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Social isolation and achievement of students with learning disabilities^{☆, ☆ ☆}

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ABSTRACT

Students with learning disabilities (LDs) experience heightened levels of social isolation, but researchers have not fully explored its various dimensions at school or determined which aspects contribute to educational gaps associated with LDs. Using the National Longitudinal Study of Adolescent to Adult Health, we find that middle and high school students with LDs are more likely to experience most types of isolation. Student with LDs have fewer friends, their friends are less educationally ambitious, they feel more detached and disliked at school, and they are more likely to avoid friendships, though surprisingly not more likely to be actively rejected. Mediation analyses indicate that the aspect of social isolation that contributes most to the LD-gap in high school graduation is one's number of school friends and their educational expectations. Perceptions of social isolation are also consequential, and together these account for nearly one-quarter of the LD-gap in high school graduation, net of past grades.

1. Social isolation and achievement of students with learning disabilities

Educational attainment in the U.S. confers economic opportunity, considerable additional earnings over time, and resources to handle adversity in healthy ways, all of which translate into greater longevity and life-satisfaction throughout adulthood (Carnevale et al. 2011; Mirowsky and Ross 2003; Montez and Hayward 2014). It is therefore a pressing concern that students with disabilities end their educational careers significantly earlier than other students. 20% of working-age adults with a disability do not have at least a high school degree, a rate twice that of the general population (Erickson et al. 2017; McFarland et al., 2018). We focus on students with learning disabilities (LDs) who have difficulties in school due to how they process information, and who comprise the single largest group of students receiving special education services in the U.S. (U.S. Department of Education 2017).

Students with LDs also face social obstacles at school, including more active rejection and detachment from their classmates (Bryan 1974; Nabuzoka and Smith, 1993; Wagner et al., 2007) and more feelings of loneliness (Margalit and Al-Yagon 2002). Though scholars have noted these important social disparities, more work is needed to identify the specific types of isolation that students with LDs

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experience and to gauge their contributions to the LD-gap in educational attainment. In this paper we delineate three aspects of the high school social milieu that may contribute to the lower graduation rates of students with LDs. These are *social capital* (number of friends, friends' expectations), *social disconnectedness* (lack of friends, reason for isolation) and *perceptions of isolation* (school detachment, feelings of loneliness). We measure these broad aspects of social isolation in multiple ways to capture what others refer to as the "many faces of isolation" (Rubin and Mills 1988) or the "different kinds of lonely" (Copeland et al., 2018). Employing a broad conceptualization of social isolation allows us to shed light on the specific aspects of social isolation that are most consequential for the educational gap between students with LDs and the general student population. Importantly, we control for prior academic performance to better isolate the impact of LD status on social isolation and achievement.

To extend our understanding of the schooling experiences of students with LDs, we first document the extent of their social isolation in a national sample using a more comprehensive array of isolation measures. We then undertake mediation analyses to estimate the degree to which LD students' lower odds of graduating high school is attributable to a lack of social capital, rejection by other students or their disinterest in peer friendships, or their perceptions of isolation and associated feelings of loneliness and detachment. Our analyses show disparities in social capital, pronounced levels of social disconnectedness, and greater perceptions of isolation among middle and high school students with LDs. Many of these measures of isolation are related to the odds of finishing high school, especially those related to social capital in school friendship networks. Overall, these three aspects of isolation account for approximately one-quarter of the high school graduation gap between students with LDs and other students.

2. Background

2.1. Disability and education

In 2015, about 6.7 million students between the ages of 3 and 21 (13% of all public-school students) received special education services in the United States for a disability (McFarland et al., 2018). Students who qualify for these services have a wide range of conditions that adversely affect their educational performance, including autism, deafness, deaf-blindness, developmental delay, emotional disturbance, hearing impairment, intellectual disability, multiple disabilities, orthopedic impairment, other health impairment, specific learning disability, speech or language impairment, traumatic brain injury, and visual impairment. This study focuses on the secondary school experiences of students with specific learning disabilities (LDs), the most-frequent disability type reported among this age-group. A specific learning disability is "a disorder in one or more of the basic psychological processes involved in understanding or using language, spoken or written, that may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations" (McFarland et al., 2018:74). LDs therefore cover many conditions that affect learning, although dyslexia is the most common.

Over one-third (34%) of students who receive special education services in public schools have a LD (McFarland et al., 2018). Other common types of disabilities are speech impairment (19%) and autism (10%). LDs are fruitful for analysis because LD diagnoses vary considerably across social characteristics, and LDs do not affect intellectual ability, which suggests that such classifications are subjective and inconsistent (Fletcher et al. 2005; Shifrer 2018). Boys, English language learners, Black students and students of color, and students from lower income families are more likely to be diagnosed with a LD (Horowitz et al. 2017; Shifrer 2018; Shifrer et al. 2011). Social influences on disability diagnoses are problematic because these diagnoses determine who receives special education services – that may help in terms of academics – and may also expose students with LDs to labeling and social distancing from their peers.

Special education services have been partly successful at bolstering the achievements of students with disabilities (Newman et al., 2011; Wagner et al., 2005). The Individuals with Disabilities Education Act of 1990 (IDEA) required public schools to make general education accessible to students of all abilities through appropriate, free accommodations, and was amended in 2004 to increase school accountability for accommodating students with disabilities within general education settings (McFarland et al., 2018; Wagner et al., 2007). IDEA's implementation arguably benefited students with disabilities. For example, between 1987 and 2003 their high school graduation rate increased by 17 percentage points, and post-secondary enrollment for students with disabilities doubled in this time period, from 15% to 32% (Wagner et al. 2005, 2007).

But this progress has not eliminated the disparities between students with disabilities and the general student population. The percentage of students with disabilities who attain a high school diploma within four years is considerably lower than the general population (69% vs. 84%) (McFarland et al., 2018), and the percentage of students with LDs who finish high school and enroll in college remains significantly lower than students without disabilities (65% vs. 84%) (U.S. Department of Education 2017; Wagner et al., 2005). We argue the persistence of educational gaps related to disabilities is due partly to enduring academic challenges but also social barriers in the form of isolation and loneliness.

2.2. Multiple forms of social isolation

Social obstacles in school can significantly shape educational attainment, above and beyond the academic challenges associated with LDs. These barriers take many forms, with varying mechanisms by which they impact educational progress and possibly the LD-gap in attainment. Three such forms are (lack of) social capital, social disconnectedness, and perceptions of isolation. To differentiate the achievement consequences of social isolation from those related to academic ability, our analyses account for prior academic performance.

Education scholars have focused on the social capital benefits of having many friends. *Social capital* refers to the resources embedded within social relationships and networks that help people get ahead in organizations (Coleman 1988; DiMaggio and Garip

2012). A broad range of social network characteristics have been considered in studies of social capital (Dika and Singh 2002; Lin 1999), and we focus on the size of students' friendship networks at school and their friends' academic orientations, expressed in their long-term educational expectations. Larger friendship networks constitute social capital because they signify broadly distributed resources where information and support are exchanged. Research confirms that having more friends at school is beneficial; those with more school friends are more likely to stay in school and graduate (Carbonaro and Workman 2013, 2016; Frostad, 2015; Humberstone 2018; South, Haynie, and Bose 2007). Friendship networks are also where norms about educational pursuits are reproduced, or challenged, as students mature and develop identities that are distinct from their parents (Crosnoe 2004, 2011). Social capital can thus take the form of friends' educational expectations (Berndt and Keefe 1995; Carolan 2018; Crosnoe 2011). This form of social capital is associated with high school graduation, for instance, above and beyond the influences of family socioeconomic status (Furstenberg and Hughes 1995), partly through friends' influences on student effort and future educational plans (Carbonaro and Workman 2016; Muller and Ellison 2001).

