 1

Student Characteristics for All Students and Students with Learning Disabilities

	All students	Students with Learning Disabilities
Special education	0.13	
Learning disability	0.05	1.00
Female	0.49	0.41
Black	0.12	0.15
White	0.70	0.69
Hispanic	0.11	0.11
Asian	0.02	0.005
Other race/ethnicity	0.04	0.05
ELL	0.06	0.07
FRL	0.50	0.67
Math achievement	-0.05	-0.99
ELA achievement	-0.05	-1.20
School discipline	0.09	0.14
Unexcused absence	2.17	2.98
N (unique student)	997,877	67,419

Note: ELL= English language learner. ELA = English Language Arts. School discipline indicates whether a student receives a suspension or expulsion at least once per year. The data include in kindergarten through grade 8 between the 2010-11 and 2016-17 academic years in Indiana.

Table 2

The Effects of Special Education on Student Outcomes for Students with Learning Disability

	Math			ELA			Discipline			Absence		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LD	0.264***	0.262***	0.259***	0.084***	0.082***	0.080***	0.021***	0.019***	0.018***	0.152***	0.110***	0.104***
	(0.008)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.002)	(0.001)	(0.001)	(0.026)	(0.024)	(0.024)
Grade FE	X	X	X	X	X	X	X	X	X	X	X	X
Year FE	X	X	X	X	X	X	X	X	X	X	X	X
Student FE	X	X	X	X	X	X	X	X	X	X	X	X
School FE		X	X		X	X		X	X		X	X
Student, teacher, and school controls			X			X			X			X
N(student-year)	2814712	2814712	2814712	2840654	2840654	2840654	4356690	4356690	4356690	4353736	4353736	4353736

Note. The results are based on Intent-To-Treat (ITT) specifications. Math and ELA models include grades 3 through 8, whereas discipline and absence outcome models include kindergarten through grade 8. LD=learning disability. FE=fixed effects. Student controls include free or reduced-price lunch eligibility (FRL) and English language learner status. Teacher controls include teacher gender, race/ethnicity, teaching experience, graduate degree, and class size. Math model controls for math teacher characteristics, and ELA model controls for ELA teacher characteristics. Discipline and Absence models control for ELA teacher characteristics. School controls include the percentage of FRL, Black, and Hispanic students, school enrollment, school level achievement. We cluster standards errors in parentheses at the school level. *** $p < 0.001$

Table 3

Heterogenous Effects of Special Education on Achievement across Subgroups for Students with Learning Disability

	Math					ELA				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
LD	0.200***	0.248***	0.251***	0.227***	0.275***	0.066***	0.080***	0.068***	0.053***	0.040***
	(0.008)	(0.008)	(0.007)	(0.008)	(0.009)	(0.008)	(0.007)	(0.006)	(0.007)	(0.007)
LD * Female	0.124***					0.030**				
	(0.010)					(0.010)				
LD * FRL		0.017***					0.000			
		(0.006)					(0.006)			
LD * ELL			0.073***					0.122***		
			(0.017)					(0.016)		
LD * Black				0.070***					0.045**	
				(0.018)					(0.016)	
LD * Hispanic				0.097***					0.110***	
				(0.017)					(0.015)	
LD * Asian				0.191**					0.388***	
				(0.062)					(0.063)	
LD * Other				0.107***					0.033	
				(0.026)					(0.022)	
LD * Middle school					-0.008					0.075***
					(0.007)					(0.006)
Grade FE	X	X	X	X	X	X	X	X	X	X
Year FE	X	X	X	X	X	X	X	X	X	X
Student FE	X	X	X	X	X	X	X	X	X	X
School FE	X	X	X	X	X	X	X	X	X	X
Student, teacher, and school controls	X	X	X	X	X	X	X	X	X	X
N (student-teacher)	2814712	2814712	2814712	2814712	2814712	2840654	2840654	2840654	2840654	2840654

Note. LD = learning disability. FE = fixed effects. Student controls include free or reduced-price lunch eligibility (FRL) and English language learner (ELL) status. Other = other race/ethnicity. Teacher controls include teacher gender, race/ethnicity, teaching experience, graduate degree, and class size. School controls include the percentage of FRL, Black, and Hispanic students, school enrollment, school level achievement. We cluster standards errors in parentheses at the school level. ** $p < 0.01$, *** $p < 0.001$

