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Algebra performance and motivation differences for students with learning disabilities and students of varying achievement levels

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ABSTRACT

Prior research has documented differences in both performance and motivation between students with learning disabilities (LD) and non-learning disabled (non-LD) students. However, few studies have conducted a finer grained analysis comparing students with LD with nondisabled students of varying achievement levels. The present study examines differences between LD, low-achieving, average-achieving, and high-achieving adolescents on algebra performance and readiness, motivational constructs (competence expectancy, interest, and goal orientation in mathematics), and the discrepancy between students' competence and their perceptions of their own competence. Results indicate that while students with LD may demonstrate lower algebra readiness and algebra achievement and more inaccurate judgments of their own competence compared with the whole non-LD sample, critical differences in performance and motivation were most evident between high-achieving and low-achieving students, not students with learning disabilities.

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Over the past several decades, differences in performance between typically developing students and students with learning disabilities (LD) have been documented, with students with LD exhibiting poorer academic performance and achievement in comparison to their nondisabled peers (Geary, 2004; Geary, Hoard, Nugent, & Bailey, 2012; Kavale & Reese, 1992; Marshall, Hynd, Handwerk, & Hall, 1997; Miles & Forcht, 1995; Miller & Mercer, 1997; Zental & Ferkis, 1993). Research has consistently shown students with learning disabilities demonstrate less persistence on academic tasks across various subject-areas and grade levels (e.g., Ayres, Cooley, & Dunn, 1990; Geary, 2011). Furthermore, an increasing body of literature focusing specifically on the motivation of students with LD indicates that these students often display different motivational profiles than their nondisabled peers (Pintrich, Anderman, & Klobucar, 1994; Sideridis, 2005).

Research has shown that, in comparison to typically developing students, children with learning disabilities report deficits in motivation and lower levels of perceived competence (Deci, Hodges, Pierson, & Tomassone, 1992; Sideridis, Morgan, Botsas, Padeliadu, & Fuchs, 2006). Similarly, students with LD report less academic strategy use and less persistence on academic tasks (Meltzer, Katzir, Miller, Reddy, & Roditi, 2004; Palmer, Drummond, Tollison, & Zinkgraff, 1982). Moreover, academic failures are more likely to negatively impact motivation and result in feelings of helplessness and lowered expectations for success in students with LD than in students without LD (Sideridis, 2003). The repeated academic failures sometimes experienced by these students may lead to further declines in students' motivation and engagement in tasks. Thus, while motivation plays an important role in predicting and influencing academic success among all groups of students, it may be particularly relevant in students with learning disabilities (Sideridis et al., 2006).

Historically, much of the research on motivation and achievement in students with LD has taken a two-group comparative approach, comparing students with LD to students without LD. Acknowledging the heterogeneous nature of students without learning disabilities, however, researchers have recently turned their attention toward understanding the relationship between achievement and motivation in students with LD and nondisabled students at various levels of academic achievement (Lackaye & Margalit, 2006; Valås, 1999). Examining the similarities and differences in achievement and motivational constructs between students with LD and non-LD students of different achievement levels allows for a closer and more nuanced understanding of the differential patterns of motivation and the associated impact on students' academic achievement (Murayama, Pekrun, Lichtenfeld, & Vom Hofe, 2013). Researchers have called for studies in which students with LD are considered separately from low-achieving students without LD, as collapsing data from these groups may conceal important differences that exist between these groups of learners (Mazzocco &

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Devlin, 2008). Importantly, these authors caution against adopting a uniform approach to supporting students who are struggling with mathematics, arguing that students with LD and low-achieving students without LD may respond to such strategies in different and important ways. Additional research aimed at further exploring the differences between these groups is warranted.

The experiences of students with learning disabilities may be different from those of low-achieving students without LD in important ways. For instance, employing a multi-group approach, Lackaye and Margalit (2006) found that while students with LD scored similarly to low-achieving non-LD students on measures of academic achievement, the self-perceptions of students with LD were unique from low-achieving non-LD students. Furthermore, it has been hypothesized that experiences with academic failures, interactions with teachers, and stigmatization surrounding the label of having a learning disability could result in changes in students' goal orientations (Schwab, 2014). Understanding these differences can provide insight into effective teaching and instructional interventions aimed at promoting academic success and achievement in all students, including those with learning disabilities.

In the present study, we examine performance and motivation differences between middle and high school LD and non-LD students of varying achievement levels in Algebra I. This context is critical and interesting for several reasons. First, Algebra I is considered to be a gate-keeper course, in which success or failure often determines whether a student will move on to higher level courses in mathematics and science and be accepted into college (U.S. Department of Education, 1997). Thus, low performance in Algebra may be a higher stake problem than performance deficits in other mathematics content areas. In addition, Algebra I courses are typically positioned during the transition into junior high school, a period in which a drop in students' academic motivation has been well documented (Midgley, Feldlaufer, & Eccles, 1989; Ryan & Patrick, 2001; Wigfield, Eccles, Mac Iver, Reuman, & Midgley, 1991). Furthermore, research suggests that early adolescence and the transition to junior high and high school may be particularly challenging for students with learning disabilities, who are even more likely to demonstrate negative changes in motivation and achievement during these periods (Beauchemin, Hutchins, & Patterson, 2008; Letrello & Miles, 2003; Usher & Pajares, 2006). As such, investigating differences in motivation and performance among these groups of students may be the first step to eventually inform educators and practitioners on how to promote learning and motivation during this critical time.