Social disconnectedness refers to "a lack of contact with others" as manifested in a "small social network, infrequent social interaction, and lack of participation in social activities" (Cornwell and Waite 2009b: 3). Disconnectedness is associated with poorer mental and physical health (Cornwell and Waite 2009b; House et al., 1988) and, as noted above, students with smaller school friendship networks fare worse in school than those with more friends (Asher et al. 1984). In this regard, the concepts of social disconnectedness and lack of social capital overlap. Yet not all forms of disconnectedness are the same (Parigi and Henson 2014). We draw on work that identifies distinct types of social disconnectedness, which provide insight into the nature of the isolation of students with LDs and how it affects their attainment. Rubin and Mills (1988) showed how social withdrawal among elementary school students may reflect passive isolation (shyness or disinterest in playing together) or active peer rejection, and that these social experiences have different causes and consequences for school. We focus on the distinct types of disconnectedness when examining this aspect of social isolation, but it should be noted that other scholars (e.g., Cornwell and Waite) use number of friends as an indicator of disconnectedness.

Building on the work that documents deficits in social skills among students with LDs, we apply the framework of social disconnectedness to understand the social lives of students with LDs and to assess the implications of different forms of social isolation for graduating high school. Others have shown that these distinctions matter in the lives of high school students. Using the same data as in this paper, Niño and colleagues (2016) compared the risks of smoking and drinking across three types of socially disconnected students: "active isolators" who have been rejected by others, "socially disinterested" students who have social competence but are solitary by choice, and students who lack social skills and are "socially avoidant." Socially disinterested students had higher risk of both smoking and drinking, while other disconnected students had either lower risk or the same risk as sociable students. Other studies using different data also find that students who are disinterested in school social ties have higher risk for negative outcomes (Copeland et al., 2018). We adopt Niño et al.'s approach in our analyses.

The third way that students with LDs may be socially disadvantaged at school is through their perceptions of isolation and detachment from their classmates. The size of the social networks in which students are embedded and students' perceptions of isolation are obviously related, but the overlap is partial (Asher et al. 1984; Cornwell and Waite 2009a). Hence the differences among those who have little to no ties—they may be rejected by others, avoiding others due to social anxiety, or disinterested. But this logic extends to the full range of network size, and for this reason some scholars place more emphasis on the subjective experience of isolation. In this view, social networks benefit educational attainment by making students feel at home and at ease in the school social environment (Johnson et al. 2001). Research on "fitting in" at school shows that students who feel more connected to their peers go on to graduate at a higher rate (Crosnoe 2000, 2004, 2011). Conversely, those who feel lonely and alienated may be at greater risk for dropout, though some studies have found no effect of loneliness on educational achievement (Asher et al. 1984).

We argue that the body of knowledge on students with LDs will benefit from a greater articulation of the specific forms of isolation for which they are most at risk. A more nuanced understanding of their social isolation is likewise important for identifying which aspect(s) of isolation—lack of social capital, particular types of disconnectedness like rejection, or the perception that they are alone at school and do not fit in—impede their educational attainment.

2.3. Social inequalities of students with LDs

What we do know from existing research is that students with LDs report greater levels of social disconnectedness and perceived isolation, variably measured, suggesting that they experience disparities in social capital. Students with LDs report fewer friends and that they feel less popular than other students (Sentenac et al., 2011; Eriksson et al., 2007; Haas et al., 2010). They also report feeling lonelier than their peers (Lackaye and Margalit 2008; Margalit and Al-Yagon 2002). Finally, students with LDs are more likely to feel "detached" from school, that they don't fit in; they more-often report "not at all" feeling part of school and "not at all" enjoying school (Wagner et al., 2007).

We argue that one reason for their heightened isolation, as measured in these disparate studies, is the stigma of disability and active rejection of their peers, akin to the discrimination and psychological distress of adults with impairments (Namkung and Carr 2019, 2020). According to interviews conducted by Green and colleagues, individuals with various kinds of disabilities—including those that create difficulties in learning—experience all of the elements of social stigma: labeling, stereotyping, separation, status loss, and discrimination (Green et al., 2005: 197). Evidence of these processes is found in the Education Longitudinal Study, where parents and teachers held lower expectations for students of comparable ability if they labeled the student as having a LD (Shifrer 2013). Similar dynamics have been observed in focus groups of parents and teachers of students with intellectual disabilities like autism, and these contributed to students' social isolation (O'Byrne and Muldoon 2018). These stereotypes are shared by students, as well. Estell and

colleagues (2008) found that elementary students with LDs were thought of as lower status by their peers, and this perception contributed to their social marginalization within general classrooms. Less work examines how LDs shape social experiences in middle and high school, yet assessments of similar labels suggest that processes of labelling and peer-preference occur across adolescence (e.g., O'Driscoll et al., 2015).

It is also likely that stigmatized perceptions of LDs restrict students' access to academically-oriented friends, a network-based educational resource that is sometimes viewed as an aspect of social capital (Dika 2002: 39–41; Furstenberg and Hughes 1995; Muller and Ellison 2001; Pribesh and Downey 1999). Comparisons to similar-performing peers (without LDs) reveal that students with LDs are disproportionately placed in remedial school tracks, limiting their advanced course-taking (Shifrer 2013, 2016). Concurrently, students are much more likely to befriend peers that they share courses with, net of grade-level and indirect relationships (Franklin, Muller, and Mueller 2013). That students with LDs spend less time with peers in advanced courses suggests their school-based friendship networks will contain fewer educationally ambitious students (Carbonaro and Workman 2016; Shifrer 2013). In addition to shaping access to this aspect of social capital, socially-patterned course placements might reify the stereotype that students with LDs are not intelligent, to peers and themselves.

Given these findings, it is likely that students with LDs will experience greater active rejection than other students. Though past studies have not directly tested this possibility with national data, it is consistent with other findings of student incivility toward students with LDs. Students with LDs are more likely to have daily trouble getting along with peers than are other students (11% vs. 3%) (Wagner et al., 2007) and they experience bullying at school more often than students in the general population (Sentenac et al., 2011). Such negative interactions across students' academic careers may also erode their interest in forming friendships over time.