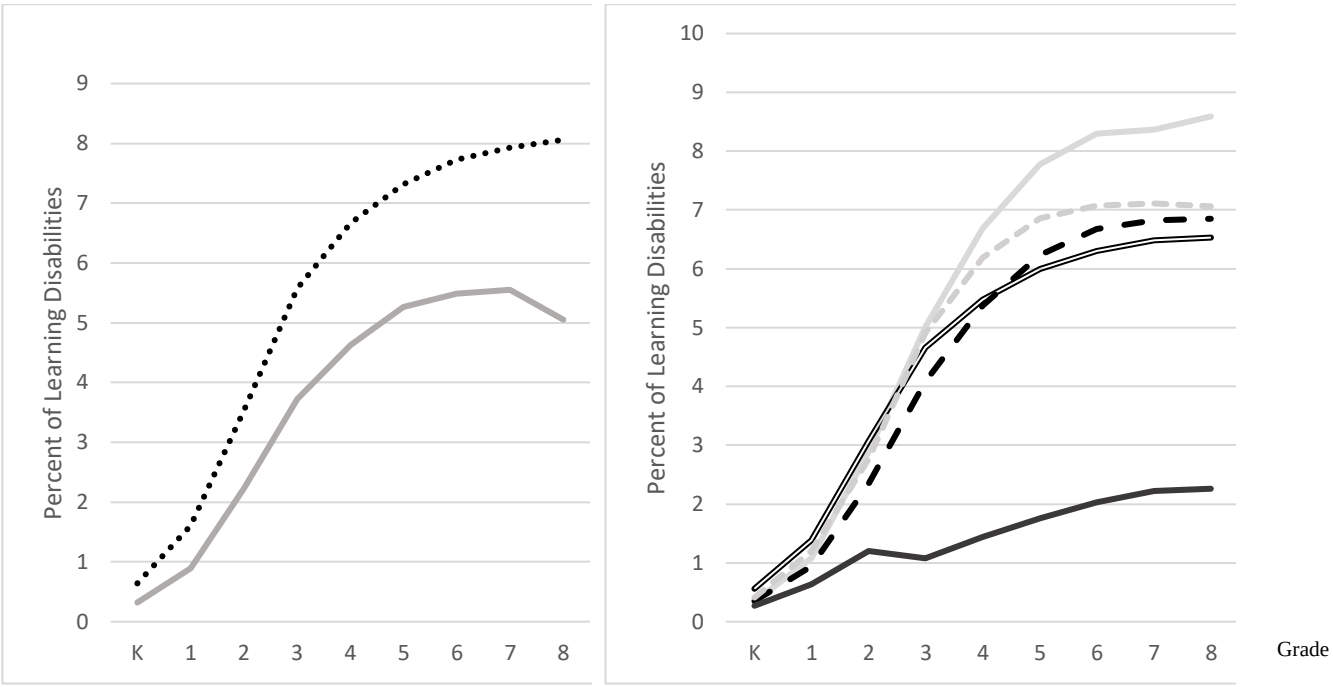
Table 4

Heterogenous Effects of Special Education on Behavioral Outcomes across Subgroups for Students with Learning Disability

	Discipline					Absence				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
LD	0.032***	0.008***	0.020***	0.014***	0.006***	0.088**	0.101***	0.114***	0.161***	-0.092***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.029)	(0.028)	(0.025)	(0.028)	(0.026)
LD * Female	-0.032***					0.038				
	(0.003)					(0.038)				
LD * FRL		0.014***					0.004			
		(0.002)					(0.033)			
LD * ELL			-0.020***					-0.114		
			(0.004)					(0.077)		
LD * Black				0.029***					-0.218*	
				(0.006)					(0.101)	
LD * Hispanic				-0.005					-0.155*	
				(0.004)					(0.073)	
LD * Asian				-0.031**					-0.188	
				(0.012)					(0.140)	
LD * Other				0.008					-0.056	
				(0.007)					(0.114)	
LD * Middle school					0.035***					0.342***
					(0.002)					(0.028)
Grade FE	X	X	X	X	X	X	X	X	X	X
Year FE	X	X	X	X	X	X	X	X	X	X
Student FE	X	X	X	X	X	X	X	X	X	X
School FE	X	X	X	X	X	X	X	X	X	X
Student, teacher, and school controls	X	X	X	X	X	X	X	X	X	X
N (student-teacher)	4356690	4356690	4356690	4356690	4356690	4353736	4353736	4353736	4353736	4353736

Note. LD = learning disability. FE = fixed effects. Student controls include free or reduced-price lunch eligibility (FRL) and English language learner (ELL) status. Other = other race/ethnicity. Teacher controls include teacher gender, race/ethnicity, teaching experience, graduate degree, and class size. School controls include the percentage of FRL, Black, and Hispanic students, school enrollment, school level achievement. We cluster standards errors in parentheses at the school level. * $p < 0.05$, *** $p < 0.001$

Figure 1
Percent of Students Identified as Learning Disabilities across Grades by Student Gender and Race/Ethnicity



Note. These findings are based on data from Indiana Department of Education between 2010-11 and 2016-17 academic years.

