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Learning Disabilities and Anxiety: A Meta-Analysis

Jason M. Nelson[1] and Hannah Harwood[2]

Abstract

This article presents the results of a meta-analysis of the empirical literature on anxious symptomatology among school-aged students with learning disabilities (LD) in comparison to their non-LD peers. Fifty-eight studies met inclusion criteria. Results indicate that students with LD had higher mean scores on measures of anxiety than did non-LD students. The overall effect size was statistically significant and medium in magnitude (d = .61) although substantial heterogeneity of results was found. Moderator effects were examined for informant type, gender, grade, publication status, and identification source. Informant type (i.e., self-, parent, or teacher report) explained a significant amount of variability in the sample of studies, and identification source (i.e., school identified or special school and clinic/hospital identified) approached statistical significance. Implications for assessment and intervention are discussed.

Keywords

learning disabilities, anxiety, meta-analysis, internalizing, multi-informant assessment

Learning disabilities (LD) and emotional problems have been associated since the first conceptualizations of LD in the early 1900s. In early accounts of students with LD, emotional problems were portrayed as a normative experience for this group of students (Blanchard, 1936; Gates, 1941; Siegel, 1954). More recently, it has been commonly assumed that students with LD experience significantly more emotional difficulties than do their non-LD classmates (Abrams, 1986; Beitchman & Young, 1997; Bender & Wall, 1994; Bryan & Bryan, 1977; Bryan, Burstein, & Ergul, 2004; Cohen, 1986; Elksnin & Elksnin, 2004; Rock, Fessler, & Church, 1997; Spreen, 1989). Anxiety is a particular form of emotional distress thought to be frequently experienced by students with LD (Huntington & Bender, 1993). The common assumption that students with LD experience higher levels of anxiety than their non-LD peers do has yet to be empirically tested by application of quantitative statistical methods to the body of literature on this topic. In this study, we conducted a meta-analysis of the extant studies on the presence of anxious symptomatology among students with LD.

Theoretical Explanations for the Relationship Between LD and Anxiety

A variety of theories have been developed to explain the possible relationship between LD and anxiety, including secondary reaction, primary disorder, and cerebral dysfunction theories (Spreen, 1989). Those espousing secondary reaction theory have suggested that anxiety develops as a result of learning difficulties, whereas primary disorder theorists have argued that learning problems are caused by high levels of anxiety. Cerebral dysfunction theorists have proposed that LD and anxiety have a common brain-based etiology and, therefore, frequently co-occur. According to Spreen (1989), few data are available to either support or disconfirm any of these theories, although secondary reaction theory is most commonly assumed to explain the relationship between LD and emotional difficulties.

The intuitive appeal of secondary reaction theory is apparent. Academic achievement is a central activity of childhood; adequate progress in reading, writing, and mathematics represents one of the major developmental tasks to be accomplished during the school-age years (Walzer & Richmond, 1973). At an early age, children recognize the importance placed on academic success by their teachers and parents. Therefore, those who struggle to master academic skills may develop an anxiety reaction in anticipation of possible academic failure (Zinkus, 1979). The experience of anxiety may become a greater obstacle to learning

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than the student's LD by compounding learning struggles or causing avoidance of academic work (Cohen, 1986).

Impact of Anxiety on Cognitive and Academic Performance

A large body of research has indicated that high levels of anxiety have deleterious effects on performance on cognitive and academic tasks. High levels of anxiety introduce task-irrelevant cognitions into the limited storage component of the information processing system. This anxiety-produced distracting information disrupts attentional focus and consumes space in working memory, resulting in inefficient information processing (Eysenck, Derakshan, Santos, & Calvo, 2007). Supraordinate components of the information processing system are also negatively affected by high levels of anxiety. In particular, individuals experiencing high levels of anxiety engage metacognitive skills (e.g., strategy use and monitoring) less frequently (Fisher, Allen, & Kose, 1996; Pekrun, Goetz, Titz, & Perry, 2002; Veenman, Kerseboom, & Imthorn, 2000). Deficits in specific cognitive abilities such as working memory (Swanson & Sachse-Lee, 2001) and metacognition (Wong, 1991) are common characteristics of LD. Additional impairment in these cognitive processes as a result of anxiety may be particularly debilitating.