Students with LDs are more isolated from other students in part due to their stigmatization, rejection, and victimization from their classmates (Barga 1996; Green et al., 2005; Sabornie 1994; Shifrer 2013, 2016). But for many decades, scholars have also investigated how social skill deficits among students with LDs contribute to their isolation at school, and whether these deficits are endemic to LDs or merely concomitant (e.g., Gresham 1992; Kavale and Forness 1996). This body of work yields two important points. One is that youth with LDs have considerable deficits in social skills (Elksnin and Elksnin 2004; Gresham 1992). According to one estimate derived from a meta-analysis of published studies at the time, around 75% of students with LDs have significantly fewer social skills than their non-LD peers (Kavale and Forness 1996). Secondly, is that scholars disagree on the source of these deficits. Some endorse the possibility that learning disabilities and associated social difficulties are both the result of central nervous system dysfunction, but the evidence is thin (Gresham 1992). Others claim that behavioral issues and LDs are comorbid, that a common presentation of learning disability is lack of impulse control, hyperactivity, or poor cooperation (Haager and Vaughn 1995; Ruegg 2006; Sabornie 1994).

But it is quite difficult to parse out the degree to which social troubles are a feature of LDs as opposed to a social outcome associated with peer stigmatization or academic struggles. Difficulty controlling one's temper may be the result of victimization and bullying (Sabornie 1994), while acting out in class can be a strategy that students with LDs use to elude language-based class activities and the stigma of taking longer than other students (Ruegg 2006; Barga 1996). In other words, the social skill deficits associated with LD status may stem from students' attempts to manage social and academic challenges. Haager and Vaughn (1995) conclude as much after finding that elementary school teachers rated students with LDs lower on cooperation, assertion, and self-control, and higher on hyperactivity compared to average or high achieving students, but no differently than non-LD students who were low achieving (below the 30th percentile on a standardized reading test). These findings show how important it is to account for past academic performance, since students with poor academic performance also demonstrate behaviors that might diminish their social connections. Nonetheless, it is likely that one reason for the social isolation of some students with LDs is difficulties getting along with other students, whatever the cause.

To sum, the loss of social capital due to social disconnectedness and perceptions of isolation constitute potentially important social obstacles to the educational attainment of students with LDs. Yet, despite the scattered evidence that students with LDs experience negative stereotypes, marginalization, loneliness, and feelings of not fitting in, little work has explicated the degree to which these social barriers limit their educational attainment. Further, while past research has examined individual aspects of isolation, this work has not undertaken a comprehensive analysis of the multidimensional nature of social isolation as experienced by students with LDs, and often lacks controls for academic ability and other social confounders. Such an analysis may give insight into the extent to which their isolation is driven by rejection from other students (due to stigma, stereotypes, fear of status loss, etc.) or some other source of social disconnectedness.

2.4. Current study

This study first examines the degree to which students with LDs experience different kinds of social isolation including a lack of social capital, various types of disconnectedness, and perceptions of isolation at school. We then assess which aspects of isolation contribute to LD-related disparities in educational attainment. We hypothesize the following.

1. Students with LDs will have less social capital, be more socially disconnected, and report greater perceptions of isolation than other students.
2. Lack of social capital, disconnectedness, and perceptions of isolation will account for part of the LD-gap in high school graduation.

It is important to account for potential confounders when examining these hypotheses, since LD-status is associated with multiple social statuses and contextual characteristics that are also associated with isolation and educational attainment. To test our hypotheses more rigorously, we control for potential confounders including gender, race/ethnicity, family socioeconomic status (SES), school size,

and school type. These analyses also account for academic ability since earlier academic performance could shape student friendship networks and high school completion via course and curricular program placement.

3. Methods

3.1. Sample

Data for the study come from the National Longitudinal Study of Adolescent to Adult Health (Add Health). Around 90,000 respondents were initially surveyed in grades 7–12 in 1994–95 from 80 high schools and 52 feeder schools. From those schools' rosters, Add Health recruited a representative sample of 20,745 students for a lengthier in-home survey. Follow-up interviews were conducted in 1996 (wave 2 in-home), 2001–02 (wave 3 in-home), 2008 (wave 4 in-home), and 2016–18 (wave 5 in-home) respectively (Harris 2013). Of the 12,105 students who ed in-home surveys, 8136 also participated in waves 2 and 4.

Add Health is especially well-suited to elucidate the relationships among LDs, various aspects of social isolation, and educational success. While other datasets contain information about students' friendships and academic performance, Add Health is unique in its attempt to collect friendship network data from all students in the schools attended by those who were subsequently selected for home interviews. Such information combined with data on feelings of isolation and educational progress allows for a rigorous assessment of the effects of social capital, disconnectedness, and perceptions of isolation on educational attainment. In short, Add Health uniquely provides the means to examine the degree of social disconnectedness and perceived isolation of students with LDs and to measure their effects on subsequent academic success through various mechanisms. A limit of existing research on students with LDs is that much of it consists of snapshots at one time point.

This study used waves 1, 2, and 4 of Add Health to test whether students with a LD in the first wave were more socially disconnected and felt more isolated than their peers, and how consequential these factors were for their high school graduation. We account for missing data using multiple imputation techniques in Stata 16. After excluding 229 observations without sampling weights the final analytic sample consists of 7907 respondents.

3.2. Measures

Learning Disability Status. We determined LD status by coding responses to an item on the parent questionnaire (wave 1) that asks, "Does (he/she) have a specific learning disability, such as difficulties with attention, dyslexia, or some other reading, spelling, writing, or math disability?" The parent-questionnaire also asks about other disabilities, such as blindness, deafness, and physical and cognitive impairments. In the analyses, students with LDs are contrasted to all other students, and our multivariate models include a control for other disabilities. Additional analyses confirmed that similar results were obtained if we excluded students who had disabilities other than a LD.

Measurement differences between Add Health and other national studies of education resulted in a higher estimate than reported elsewhere. Our weighted estimate of the proportion of students with LDs was 11% in Add Health, greater than other national estimates which use the Educational Longitudinal Study (e.g., Shifrer 2013) or data from the Office of Special Education Programs (used for assessment of IDEA; U.S. Department of Education 2007). Whereas the Education Longitudinal Study asks parents about "specific learning disabilities" (Ingels et al., 2004), Add Health also references "difficulties with attention." This wording invites parents to erroneously designate ADHD and similar difficulties as specific learning disabilities. Thus, our measure of LD status likely includes conditions that are not considered specific learning disabilities by school officials, such as ADHD and auditory processing disorder, though we are unsure to what extent. However, both specific learning disabilities and these similar conditions can lead to challenges with information processing, academic performance, and active rejection by their peers (Cortiella and Horowitz 2014; O'Driscoll et al., 2015). We therefore expect such students to experience similar levels of social isolation, and for these barriers to impede their educational pursuits.

Social Capital. We use two measures of social capital, number of friends and friends' educational expectations. Participants in the initial Add Health survey (1994–95) received a roster of students in their respective schools and "feeder" school(s) and were asked to identify up to 10 friends (up to 5 boys and 5 girls). Students could also nominate friends outside of their school system. We use sent and received friendship nominations to calculate number of friends, specifically the number of friends the student nominated (up to 10) plus the number of students in the school who nominated the respondent as their friend, accounting for repeats.¹

Add Health also asked respondents at wave 1 the chances they will graduate college, responses ranging from "No chance" (0) to "It will happen" (8). We use the average response of students' friends – the same peers included in number of friends – to indicate their friends' educational expectations.² The analyses use a standardized measure so that a one-unit difference corresponds to a one-standard deviation change.