Appendix Table 1

The Effects of Special Education on Student Outcomes for Students with Learning Disability

	Math	ELA	Discipline	Absence
	(1)	(2)	(3)	(4)
LD	0.221***	0.057***	0.014***	0.057*
	(0.007)	(0.005)	(0.001)	(0.024)
Grade FE	X	X	X	X
Year FE	X	X	X	X
Student FE	X	X	X	X
School FE	X	X	X	X
Student, teacher, and school controls	X	X	X	X
N(student-year)	2814712	2840654	4356690	4353736

Note. The results are based on treatment-on-the-treated (TOT) specifications. Math and ELA models include grades 3 through 8, whereas discipline and absence outcome models include kindergarten through grade 8. LD=learning disability. FE=fixed effects. Student controls include free or reduced-price lunch eligibility (FRL) and English language learner status. Teacher controls include teacher gender, race/ethnicity, teaching experience, graduate degree, and class size. Math model controls for math teacher characteristics, and ELA model controls for ELA teacher characteristics. Discipline and Absence models control for ELA teacher characteristics. School controls include the percentage of FRL, Black, and Hispanic students, school enrollment, school level achievement. We cluster standards errors in parentheses at the school level. *** $p < 0.001$

Appendix Table 2
Student Characteristics that Predict Sometimes LD status (Relative to Always LD)

	Bivariate	Multivariate
	(1)	(2)
Female	0.047***	0.011**
	(0.004)	(0.004)
FRL	0.059***	0.066***
	(0.008)	(0.005)
ELL	0.113***	0.073***
	(0.015)	(0.011)
Black	0.067***	0.100***
	(0.005)	(0.006)
Hispanic	0.079***	0.025**
	(0.006)	(0.008)
Asian	0.137***	0.086**
	(0.025)	(0.027)
Other race/ethnicity	0.045***	0.050***
	(0.009)	(0.009)
ELA	-0.007	-0.001
	(0.005)	(0.003)
Math	-0.020***	-0.022***
	(0.005)	(0.003)
School Discipline	-0.285***	-0.344***
	(0.012)	(0.008)
Absence	-0.001	0.000
	(0.001)	(0.000)
N (unique student)	67419	67419

Note. FRL = free or reduced-price lunch eligibility. ELL = English Language Learner. School Discipline = a student was suspended or expelled at least once. The results are from students who are classified as having a LD at least once in our study period. We cluster standards errors in parentheses at the school level. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix Table 3
Special Education and Student Achievement with Standard Error Clustering at the Student and Teacher Level

	Math		ELA		Discipline		Absence	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cluster Level	Student level	Teacher Level	Student level	Teacher Level	Student level	Teacher Level	Student level	Teacher Level
LD	0.259***	0.259***	0.080***	0.080***	0.018***	0.018***	0.104***	0.104***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.001)	(0.001)	(0.020)	(0.019)
Grade FE	X	X	X	X	X	X	X	X
Year FE	X	X	X	X	X	X	X	X
Student FE	X	X	X	X	X	X	X	X
School FE	X	X	X	X	X	X	X	X
Student, teacher, and school controls	X	X	X	X	X	X	X	X
N (student-year)	2814712	2814712	2840654	2840654	4356690	4356690	4353736	4353736

Note. ELA = English Language Learner. LD=learning disability. FE=fixed effects. Student controls include free or reduced-price lunch eligibility (FRL) and English language learner status. Teacher controls include teacher gender, race/ethnicity, teaching experience, graduate degree, and class size. School controls include the percentages of FRL, Black, and Hispanic students, school enrollment, school level achievement. I cluster standards errors in parentheses at the school level. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix Table 4
Special Education and Student Achievement without Retained Students

	(1) Math	(2) ELA	(3) Discipline	(4) Absence
LD	0.260***	0.081***	0.018***	0.124***
	(0.007)	(0.006)	(0.002)	(0.024)
Grade FE	X	X	X	X
Year FE	X	X	X	X
Student FE	X	X	X	X
School FE	X	X	X	X
Student, teacher, and school controls	X	X	X	X
N	2807699	2833599	4299339	4296433