High levels of anxiety likely have an epiphenomenal effect on academic performance via disruption of the information processing system. For example, elevated anxiety during reading interferes with the phonological loop, causing the need for articulatory rehearsal, which taxes working memory capacity (Calvo & Eysenck, 1996). Because reading involves holding information in working memory from one sentence to the next, poor reading comprehension may result when working memory is disrupted by anxiety (Eysenck et al., 2007). Similarly, the negative association between trait anxiety and math achievement has been found to be mediated by verbal working memory (Owens, Stevenson, Norgate, & Hadwin, 2008). Over time, the impact of persistently heightened anxiety on academic achievement may contribute to negative educational outcomes, such as failure to complete high school and failure to enter college (Kessler, Foster, Saunders, & Stang, 1995; Van Ameringen, Mancini, & Farvolden, 2003).

Importance of Understanding the Relationship Between LD and Anxiety

Understanding students with LDs' experience of anxiety has implications for assessment, intervention, and training. Several authors have argued that the emotional needs of students with LD are often neglected because they are often served only for the LD itself (Bender & Wall, 1994; Rock et al., 1997; Sabornie, 1994). Bryan and Bryan (1977) stated that although separating students with special needs into distinct groups (e.g., LD vs. emotionally disabled) serves a practical purpose by "determining which competing professionals do what to whom under what circumstances" (p. 142), it also may cause the emotional distress purportedly experienced by students with LD to go untreated. Understanding the level of anxiety commonly experienced by students with LD would inform whether the routine assessment of symptoms and the provision of intervention services to reduce anxiety are warranted. Because teachers who specialize in LD likely do not receive training in these types of interventions (Bryan & Bryan, 1977), a clearer understanding of students with LDs' experience of anxiety could potentially inform training needs.

Purpose of Study and Research Goals

Our primary purpose was to conduct a meta-analysis to quantify the magnitude of the difference in anxious symptomatology, if any, between students with and without LD. To address this purpose, we pursued two research goals. First, we sought to determine whether students with LD had higher mean scores than non-LD students did on measures of anxiety and, if so, to determine the magnitude of the difference between scores. Second, we examined whether anxious symptomatology among students with LD varied based on informant type (self-, parent-, or teacher-report), gender, grade, identification source (school, special school, clinic/hospital, or researcher), and publication status (peer-reviewed journal articles or dissertations).

Method

Locating Studies

To locate relevant studies, we conducted searches using PsycINFO, ERIC, and Dissertation ProQuest databases. Search terms for group included *learning disabilities*, *learning disabled*, and several variations (e.g., *reading disabilities*, *dyslexia*, *math disabilities*). The search included the terms *anxiety*, *anxious*, *internalizing*, *emotional*, *personality*, and *behavior* for the dependent variable. The terms *depression* and *depressed* were also searched because it is common for anxiety and depression to be studied together. Furthermore, the names of common narrow-band (e.g., Revised Children's Manifest Anxiety Scale) and broad-band measures that include anxiety scales (e.g., Behavior Assessment System for Children) were used as search terms. The search was limited to studies reported in and after 1977 because this was the first year that LD became a special education classification under the Education for All Handicapped Children Act of 1975. All studies discovered were reported between 1977 and 2007. After the

database search was completed, we reviewed all reference lists of included studies to locate additional studies.

We obtained 533 studies through the database search and the reference list reviews. Of these studies, 277 were journal articles and 256 were dissertations. Seven studies (all dissertations) could not be obtained through library loan because some university libraries employ a noncirculating policy for dissertations. When studies could not be borrowed, we conducted an Internet search to obtain current contact information of the authors; however, this procedure did not lead to the acquisition of any of the seven dissertations.

Inclusion Criteria

Five inclusion criteria were used to select the studies. First, LD must have been defined according to state or federal education guidelines, according to the criteria of the Diagnostic and Statistical Manual of Mental Disorders, or according to a method that was consistent with either of the two guidelines. Additionally, studies were included if the sample of students was reported to be eligible for special education services through an LD placement in a public school but the authors did not further define the diagnostic requisites. Second, students with LD were required to be school aged, defined as kindergarten to 12th grade. Third, for their studies to be included, researchers were required to report using an instrument to assess anxiety that was labeled as measuring anxiety exclusively or that was labeled as measuring anxiety and included an associated term (e.g., anxiety/withdrawn). We excluded studies in which instruments were used that combined anxiety with other conditions such as anxiety/depression or in which projective instruments (e.g., Rorschach) were used to measure anxiety. Studies incorporating instruments that measured types of anxiety other than trait anxiety (e.g., test anxiety) or general anxiety (e.g., social anxiety) were excluded. In this study, *trait anxiety* was defined as general anxiety that is stable over time and across settings. Fourth, authors of the studies also had to report statistics to calculate an effect size. For studies in which a control group was not included, the mean and standard deviation of the instrument were used as the comparison statistics. The standardization samples of the instruments were large; therefore, in line with other meta-analyses (e.g., Frazier, Youngstrom, Glutting, & Watkins, 2007), a sample size of 100 was used to minimize overrepresentation of these studies in the analysis. Fifth, studies were required to be reported in peer-reviewed journal articles or doctoral dissertations.