Social Disconnectedness. We use three categorizations of social disconnectedness, "avoided," "rejected," and "disinterested," that are used in social isolation scholarship (Copeland et al., 2018; Niño et al., 2016). Respondents are coded in the avoided category if they

¹ Another frequently-used network measure is Bonacich centrality, commonly interpreted as capturing their social prestige or popularity. Similar results were obtained when using centrality instead of network size in our analyses.

² For the 243 respondents who did not send or receive any friendship nominations, we assigned the sample mean for their value of friends' expectations. Dropping these cases or using multiple imputation yielded similar results.

did not receive any friend nominations from their peers and did not nominate any peers as friends themselves. Those in the rejected category nominated peers as friends but did not receive any nominations from their peers. Finally, respondents were coded as disinterested if they received nominations from their peers but did not nominate any peers as friends on their own accord.

Perceived Isolation: To measure students' perceptions of isolation, we constructed a perceived isolation scale. We identified six measures capturing loneliness and detachment from school. Using polychoric correlations (for ordinal measures), exploratory factor analysis (EFA) identified one latent factor (eigenvalue = 2.27) that drove covariation among the six measures (see [Appendix A](#)). Cronbach's alpha ($r = 0.72$) also confirmed adequate intercorrelation among the six measures. The final scale is equal to the average, standardized score.

High School Diploma Status. Educational attainment is measured by high school graduation, given our focus on social barriers to educational outcomes within the high school setting, as opposed to post-secondary attainment. Students who graduated from high school as of wave 4 are coded 1 and others coded 0. Students who did not graduate high school but later obtained an equivalency degree (GED) are also coded 0 on diploma status.

Control Variables. To better isolate the social challenges of a LD status as compared to the learning challenges related to processing language or completing written assignments, we control for GPA at waves 1 and 2, depending on the outcome measure. GPA is the average of students' core course grades (English, mathematics, social studies, and science) on a standard 4-point scale, where As represent the highest value (4) and D/Fs represent the lowest value (1). Multivariate analyses additionally control for gender (1 = female; 0 = male), age at wave 1 (in years), and race/ethnicity. We include a measure that accounts for the presence of other disabilities, to better isolate the aspects of isolation and the educational attainments associated with having a LD as opposed to no disabilities and also other disabilities. The analyses also control for parent SES using highest educational attainment by a parent or guardian (1 = high school degree or less; 2 = some college; 3 = bachelor's degree or higher) and household income in thousands of dollars. In sensitivity analyses, we also control for grade retention using a dichotomous measure (1 = Yes; 0 = No) based on the question, "Have you ever repeated a grade or been held back a grade?" Finally, school-level controls consist of school type (public, Catholic, and private) and school size measured in hundreds of students. A handful of students in the sample attended a special education school ($n < 20$), too few students to treat as a unique group.

3.3. Analysis

About 2550 observations (~28.53%) were missing data for measures used in the current study. We used multiple imputation (MI) in Stata 16.0 to account for missing values among the study measures. The primary dependent variable, high school graduation, was not imputed. Stata's MI procedures created 15 imputation data sets, and the reported results are based on pooling the estimates. Using multiple imputation retained an additional 2321 observations and the results did not differ greatly from analyses that used listwise deletion.

The results are presented as follows. First, descriptive statistics in [Table 1](#) assess how much students with LDs differ from other students in terms of their *overall levels* of social capital (number of friends, friends' educational expectations), types of social disconnectedness, perceived isolation, and high school graduation status. Next, we more rigorously test hypothesis 1, that students with LDs are more socially isolated than other students, by regressing measures of social capital, social disconnectedness, and perceived isolation on LD status and control measures. These ordinary least-squares (OLS) and logistic regression analyses importantly control for confounding social factors like SES and academic ability. These results are illustrated in [Fig. 1](#) and the models are reported in [Appendix B](#).

We then examine Hypothesis 2, that measures of social isolation partly explain the LD-gap in high school graduation. Logistic regression estimates how LD status, number of friends, friends' educational expectations, social disconnectedness, and perceived isolation are associated with the odds of subsequently earning a high school diploma ([Appendix C](#)). Simple comparisons of logit coefficients across models that do and do not include the social isolation mediators are not appropriate ([Long and Mustillo 2021](#)). Therefore, we test Hypothesis 2 using KHB mediation analysis ([Kohler, Karlsen, and Holm 2011](#)) and report these results in [Table 2](#). We also report in this table the percent contribution of each mediator to the overall indirect effect of LD status on education through social isolation. Currently, the KHB mediation package cannot parse out net contributions of mediators when also using Stata's multiple imputation techniques to account for missing data. Thus, we ran KHB's "disentanglement" option on each of the 15 imputed data sets and report in [Table 2](#) the average results, as in other previous studies (e.g., [Seto and Said 2020](#)).

We tested for possible multicollinearity in the variables for the regression models that underlie the mediation analysis ([Appendix C, Model V](#)). The variance inflation factors (VIFs) and tolerances of these measures verify that multicollinearity is not an issue. It is also plausible that shared school contexts are affecting the multivariate results, so we checked for robustness when using multilevel, mixed-effects models instead. The results from multilevel modeling ([Appendices D and E](#)) generally did not differ substantially from the results presented here.³

All descriptive statistics and multivariate analyses are weighted with the cross-sectional sample weights (*schwtps*; *gswgt1*; and *gswgt4_2*) to account for survey attrition and the Add Health sampling design ([Chen and Chantala 2014](#)).

³ One notable difference in the multilevel results was that the net association between LD status and perceived isolation was nonsignificant ([Appendix D](#)).

Table 1
Descriptive statistics of students with LDS and without LDS (N = 7907).

Variables	Learning Disabilities (n = 842)		No Learning Disabilities (n = 7065)		Min	Max
	Mean/Proportion.	Std. Dev	Mean/Proportion	Std. Dev.		
Social Capital						
Number of Friends	6.23***	(4.04)	7.88	(4.36)	1.00	33.00
Friends' Educational Expectations	-0.31***	(1.15)	-0.02	(0.96)	-4.88	2.24
Social Disconnectedness Types						
Typical	0.70		0.85		0.00	1.00
Avoided	0.07***		0.02		0.00	1.00
Rejected	0.07		0.05		0.00	1.00
Disinterested	0.17***		0.09		0.00	1.00
Perceived Isolation	0.18***	(1.10)	-0.04	(0.98)	-1.46	5.04
High School Diploma Status	0.74***	-	0.88		0.00	1.00
GPA at Wave 1	2.41	(0.75)	2.91	(0.77)	1.00	4.00
GPA at Wave 2	2.45	(0.69)	2.89	(0.72)	1.00	4.00
Ever Repeated a Grade	0.47	-	0.16		0.00	1.00
Other Disabilities	0.00	-	0.13		0.00	1.00
Age at Wave 1	15.68	(1.59)	15.41	(1.56)	12.00	21.00
Female	0.36		0.54		0.00	1.00
Race/ethnicity						
Non-Hispanic White	0.78		0.76		0.00	1.00
Non-Hispanic Black	0.14		0.14		0.00	1.00
Hispanic	0.07		0.09		0.00	1.00
Other Non-Hispanic Race	0.01		0.01		0.00	1.00
Parents: High School or Less	0.43	-	0.36	-	0.00	1.00
Parents: Some College	0.32	-	0.32	-	0.00	1.00
Parents: Bachelor's or Higher	0.25	-	0.32	-	0.00	1.00
Household Income	44.88	(63.84)	46.49	(48.36)	0.00	999.00
School Type						
Public	0.88		0.86		0.00	1.00
Private	0.08		0.09		0.00	1.00
Catholic School	0.05		0.05		0.00	1.00
School Size	6.03	(7.02)	6.38	(7.86)	0.00	1.00

