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Empirical study

Domain-specific metacognitive calibration in children with learning disabilities

N. Crane *, A. Zusho, Y. Ding, A. Cancelli

Fordham University, United States

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ABSTRACT

Research has shown that a student's self-efficacy levels can predict his or her academic performance. Although moderate overconfidence in one's abilities is beneficial, research has demonstrated that students who can calibrate (i.e., accurately assess their abilities) are more likely to achieve higher levels of academic performance. Individuals with learning disabilities have been found in previous studies to have poor levels of calibration when compared to typically developing students, particularly on academic tasks. Building on this line of research, this study examined the self-efficacy and metacognitive calibration of students with learning disabilities across both academic and non-academic contexts. Twenty-nine students with learning disabilities were given both an academic and a non-academic task and asked to predict their performance on both tasks. Multiple calibration scores were calculated by comparing participants' expected performance to their actual performance. Overall, students reported reduced metacognitive calibration on both academic and non-academic tasks; however, their patterns were more extreme for the non-academic task. Specifically, students reported much higher levels of self-efficacy for the non-academic task despite much lower metacognitive calibration scores. These findings point to the possibility that the history of failure experienced by students with learning disabilities on academic tasks may actually improve their calibration with those tasks and that they may have an overall deficit in their ability to predict their own abilities.

1. Introduction

Research consistently demonstrates self-efficacy – typically defined as an individual's beliefs about how well he or she can control the events of life – to be a strong predictor of his or her academic performance (Bandura, 1989; Pajares & Johnson, 1996). Self-efficacy is often used as a measure of how much confidence individuals have in their ability to complete a task or reach a goal. Students' self-efficacy beliefs can influence their learning process in many different ways, including the strategies they use, the goals they set, and the ways in which they respond to setbacks (Bandura, 1989; Zimmerman, 2008).

Several studies have been conducted exploring the link between self-efficacy and indices of academic achievement. A meta-analysis of these studies found that academic performance is significantly influenced by self-efficacy, with those students reporting higher levels of self-efficacy receiving significantly higher grades (Multon, Brown, & Lent, 1991). Research also suggests that students with stronger beliefs in their ability try harder, are less inclined to give up upon reaching setbacks, and set higher goals for themselves.

Whereas self-efficacy refers to a person's confidence in his or her ability to perform well on a task, metacognitive calibration refers to the accuracy of a learners' perception of his or her own performance (Pieschl, 2009). Metacognitive calibration is a skill of metacognitive monitoring, which refers to a learner's ability to monitor his or her own comprehension and performance. When individuals monitor their own performance, they are able to adjust their effort and strategies based on their perceived success and failure. Because calibration characterizes how aware students are of their own internal processes, such as what they do and do not know (Pieschl, 2009; Stone, 2000), accurate calibration is considered necessary for successful learning (Pieschl, 2009; Stone, 2000; Wiley, Griffin, & Thiede, 2005).

Calibration is traditionally assessed by having students perform a task, and prior to this, completing a questionnaire in which they predict their own performance. Early attempts at studying calibration tended to look at physical activities, for example, studying expectations for success at a ring toss game (Hoppe, 1930). However, many recent studies have examined metacognitive

* Corresponding author at: 2025 Broadway Apt 26K, New York, NY 10023, United States.
E-mail address: neilcrane6@aol.com (N. Crane).

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calibration in academic or knowledge-based tasks (Burson, Larrick, & Klayman, 2006; Klassen, 2007).

Metacognitive calibration is also an aspect of executive function. Executive function is generally defined as the higher order brain functions that regulate cognition and allow an individual to control his or her behavior (Elliott, 2003). Traditionally, executive function and its deficits have been associated with the prefrontal regions of the frontal lobe of the brain (Alvarez & Emory, 2006). Individuals with deficits in executive function will often have reduced calibration, as they may have reduced ability to monitor their own performance and judge what they do and do not know.

2. Metacognitive calibration and learning disabilities

A specific learning disability (SLD) is defined by the Individuals with Disabilities Education Act (IDEA, 2004) as being a disorder in psychological processes that impacts an individual's ability to perform academic tasks, such as reading, writing, listening, or mathematical calculations. In order to be classified as having an SLD, individuals must have academic deficiencies that cannot be explained by perceptual or motor difficulties, mental retardation, emotional disturbance, or environmental difficulties (IDEA, 2004). Learning disabilities are generally diagnosed either through examining the discrepancy between cognitive ability and achievement or through examining a student's response to interventions.