Exclusion Criteria

The sample of studies was further defined by applying the following exclusion criteria. All single-subject and case studies were excluded. Studies were excluded if the sample of students with LD was selected because of a comorbid condition (e.g., behavior disorder) or if the students were selected because of any characteristic other than or in addition to LD (e.g., gifted LD). Studies were also excluded if the sample had been represented in another study. When the same study was reported in a dissertation and peer-reviewed journal article, the peer-reviewed journal article was included and the dissertation was excluded. Finally, studies in which a control group was not included were excluded if the manual for the instrument used could not be obtained to incorporate statistics for a comparison group. Fifty-eight studies met all criteria and were included in this study.

Coding Procedure

A template (available upon request from the first author) was developed prior to conducting the search to code the studies according to the inclusion criteria, exclusion criteria, and moderator variables. Of the 533 studies coded, two independent raters coded 35%. The interrater agreement for inclusion decisions was .96. When disagreements occurred, coders reconsidered the study together until an agreement was reached.

A separate rater agreement reliability index was calculated for all moderator variables of the included studies. Moderator variables included grade level, identification source, gender, informant type, and publication type. To examine grade level, we categorized the studies as including students in elementary school, middle and high schools, and mixed level. The elementary school category included kindergarten through 6th grade; the middle and high school category included 7th through 12th grades. Studies that incorporated groups that were mixed included students from all grade levels or combined elementary and middle school. If the author did not report grade level but reported age ranges, the grade level categories were imposed on the age ranges. The elementary school category and the middle and high school category included students aged 5 to 12 years and 13 to 18 years, respectively. The identification source variable was categorized as school identified, special school identified, clinic/hospital identified, or researcher identified. Gender was coded as male or female. The informant moderator variable was categorized as self-, parent, or teacher report. Publication status was either peer-reviewed journal article or dissertation. The interrater agreement for moderator variables was .98. Again, when disagreements occurred, coders reconsidered the study together until they reached an agreement.

Analyses of Effect Sizes

We used the Comprehensive Meta-Analysis (Biostat, 2000) computer program to conduct all analyses. Effect sizes were

computed using the means and standard deviations of the groups. If these statistics were not reported in the studies, other data (e.g., *t*-test statistics) were used to estimate effect sizes. Cohen's *d* was calculated for each analysis. Hedges's *g* was also calculated because it corrects for bias of *d* when small samples are used (Hedges, 1981). Because these effect sizes were virtually identical in this study, only *d* is reported because of its customary use in other meta-analyses.

A random-effects statistical model was used. Whereas within a fixed-effect model an assumption is made that one true (common) effect size underlies all the studies of a meta-analysis, a random-effects model allows for the possibility that the true effect size varies from study to study (Borenstein, Hedges, Higgins, & Rothstein, 2009). We judged the assumptions of the fixed-effects model to be implausible because we could not assume that the factors that could influence each effect size were the same across studies. Rather, because of the manner in which researchers have investigated this topic (e.g., self- vs. parent vs. teacher report) and the subjective nature of the phenomena under investigation, it was unlikely that each effect size was influenced in the same way across studies. In such instances, the random-effects model is recommended (Borenstein et al., 2009).

The following procedures were incorporated to calculate the overall effect size. When more than one effect size could be calculated per study, we calculated each effect size, computed the mean of the effect sizes for each study, and included the overall effect size in the analysis. For example, in the case that studies were longitudinal and statistics were reported over time, we calculated an effect size at each time point and then combined them to obtain an overall effect size for the study. This procedure prevented violation of the assumption of independent data points. Violation of this assumption results in the allotment of undue weight to those studies with multiple effect sizes (Lipsey & Wilson, 2001). Additionally, we examined the effect size distribution for potential outliers by calculating standardized residuals. Values greater than three were determined to be outliers because standardized residuals of this magnitude are rare (Hedges & Olkin, 1985). Outliers were not detected.

To examine potential moderator effects, we disaggregated the data from the overall effect size analysis. If authors of the included studies reported data separately for a moderator variable, we combined these data to form one overall effect size for the overall effect size analysis. In contrast, for the moderator analyses, we entered the data separately for each classification of the moderator variable. For example, when conducting the moderator variable analysis for gender, if a study reported data separately for males and females, we calculated an effect size for each gender rather than combining them into one effect size. Because not all studies reported disaggregated data to permit moderator analyses, the number of studies for each potential moderator varied. When determining statistical significance of the moderator effects, we attempted to reduce the risk of Type I error by using a conservative alpha level of .01.