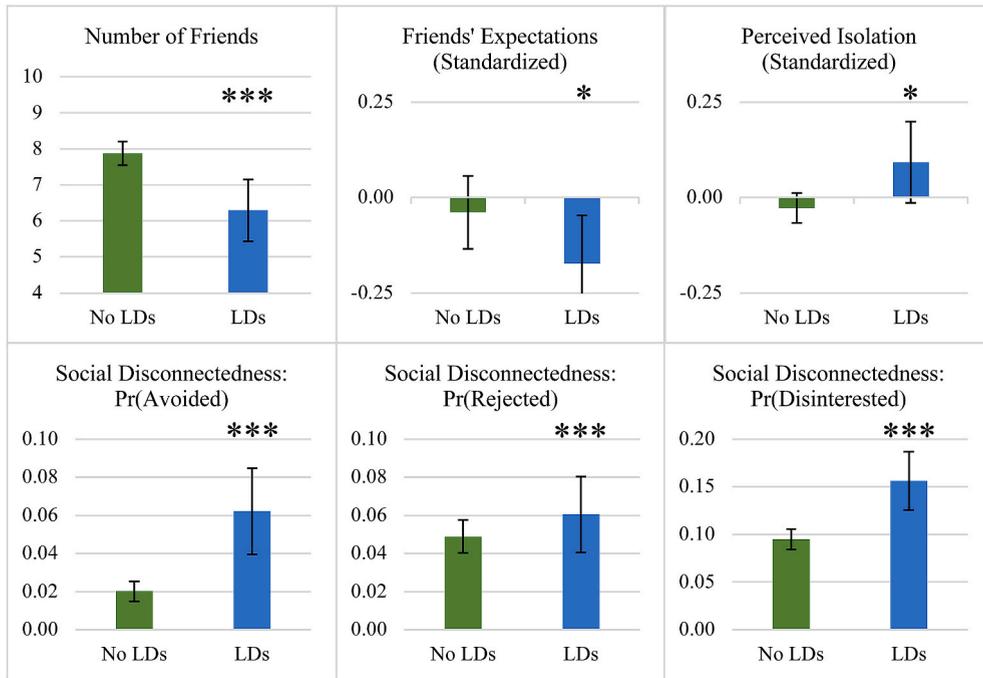
Note: Significant mean differences identified for key variables of interest between students with LDs and other students using two-tailed t-tests. * $p \leq 0.05$ | ** $p \leq 0.01$ | *** $p \leq 0.001$.

4. Results

Table 1 shows weighted descriptive statistics by LD status. Bivariate analyses of key variables indicate that students with LDs less often graduated high school (74% v. 88%) and are significantly more isolated on five out of the six aspects of isolation presented. Students with LDs have fewer friends on average than other students (6.2 v. 7.9 friends), and their friends hold lower expectations for their future educational attainment by a third of a standard deviation. Students with LDs are likewise more prone to be socially disconnected than students without LDs, at least in terms of avoidance and disinterest. Disinterest is the most common type of disconnectedness, as others have found (Niño et al., 2016), but it is particularly common among students with LDs at 17%. Avoidance of social relationships, as indicated by no friend nominations sent or received, is also significantly more common among students with LDs than other students—a condition that describes only 2% of other students but 7% of students with LDs. Unexpectedly, students with LDs are no more likely to be actively rejected by their schoolmates, as indicated by receiving no peer friend nominations despite having identified one or more schoolmates as a friend at school. Overall, about 31% of students with LDs experience some type of social disconnectedness, compared to about 16% of their peers. These structural indicators of social isolation are also reflected in perceptions of isolation. Students with LDs perceive higher levels of isolation than their peers, by about 0.20 standard deviations on average. Yet these bivariate associations may be attributable to covariation with gender, race/ethnicity, SES, and academic abilities.

Next, we test hypothesis 1 – that students with LDs experience inequalities in social capital, social disconnectedness, and perceived isolation – while controlling for GPA, other disabilities, age, gender, race/ethnicity, SES, school type, and school size. The key results are visually summarized in Fig. 1 (see Appendix B for complete regression results). Adjusting for the covariates, students with LDs still experience significant deficits in social capital. Like in Table 1, having a LD is associated with having between one and two fewer friends than students without disabilities. Further, these social ties are less likely to hold high educational expectations when students have a LD. After accounting for covariates, students with LDs still experience two of the three types of social disconnectedness more often than their peers, having 0.04 higher predicted probability of being socially avoidant and 0.06 higher predicted probability of being disinterested in friendships compared to students without disabilities. Finally, the positive association between having a LD and perceived isolation remains significant, net of other social factors. Taken together, the results in Fig. 1 powerfully attest to the social challenges associated with having a specific learning disability like dyslexia, above and beyond difficulties related to academic performance.

Hypothesis 2 predicted that deficits in social capital, more frequent experiences of social disconnectedness, and heightened levels of perceived isolation contribute to the lower rates of high school graduation observed among students with LDs, compared to their peers.



Note: Figure provides group-specific predictions for continuous measures and predicted probabilities of binary measures of social isolation, respectively. Estimates drawn from models in Appendix B. Statistically significant differences indicated with asterisks.

* $p \leq 0.05$ | ** $p \leq 0.01$ | *** $p \leq 0.001$

Fig. 1. Group-specific measures of social isolation, net of controls (N = 7907).

Note: Figure provides group-specific predictions for continuous measures and predicted probabilities of binary measures of social isolation, respectively. Estimates drawn from models in Appendix B. Statistically significant differences indicated with asterisks. * $p \leq 0.05$ | ** $p \leq 0.01$ | *** $p \leq 0.001$.

Table 2

Mediation analyses of social isolation on LD-gap in high school graduation (N = 7907).

Effects of LD Status	B	SE	% Reduced
Total	-0.60***	(0.09)	-
Direct	-0.46***	(0.10)	-
Indirect	-0.14***	(0.03)	23.54%
Social Capital			
Number of Friends	-	-	12.33%
Friends' Expectations	-	-	2.78%
Social Disconnectedness			
Avoided ^a	-	-	3.34%
Rejected ^a	-	-	-0.21%
Disinterested ^a	-	-	0.68%
Perceived Isolation	-	-	4.62%

Note: Estimates of log-odds and percent mediation derived using Kohler, Holm, and Breen (KHB) method. Disentangled mediation effects estimated by averaging results across the 16 datasets (original + 15 imputed).

*** $p \leq 0.001$.

^a Variable was not associated with high school graduation in the full model, net of LD status, other social isolation measures, and controls.