Several studies have examined the self-efficacy of students with SLD. Although the results of these studies have not always been consistent, many studies have found that students with SLD have reduced self-efficacy when compared to non-SLD peers (Baird, Scott, Dearing, & Hamil, 2009; Klassen, 2010; Lackaye, Margalit, Ziv, & Ziman, 2006). Correspondingly, students with SLD have also been found to have lower levels of academic self-concept, indicating that they tend to have reduced expectations for their overall academic success (Ayres, Cooley, & Dunn, 1990; Chapman, 1998).

Research findings also suggest that students with SLD generally display lower levels of metacognitive calibration. For example, Klassen (2007) gave spelling and writing tests to adolescents both with and without learning disabilities. Before each test, both groups were given an example of the types of questions they would be answering and were asked to predict the percentage of questions that they would answer correctly. Klassen (2007) found that adolescents with SLD were less calibrated and tended to overestimate their performance in spelling and writing when compared to adolescents without learning disabilities. These results have been replicated in other studies (Job & Klassen, 2012; Tabone, 2011).

This reduced calibration shown by individuals with SLD has been proposed to negatively impact their academic performance (Bandura, 1989; Klassen, 2006). Under normal circumstances, having high levels of self-efficacy is associated with improved academic performance, as individuals who are more confident in their abilities will try harder, be more resilient to setbacks, and set challenging goals (Bandura, 1989; Zimmerman, 2008). Taylor and Brown (1988) have suggested that overconfidence is a normal characteristic of human thought, and that it is helps people be adaptive, creative, and to respond to constructive criticism in a positive way. However, displaying extremely high levels of overconfidence, or a lack of calibration between self-efficacy judgments and performance, is believed to be less beneficial in that it can lead to poor preparation efforts and lack of self-awareness about areas of weakness that need to be addressed (Bandura, 1989; Klassen, 2006).

Moreover, there is reason to believe that this overconfidence may be exacerbated in certain domains. For example, research on the self-concept of individuals with SLD in non-academic areas has found that adolescents with learning disabilities have similar levels of self-concept as typically developing adolescents (Gans, Kenny, & Ghany, 2003). Thus, questions have been raised as to whether the pattern of calibration is similar across academic and non-academic contexts. To our knowledge, only one study to date has examined this issue in depth. Specifically, Job and Klassen (2012) examined the calibration of adolescents with learning disabilities in both a spelling task and in a throwing task. The results indicated that individuals with SLD had reduced calibration on both the academic task and the non-academic task. However, it is important to note that the non-academic task used in Job and Klassen's study was a physical one – a throwing task. Thus, questions remain about how individuals with SLD would perform on a non-academic task that relies more heavily on cognitive skills.

3. Overview of the study

Past studies have suggested that children with SLD show reduced academic calibration compared to children without SLD (Job & Klassen, 2012; Klassen, 2007; Tabone, 2011). These results have been sufficiently replicated to provide significant support for the theory that students with SLD show a reduced ability to predict their future performance on academic tasks. However, limited research has been conducted to examine if students with SLD have a global calibration deficit or if their deficit is specific to academic tasks. Children with learning disabilities frequently show difficulties with executive function (de Weerdt, Desoete, & Roeyers, 2013; Toll, Van Der Ven, Kroesbergen, & Van Luit, 2011), which may suggest that some of their difficulties with metacognitive calibration are the result of biological factors. However, it has also been suggested that students with SLD may over-predict their performance on academic tasks as a defense mechanism in response to a history of academic failure. If this is the case, then this reduced calibration may not carry over to non-academic areas. However, if reduced calibration were a core deficit in students with SLD, then it could be expected that calibration reduction would occur in all areas.

Accordingly, the purpose of this study was to further examine the metacognitive calibration of students with learning disabilities and the extent to which it is domain-specific. Specifically, in line with Job and Klassen (2012), this study also compared the calibration of students with learning disabilities on academic tasks to their calibration on non-academic tasks. However, we used a task of fluid reasoning (picture arrangement) to measure non-academic calibration as opposed to the physical coordination task used by Job and Klassen (2012). This allowed us to directly compare two cognitive tasks, one of which had an academic achievement element and one of which did not. The similarity between these two tests allowed them to be more easily compared and gave further evidence as to whether individuals with learning disabilities possess a core or biological deficit in metacognitive calibration or if it is specific to individual tasks. Additionally, this study examined metacognition in a more in-depth manner than the study by Job and Klassen (2012). Job and Klassen (2012) calculated metacognitive calibration by simply comparing the number of questions predicted to be correct with the number actually correct. This study expanded upon this measurement by using a variety of research-based methods to calculate metacognitive calibration, as described below. Finally, unlike Job and Klassen (2012), this study was not concerned with examining differences between typically developing children and children with learning disabilities because these differences are currently well established in the literature. Instead, this study used a repeated measures design to study within-subject differences in calibration.

Research on calibration has also progressed in terms of measurement. Schraw (2009) proposed the use of multiples measures