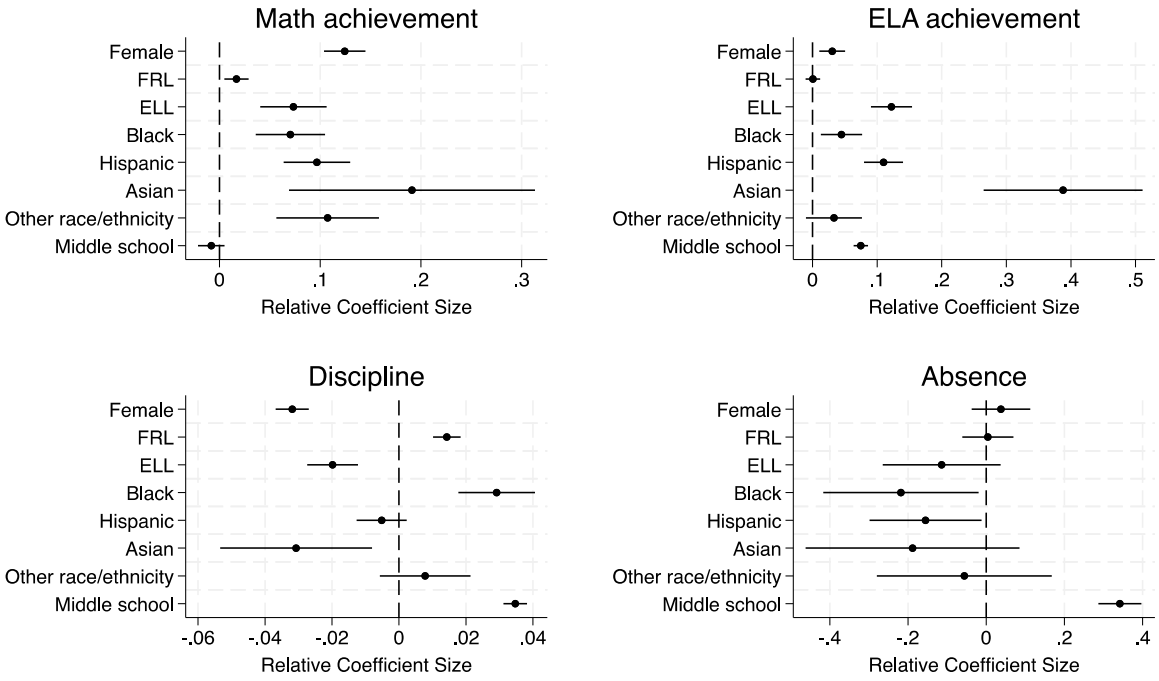
Note. Math and ELA models include grades 3 through 8, whereas discipline and absence outcome models include kindergarten through grade 8. LD=learning disability. FE=fixed effects. Student controls include free or reduced-price lunch eligibility and English language learner status. Teacher controls include teacher gender, race/ethnicity, teaching experience, graduate degree, and class size. Math model controls for math teacher characteristics, and ELA model controls for ELA teacher characteristics. Discipline and Absence models control for ELA teacher characteristics. School controls include the percentage of FRL, Black, and Hispanic students, school enrollment, school level achievement. I cluster standards errors in parentheses at the school level. *** $p < 0.001$

Appendix Table 5
Special Education and Student Achievement across Service Settings

	(1) Math	(2) ELA	(3) Discipline	(4) Absence
LD				
Regular classroom	0.237***	0.065***	0.015***	0.080**
	(0.007)	(0.006)	(0.001)	(0.025)
Resource room	0.212***	0.035***	0.022***	0.064
	(0.010)	(0.009)	(0.003)	(0.039)
Separate classroom	0.172***	0.018	0.061***	0.346**
	(0.031)	(0.025)	(0.009)	(0.129)
Other service settings	0.175***	0.020	0.049***	0.132
	(0.023)	(0.020)	(0.006)	(0.134)
Grade FE	X	X	X	X
Year FE	X	X	X	X
Student FE	X	X	X	X
School FE	X	X	X	X
Student, teacher, and school controls	X	X	X	X
N	2814712	2840654	4356690	4353736

Note. Regular classroom = Students with LD study in regular classrooms 80% or more. Resource room = Students with LD study in regular classrooms between 40% and 79%. Separate classroom = Students with LD study in regular classroom less than 40%. Other = separate day school facility, residential facility, parental place in private school, or student's disability requires home services as determined by case conference committee. I cluster standards errors in parentheses at the school level. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Appendix Figure 1
The Heterogenous Effects of Special Education Services for Students with LD Across Subgroups



Note. FRL = free or reduced-price lunch. ELL = English Language Learner. Reference group for race/ethnicity and middle school is White and elementary school, respectively. Discipline = A binary variable that indicates whether a student receives a suspension or an expulsion. Absence = days of unexcused absence.