We first describe the observed associations between social isolation and high school graduation (available in Appendix C). In regard to social capital, each additional friend is associated with 4% higher odds (OR = 1.04, $p < 0.01$) of subsequently graduating high school, net of those friends' expectations, personal social disconnectedness, and perceived isolation. Also important is having educationally-motivated friends. A one-standard deviation increase in friends' expectations translates to 20% higher odds (OR = 1.20, $p < 0.001$) of earning a high school diploma. A one standard deviation increase in perceived isolation has a similar, but negative predicted change on the odds of high school graduation (OR = 0.77, $p < 0.001$). Seeing oneself as belonging at school, fitting in with other students, and feeling connected to others is a significant predictor of high school graduation above and beyond the influences of social capital and the

various control measures.

To test Hypothesis 2, that social isolation partly explains the LD-gap in high school graduation, formal mediation analyses (KHB method) rescale the coefficients derived from nonlinear nested models of high school graduation containing no measures of social isolation and all 3 aspects of social isolation. Table 2 shows that considered together, differences in social capital, disconnectedness, and perceived isolation account for nearly a quarter (23.54%) of the association between LD status and high school graduation, net of past academic achievement and other covariates. Further, what is key among all of the measures of social isolation is social capital, especially number of friends that accounts for over half of the total indirect effect. These results suggest that social isolation, particularly as manifested in fewer friends, is a significant barrier to the educational attainment of students with LDs, controlling for academic achievement.

5. Discussion

Students with LDs face educational challenges related to the difficulties they experience with verbal or written information that detract from their “ability to listen, think, speak, read, write, spell, or do mathematical calculations” (*Individuals with Disabilities Education Act 2019*). However, students with LDs also encounter social challenges in the form of fewer friends, disconnectedness from their classmates, and heightened perceptions of isolation. Scholars have surmised that the social isolation of students with LDs is partly the result of the stigmatization of disabilities in society (Barga 1996; Green et al., 2005; Shifrer 2013; O’Driscoll et al., 2015), and partly reflects the social skills deficit associated with LDs (Elksnin and Elksnin 2004; Gresham 1992). In the current study, we sought to extend this literature by examining multiple facets of social isolation to identify the aspects that are most elevated among students with LDs. Then we used mediation analysis to estimate how much the various aspects of social isolation contribute to the education gaps between students with LDs and other students. Accordingly, we tested whether students with LDs have less social capital, are more disconnected, and report greater perceptions of isolation, before and after accounting for potential confounders like family SES, race/ethnicity, and academic ability. We then assessed whether and to what extent these aspects of social isolation account for the LD-gap in high school graduation, controlling for past grades and other covariates.

Analyses of a nationally representative sample of adolescents confirmed—sadly—that students with LDs are at greater risk for nearly every measure of social isolation we considered. They have fewer friends in general and these friends hold more modest expectations for their educational careers. They are more socially disconnected both by nature of identifying fewer school friends but also in terms of a greater likelihood of avoiding friendships or being disinterested in them. Structural conditions of deficient social capital and amplified disconnectedness are accompanied by their heightened perceptions of isolation. Though these associations are cross-sectional and thus merit due caution (Mouw 2006), the extensive pattern of greater isolation is not due to academic or demographic distinctions between students with LDs and other students. Students with LDs report higher levels of each aspect of isolation, even controlling for academic ability, school type, school size, family SES, age, gender, and race/ethnicity. Since social difficulties are also associated with lower academic performance and struggles in the classroom, it is critical that we controlled for past grades. Our accounting for grades and use of a nationally representative sample means that our estimates are rigorous relative to past studies.

These significant differences in social capital (number of friends and friends’ educational expectations), avoidance, disinterest, and perceived isolation are consistent with the view that disabilities are stigmatizing in high school and for this reason contribute to interpersonal conflict (Sentenac et al., 2011), fewer friends (O’Driscoll et al., 2015), and feelings that they do not belong (Wagner et al., 2007). One important way that the results do not support an interpretation of stigmatization is the result that students with LDs are no more likely to be socially rejected (identify others as friends but have no one identify them as such). Also, students with LDs were twice as likely as other students to show disinterest in friendships (identify no friends but have others identify them as their friend; 17% versus 9% for other students), and this may reflect a personal preference for isolation, disinterest due to past negative experiences with classmates, or strategies to avoid language-based class activities (Haager and Vaughn 1995; Ruegg 2006). Moreover, our multivariate models explained relatively small portions of the total variation in social isolation, ranging between 1 and 11%. More work is needed to determine whether or how much of this relative isolation is a consequence of disability-based stigmatization in earlier grades.

The analyses also confirmed that social isolation explains a non-trivial portion of the sizable gap in high school graduation between students with LDs and other students. Controlling for academic ability and other school and student characteristics, the various aspects of social isolation together accounted for around 1/4 of the high school graduation gap, according to the mediation analyses. Measures of social capital and perceived isolation were significantly associated with high school graduation, whereas social disconnectedness was not associated with high school graduation, when accounting for LD status, other aspects of social isolation, and covariates. The mediation analyses also suggest that the most important aspect of social isolation for predicting graduation was social capital and especially number of friends.

An implication of these findings is that the aspect of isolation that most negatively affects students with LDs is the lack of social capital. Academic resources in the form of larger friendship networks comprised of more educationally ambitious friends are relatively lower for students with LDs, they have a robust impact on the odds of graduating high school, and this dimension of isolation was a significant mediator of the LD-related gap in high school graduation. Admittedly, there is overlap in the conceptualization of a lack of social capital and disconnectedness, as both have been measured with friendship network size in past research (Cornwell and Waite 2009; Humberstone 2018). We conclude the results favor the social capital interpretation more than the social disconnectedness interpretation, because of the nonsignificance of distinct types of disconnectedness (avoidance, rejection, and disinterest) that other scholars have found to be associated with student outcomes in the past (Copeland et al., 2018; Niño et al., 2016; Rubin and Mills 1988). Our findings might conflict with past studies because they do not typically account for network size and place most of the sample into a

single category of “sociable.” We found that students’ number of friends and those friends’ expectations continued to shape high school graduation after accounting for experiences of social disconnectedness. This result held for students who did *and* did not experience a form of social disconnectedness (available upon request). Still, future research should aim to more clearly parse out each dimension’s unique contribution to the LD-gap in attainment net of other components of social isolation, and the specific influences of individual variables like number of friends and their educational expectations.

Future research can take additional steps to improve upon the current study. For one, Add Health’s sample of secondary students was initially surveyed a quarter-century ago. Public attention directed towards students with disabilities, specifically LDs, has undoubtedly increased since these initial interviews (Horowitz et al., 2017; Wagner et al., 2007). However, research continues to find that having a learning disability affects students’ friendships, peer-conflict, and social status in school (Estell et al., 2008; Haas et al., 2010; Sentenac et al., 2011). Future studies should test these findings using more contemporary data, though it seems likely these social dynamics continue to apply to today’s high school students. A more rigorous examination of students’ course taking patterns would also improve current understanding of the indirect influence that structural inequalities in school have on other dimensions of academic achievement and attainment for students with LDs. For example, it is likely their disproportionate remedial track placement (Shifrer 2013, 2016) and subsequent filtering of potential friendships (Carolan 2018; Frank et al., 2013) has cumulative effects on students with LDs’ educational performance (e.g., Frank et al., 2008). Such a detailed analysis of course taking patterns is outside the scope of the current study, but would nonetheless provide insights as to the structural barriers limiting these students’ educational attainment.