Results

Table 1 displays the sample sizes and effect sizes of each of the included studies. A total of 3,336 students with LD were included and a total of 97 effect sizes were calculated. Effect sizes were interpreted in accordance with Cohen's (1988) guidelines that those ranging from .20 to .49, .50 to .79, and .80 and above should be regarded as small, medium, and large, respectively. A positive effect size indicated that the individuals with LD experienced higher levels of anxious symptomatology than did non-LD individuals. Prior to conducting the analyses, we compared those studies in which a non-LD control group was incorporated ($n = 42$) to those in which a non-LD control group was not included and a mean score from the norm sample of the instrument was imputed ($n = 16$) to determine whether combining these studies was justifiable. The result of this comparison was not statistically significant, $Q_b = 0.62$, $df = 1$, $p = .43$, indicating that it was reasonable to include these two types of studies together in our analyses.

Analysis of Overall Effect Size

The overall effect size was statistically significant ($z = 10.95$, $p < .001$) and medium in magnitude ($d = .61$). Individuals with LD had higher mean scores on measures of anxiety than did non-LD individuals. Table 1 shows that approximately 95% (55 of 58) of studies were in the direction of students with LD having higher anxiety scores than did non-LD students. Because it is not guaranteed that we located all the studies with relevant data for this topic, we calculated the classic fail-safe *N* and found that 4,948 missing studies would need to be located to bring the *p* value to greater than .01. To determine the number of studies that would be needed to reduce the overall effect size to a trivial magnitude (designated as .19), we calculated Orwin's fail-safe *N* and found that 216 studies with a mean effect size of .1 would be needed to reduce the overall effect size to this magnitude.

Table 1 displays a wide range of effect sizes (–0.21 to 1.83). The null hypothesis that all studies share a common effect size was rejected, $Q_w = 312.95$, $df = 57$, $p < .001$. We calculated Tau (T) to investigate the distribution of effect sizes surrounding the mean effect. The T was .37 and equated to a 95% confidence interval of –0.12 to 1.34, indicating that most of the true effects fell in this range. Additionally, we calculated the I^2 statistic, which indicated

Table 1. Effect Sizes of Included Studies

Study	*N* of Learning Disabled Sample	*k*	*d*	Lower Limit	Upper Limit
Acker (1990)	48	1	0.95	0.53	1.38
Boersma (1984)	68	2	0.56	0.25	0.87
Bonner (1986)	50	1	0.56	0.18	0.94
Branch, Cohen, & Hynd (1995)	20	4	1.83	1.30	2.35
Breen & Barkley (1984)	15	1	0.93	0.38	1.49
Casey, Levy, Brown, & Brooks-Gunn (1992)	28	1	0.92	0.41	1.43
Clark (1982)	70	1	0.16	–0.14	0.47
Clark (1987)	30	2	0.27	–0.02	0.56
Cohen, DuRant, & Cook (1988)	221	1	0.55	0.23	0.88
Cohen & Hynd (1986)	40	1	1.20	0.81	1.59
Coronado (1995)	45	1	0.65	0.22	1.07
Ehly, Reimers, & Keith (1986)	23	1	0.91	0.35	1.47
Elder (1992)	28	2	0.70	0.15	1.25
Ellen (1989)	125	1	0.88	0.64	1.12
Fisher, Allen, & Kose (1996)	45	1	1.04	0.60	1.49
Goh, Cody, & Dollinger (1984)	30	1	0.48	0.07	0.89
Golden (1983)	39	1	0.75	0.29	1.21
Grewe (1993)	32	1	0.94	0.52	1.35
Grolnick & Ryan (1990)	37	1	0.78	0.31	1.25
Hale (1994)	64	2	0.89	0.60	1.18
Hiebert, Wong, & Hunter (1982)	39	1	0.85	0.39	1.30
Hildreth (1987)	68	2	0.86	0.51	1.21
LaGreca & Stone (1990)	11	1	1.07	0.16	1.99
Li (2003)	135	1	0.10	–0.16	0.35
Luettgen (1988)	18	1	0.07	–0.59	0.73
Maag & Reid (1994)	95	3	0.97	0.69	1.25
Margalit & Heiman (1983)	20	1	1.19	0.52	1.86
Margalit & Heiman (1986)	20	1	1.72	1.00	2.45
Margalit & Shulman (1986)	20	1	1.57	0.86	2.28
Margalit & Zak (1984)	108	1	0.68	0.41	0.95
Martinez & Semrud-Clikeman (2004)	90	3	0.27	–0.03	0.56
Mattison, Bagnato, Mayes, & Felix (1990)	69	1	0.38	0.07	0.69
McClain (1997)	48	6	0.97	0.73	1.22
Mercer (2004)	83	1	0.13	–0.17	0.42
Miller, Hynd, & Miller (2005)	20	1	0.56	0.04	1.07
Murphy (1984)	55	1	0.22	–0.12	0.56
Murray (1978)	104	1	0.21	–0.06	0.48
Newcomer, Barenbaum, & Pearson (1995)	85	12	–0.04	–0.20	0.12
Nussbaum & Bigler (1986)	75	3	0.98	0.71	1.25
O'Brien (2005)	24	1	1.25	0.78	1.72
Paget & Reynolds (1984)	106	1	0.47	0.19	0.75
Perez (1991)	66	2	0.18	–0.16	0.51
Reardon (1990)	30	1	0.03	–0.47	0.54
Reidy (1985)	20	1	0.21	–0.41	0.84
Rennels (1988)	106	1	0.98	0.69	1.27
Rodriguez & Routh (1989)	31	4	0.88	0.56	1.20
Schneider & Yoshida (1988)	30	1	0.62	0.11	1.14
Schnel (1982)	92	2	0.66	0.46	0.86
Short (1992)	31	1	0.19	–0.32	0.69
Sliwa (1977)	40	1	–0.10	–0.54	0.34
Stein (1990)	91	1	0.06	–0.23	0.34
Stein & Hoover (1989)	30	2	0.72	0.27	1.17
Toro, Weissberg, Guare, & Liebenstein (1990)	86	1	0.13	–0.17	0.43
Valenti (1986)	49	1	–0.21	–0.55	0.13
Vaughn, Zaragoza, Hogan, & Walker (1993)	10	4	0.39	–0.06	0.84
Weinberger (1981)	41	1	0.73	0.29	1.18
Wenner (1993)	23	1	1.09	0.43	1.75
Wilcutt & Pennington (2000)	209	1	0.29	0.09	0.48
Overall effect size (random effects)	3,336	97	0.61	0.50	0.72