Given our focus on the Algebra I student population, we will investigate three motivational constructs that are particularly relevant for adolescents learning mathematics: Competence expectancy, interest, and achievement goal orientation. Evidence suggests students' competence expectancy is related to achievement goal orientations, as students continuously make evaluations of their own competence, and goal orientations involve students' goals for developing and demonstrating their competence. Theorists have further proposed that students who have high competence expectancies are more likely to adopt performance approach and mastery-oriented achievement goal orientations (Elliot & Church, 1997). As such, competence expectancies are thought to impact students' orientation toward different achievement goals and affect students' interests in engaging in tasks (Elliot & Church, 1997; Zisimopoulos & Galanaki, 2009). Prior literature highlights the role that competence expectancy, interest, and achievement goal orientation play in promoting academic achievement and success in both students with and without LD; however, research has also revealed a unique profile pertaining to the relationship between these constructs for students with LD that may differ in important ways from non-LD students. In the following sections, we define each of these constructs and review the current research describing how they may differ for students with LD and non-LD students of varying achievement levels.

1. Competence expectancy and interest

Theorists have long postulated that students have a psychological need to feel competent in their perceived ability to master tasks (Deci & Ryan, 1985). Competence expectancy refers to the expectations one holds for success on specific tasks (Elliot & Church, 1997).[1] Research over the past few decades has revealed that students with LD are more likely to hold negative beliefs and expectations about their competence on academic tasks than their nondisabled peers (Grolnick & Ryan, 1990). Repeated academic challenges and failures (as are commonly experienced by low achieving students and those with learning disabilities) may lead these students to adopt lowered expectations of themselves, which can hinder the process of selecting and committing to one's own goals (Fuchs, Bahr, & Rieth, 1989).

Research indicates that students with higher levels of competence expectancy are more likely to demonstrate enjoyment and interest on a relevant task, and thus be more motivated and interested in engaging in and completing the task (Losier & Vallenard, 1994; Zisimopoulos & Galanaki, 2009). Theorists suggest that as students struggle to succeed in academic tasks, they develop lower expectations of their own competence, which leads to a decrease in their motivation and interest in engaging in similar tasks (Zisimopoulos & Galanaki, 2009). Given the likelihood, then, of facing repeated academic failures and increased chances of developing low academic ability beliefs, it can also be expected that students with learning disabilities are likely to develop deficits in motivation and interest. Alternatively, rather than simply considering ability beliefs in terms of absolute levels, researchers in the field of metacognitive monitoring suggest a more nuanced approach toward assessing students' expectations or judgments of success. Chen (2003) found that how well-matched, or *calibrated*, students' expectations of their own performance was with their actual performance on a task was predictive of middle school students' mathematics performance overall. Although Chen did not consider LD status, some research outside of mathematics suggests that LD students actually overestimate their ability in academic tasks (Job & Klassen, 2012; Klassen, 2007). However, we do not know whether this tendency to overestimate competence holds true for LD students' mathematics skills as well. Thus, not only it is important to consider the impact of students' ability beliefs on their later performance overall, but also how any discrepancy between students' ability beliefs and actual competence may differ for LD students and non-LD students of varying levels of achievement.

While a number of theoretical conceptualizations of interest have emerged in the literature, interest is widely considered a critical motivational construct that supports engagement and learning (Renninger & Hidi, 2011). Students who are interested in the task are more likely to persist in task completion, allocate necessary attentional resources to the task, and derive more personal enjoyment from engaging in it (Ainley, Hidi, & Berndorff, 2002; Hidi, 1990; Hidi & Harackiewicz, 2000). Researchers concerned with understanding the development of academic interest have found that interest can be related to prior academic success in the course or

[1] Elliot's Competence Expectancy construct has similarities to ability beliefs measures, including the Expectancies for Success construct (e.g., Wigfield & Eccles, 2002). There are differences in all of these measures in terms of how specific the task is (how I expect to do in math in general vs. on this math question I'm answering) and whether they are being asked to focus on their own sense of competence or in comparing themselves to others. However, Eccles and colleagues have found that children and adolescents don't distinguish between competence beliefs and expectancies (Wigfield & Eccles, 2002) and that many of these measures load on the same factor (Eccles et al., 1993; Eccles & Wigfield, 1995). For the present study, we utilize the term competence expectancy to refer to the broad construct of how students think they will do in the class they are taking.

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