Another area for future research is to investigate whether and how LD-related disparities in education vary by gender and age. According to some studies, younger girls with LDs face more severe social sanctions than boys (Bryan 1974) which may lead to larger impacts on educational achievement. Other studies suggest that there has been greater improvement in the high school graduation rates of boys with LDs than girls with LDs (Wagner et al., 2005: 2–5). Our analyses of Add Health (not shown) indicated that girls with LDs are just as likely to earn a high school diploma as are girls without disabilities, adjusting for high school grades. LDs can also have varying influence across age. Older (16 years and older at wave 1) and younger (12–15 years at wave 1) students with LDs were similarly isolated, yet only younger students with LDs experienced worse educational attainment after accounting for social isolation and academic achievement (analyses not shown). A possible reason for the relatively smaller impacts of LD on older students is attrition—they first participated in Add Health at a later age, and students prone to dropping out of high school may already have done so (Office of Special Education Programs: U.S. Department of Education, 2014). Though outside the scope of this study, future work should consider gender, age, and other status characteristics that potentially condition the relationships between LDs and educational attainment.

Future research should additionally aim to uncover the mechanisms through which social networks influence educational attainment for students with LDs. The importance of friendships for expectations and school adjustment are well-noted (Bryan et al., 2012; Carbonaro and Workman 2013; Crosnoe 2011), and the current study presents supporting evidence for these relationships. Yet, the psychosocial characteristics represented in the current study are not exhaustive of the potential resources social capital might present in school. For example, having academically-savvy friends might translate into other educational resources unmeasured in Add Health, such as student-collaboration on class assignments and projects (Carolan 2014). And as noted, there are likely to be reciprocal dynamics at play, where academic struggles lead to negative interactions and greater isolation (Barga 1996), and the association between peers’ expectations and high school graduation may be partly due to social sorting (Mouw 2006).

Continued work on identifying mechanisms is important because it could lead to policy innovations that address social challenges as well as academic ones. Researchers have successfully developed a wide range of academic interventions for students with LDs that have proven effective, whereas non-academic interventions like social skills training or socioemotional learning have had more modest results (Elksnin and Elksnin 2004). Some long-term interventions, such as the Peer EXPRESS program, have proven successful at reducing (but not eliminating) peer victimization, by bringing together adolescents with and without disabilities in school and community settings (Saylor and Leach 2009). Other interventions that are short-term in nature, begin in earlier grades (e.g., “social autopsies,”), and reward systems for social competence may be valuable (Ruegg 2006) but are less-often effective at reducing social conflict with peers (Vreeman and Carroll 2007). Importantly, greater attention needs to be paid to the social capital lost due to isolation, an issue that is almost entirely absent in past research on LD interventions.

APPENDIX A. Factor loadings and unique variance of items in perceived isolation scale (N = 7907)

Variables	Factor Loadings	Unique Variance
How strongly do you agree or disagree with the following statement?		
I feel like I am part of this school*	0.72	0.48
I feel close to people at this school*	0.66	0.56
I am happy to be at this school*	0.63	0.60
How often was the following true in the past week?		
You felt that people disliked you	0.61	0.62
People were unfriendly to you	0.58	0.67
You felt lonely	0.45	0.80
Latent Factors	Eigenvalue	% Variance Explained
Factor 1	2.27	85.49%

Note: Estimates derived using polychoric correlations.

* reverse coded to correspond to greater loneliness.

APPENDIX B. Multivariate analyses of social capital, disconnectedness, and perceived isolation (N = 7907)

Variables	Number of Friends ^a b/se	Friends' Educational Expectations ^a b/se	Avoided ^b OR/se	Rejected ^b OR/se	Disinterested ^b OR/se	Perceived Isolation ^a b/se
LD Status ^c	-1.58*** (0.33)	-0.13* (0.05)	3.28*** (0.70)	1.26 (0.26)	1.80*** (0.21)	0.12* (0.06)
GPA at Wave 1	0.18*** (0.11)	0.87 (0.03)	0.95 (0.15)	0.93 (0.11)	-0.18*** (0.07)	0.38** (0.03)
Other Disabilities ^c	-0.04 (0.20)	1.53 (0.05)	0.90 (0.37)	1.52* (0.24)	0.02 (0.25)	-0.70*** (0.05)
Age at Wave 1	-0.07** (0.07)	1.01 (0.02)	0.94 (0.06)	1.13*** (0.06)	0.05*** (0.04)	-0.05 (0.01)
Female ^d	0.33* (0.14)	0.05 (0.03)	0.50*** (0.09)	0.57** (0.10)	0.55*** (0.06)	0.13*** (0.04)
Race/Ethnicity ^e						
Non-Hispanic Black	-1.25*** (0.31)	0.34*** (0.10)	1.89* (0.51)	1.32 (0.27)	2.33*** (0.29)	0.05 (0.05)
Hispanic	-0.83** (0.30)	0.00 (0.07)	1.17 (0.39)	0.94 (0.19)	1.93** (0.46)	-0.08 (0.06)
Other Non-Hispanic Race	-1.85 (1.15)	-0.62 (0.74)	0.22 (0.23)	6.07** (3.85)	1.13 (0.57)	0.17 (0.24)
Parental Education ^f						
Some College	0.07 (0.21)	0.14** (0.05)	0.95 (0.24)	1.17 (0.25)	1.18 (0.19)	-0.06 (0.04)
Bachelor's or Higher	0.35 (0.21)	0.37*** (0.06)	1.06 (0.35)	0.82 (0.23)	0.85 (0.12)	-0.09 (0.06)
Household Income	0.00** (0.00)	0.99* (0.00)	0.99** (0.00)	1.00 (0.00)	-0.00 (0.00)	0.01*** (0.00)
School Type ^g						
Catholic School	-0.79 (0.47)	-0.02 (0.16)	1.81 (0.58)	1.53 (0.34)	1.11 (0.25)	0.10 (0.12)
Private School	-2.65*** (0.45)	0.27* (0.12)	2.42 (1.52)	1.84 (0.83)	1.41 (0.41)	-0.22* (0.09)
School Size -	0.01 (0.03)	1.05*** (0.01)	1.02 (0.01)	1.01 (0.01)	0.00 (0.01)	0.09** (0.00)
R ²	0.08	0.11	0.03	0.01	0.04	0.05
AIC	45,056	21,177	5492	2048	3058	22,129

Note: Estimates derived from a: ordinary least-squares regression |b: logistic regression. Adjusted R² provided for OLS regression models and Efron's R² provided for logistic regression models. Reference groups c: no disabilities |d: male |e: non-Hispanic white |f: high school or less |g: public school. *p ≤ 0.05 | **p ≤ 0.01 | ***p ≤ 0.001.

APPENDIX C. High school graduation regressed on LD status, social capital, disconnectedness, perceived isolation, and controls (N = 7907)

Variables	Reduced Model OR/se	Full Model OR/se
LD Status ^a	0.56*** (0.09)	0.63** (0.10)
Social Capital		
Number of Friends		1.04** (0.01)
Friends' Expectations	-	1.20*** (0.06)
Social Disconnectedness		
Avoided ^b	-	0.74 (0.20)
Rejected ^b	-	1.07 (0.24)
Disinterested ^b	-	0.94 (0.14)
Perceived Isolation	-	0.77*** (0.04)
GPA at Wave 2	2.93*** (0.23)	2.69*** (0.22)
Other Disabilities ^a	0.75	0.79

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Variables	Reduced Model OR/se	Full Model OR/se
	(0.12)	(0.13)
Age at Wave 1	1.07 (0.04)	1.11** (0.04)
Female ^c	1.05 (0.10)	1.06 (0.11)
Race/Ethnicity ^d		
Non-Hispanic Black	0.96 (0.18)	0.96 (0.17)
Hispanic	0.78 (0.14)	0.80 (0.16)
Other Non-Hispanic Race	0.76 (0.45)	0.81 (0.45)
Parental Education ^e		
Some College	1.50** (0.20)	1.44** (0.19)
Bachelor's or Higher	2.37*** (0.43)	2.22*** (0.40)
Household Income	1.01* (0.00)	1.01 (0.00)
School Type ^f		
Catholic School	1.85 (0.96)	1.93 (0.99)
Private School	1.24 (0.66)	1.21 (0.65)
School Size	1.04** (0.01)	1.04** (0.01)
Efron's R ²	0.13	0.15
AIC	5035	4880

Note: Reference groups are a: no disabilities | b: typical social connectedness | c: male | d: non-Hispanic white | e: high school or less | f: public school.

*p ≤ 0.05 | **p ≤ 0.01 | ***p ≤ 0.001.

APPENDIX D. Multilevel analyses of social capital, disconnectedness, and perceived isolation (N = 7907)

Variables	Number of Friends ^a b/se	Friends' Educational Expectation ^a b/se	Avoided ^b OR/ se	Rejected ^b OR/ se	Disinterest ^b OR/ se	Perceived Isolation ^a b/se
LD Status ^c	-1.52*** (0.35)	-0.11* (0.05)	3.37*** (0.77)	1.28 (0.27)	1.79*** (0.21)	0.09 (0.09)
GPA at Wave 1	0.44*** (0.11)	0.17*** (0.03)	0.86 (0.16)	0.95 (0.11)	0.93 (0.07)	-0.16*** (0.04)
Other Disabilities ^c	-0.64** (0.20)	-0.06 (0.04)	1.50 (0.40)	0.90 (0.24)	1.58** (0.27)	0.00 (0.06)
Age at Wave 1	-0.16** (0.06)	-0.03 (0.01)	1.01 (0.07)	0.93 (0.06)	1.18*** (0.05)	0.04* (0.01)
Female ^d	0.33* (0.14)	0.04 (0.03)	0.47*** (0.09)	0.54** (0.10)	0.55*** (0.06)	0.12** (0.04)
Race/Ethnicity ^e						
Non-Hispanic Black	-0.74*** (0.18)	0.09 (0.05)	1.50 (0.42)	1.25 (0.24)	2.16*** (0.28)	0.09 (0.05)
Hispanic	-0.02 (0.22)	-0.04 (0.07)	0.86 (0.33)	0.92 (0.20)	1.68 (0.47)	-0.01 (0.06)
Other Non-Hispanic Race	-1.51 (1.14)	-0.73 (0.77)	0.17 (0.18)	6.40** (4.46)	1.05 (0.56)	0.35 (0.19)
Parental Education ^f						
Some College	-0.04 (0.18)	0.08 (0.04)	0.95 (0.26)	1.13 (0.25)	1.16 (0.18)	-0.05 (0.06)
Bachelor's or Higher	0.30 (0.22)	0.21*** (0.04)	1.07 (0.36)	0.76 (0.20)	0.83 (0.12)	-0.10 (0.06)
Household Income	0.01** (0.00)	0.00* (0.00)	0.99* (0.00)	0.99* (0.00)	1.00 (0.00)	-0.00 (0.00)
School Type ^g						
Catholic School	-1.57* (0.78)	-0.04 (0.17)	2.39* (0.87)	1.57* (0.33)	1.27 (0.37)	-0.01 (0.08)
Private School	-2.96*** (0.78)	0.29 (0.18)	2.13 (1.54)	1.82 (0.84)	1.36 (0.45)	-0.20 (0.10)
School Size	-0.15	0.02	1.06*	1.02	1.02	0.01

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Variables	Number of Friends ^a b/se	Friends' Educational Expectation ^a b/se	Avoided ^b OR/ se	Rejected ^b OR/ se	Disintereste ^b OR/ se	Perceived Isolation ^a b/se
	(0.09)	(0.02)	(0.03)	(0.02)	(0.02)	(0.00)
ICC	0.13	0.15	0.17	0.05	0.05	0.03
AIC	44,545	20,843	2019	3057	5460	22,088

Note: Estimates derived from a: ordinary least-squares regression |b: logistic regression. Reference groups are c: no disabilities |d: male |e: non-Hispanic white |f: high school or less |g: public school.

*p ≤ 0.05 | **p ≤ 0.01 | ***p ≤ 0.001.

APENDIX E. Multilevel analyses of high school graduation (N = 7907)

Variables	Reduced Model	Full Model
	OR/se	OR/se
LD Status ^a	0.61** (0.11)	0.69* (0.13)
Social Capital		
Number of Friends		-1.04* (0.02)
Friends' Educational Expectations	-	1.25*** (0.07)
Social Disconnectedness ^b		
Avoided		0.64 (0.24)
Rejected		1.01 (0.28)
Disinterested		0.87 (0.18)
Perceived Isolation		0.82** (0.05)
GPA at Wave 2	3.28*** (0.34)	3.01*** (0.32)
Other Disabilities ^a	0.74 (0.15)	0.80 (0.16)
Age at Wave 1	0.91 (0.05)	0.95 (0.05)
Female ^c	1.05 (0.14)	1.05 (0.14)
Race/Ethnicity ^d		
Non-Hispanic Black	1.35 (0.25)	1.33 (0.24)
Hispanic	0.63 (0.17)	0.60 (0.18)
Other Non-Hispanic Race	1.20 (0.81)	1.26 (0.91)
Parental Education ^e		
Some College	1.60** (0.27)	1.55** (0.26)
Bachelor's or Higher	2.26*** (0.51)	2.10** (0.49)
Household Income	1.01 (0.00)	1.00 (0.00)
School Type ^f		
Catholic School	1.12 (0.73)	1.29 (0.81)
Private School	1.34 (1.07)	1.33 (1.07)
School Size	1.07* (0.03)	1.07** (0.03)
ICC	0.26	0.26

AIC 4992 4838 Note: Reference groups are a: no disabilities |b: typical social connectedness |c: male |d: non-Hispanic white |

e: high school or less |f: public school.

*p ≤ 0.05 | **p ≤ 0.01 | ***p ≤ 0.001.

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