the proportion of observed variance due to real differences across the studies. The I^2 of 81.79% indicated that a large proportion of the variance was due to real differences across the studies (Higgins, Thompson, Deeks, & Altman, 2003). In summary, all tests of heterogeneity indicated substantial variation across the results of the included studies and the need for examination of potential moderator effects.

Analysis of Moderator Variables

Table 2 displays the results of the moderator analyses. Informant type was found to be a statistically significant moderator variable, $Q_b = 10.98$, $df = 2$, $p = .004$. Post hoc tests indicated that anxious symptomatology among students with LD was higher when rated with teacher reports than when rated with self-reports, $Q_b = 10.80$, $df = 1$, $p = .001$. As shown in Table 2, the effect size based on teacher report was large, whereas that based on self-report was small. The effect size was medium for results based on parent report, but the difference between parent and self-reports was not statistically significant, $Q_b = 2.37$, $df = 1$, $p = .12$. Difference in reports by teachers and parents was also not statistically significant, $Q_b = 2.06$, $df = 1$, $p = .15$.

Table 2 displays the number of studies that incorporated the various identification sources (school, clinic/hospital, special school, and researcher). The vast majority ($n = 44$) of studies were those with school-identified samples. We judged the sample sizes of each of the other identification sources to be inadequate for making comparison to the studies with school–identified samples. Instead, we combined the studies with clinic/hospital–identified samples and those with special school–identified samples because they had similar results. The difference between the results of studies with school–identified samples and this combined group of studies approached statistical significance, $Q_b = 4.49$, $df = 1$, $p = .03$. The effect size was large for the studies with special school– and clinic/hospital–identified samples and medium for the studies with school-identified samples.

Neither gender nor grade level was found to be a statistically significant moderating variable. Results of studies in which male students with LD were compared to non-LD students did not significantly differ from the results of studies in which female students with LD were compared to non-LD students, $Q_b = 0.10$, $df = 1$, $p = .75$. Likewise, results of studies in which elementary school students with LD were compared to non-LD students did not significantly differ from the results of studies in which middle and high school students with LD were compared to non-LD students, $Q_b = 0.15$, $df = 1$, $p = .70$. To more directly investigate potential differences between students with LD by gender and grade level, we searched the studies to find those in which both male and female students with LD or both elementary school and middle and high school students with LD were included and data were disaggregated according to these variables. Instead of examining how these groups of students with LD compared to non-LD students, we sought to examine how these groups of students with LD compared to each other (i.e., female students with LD vs. male students with LD; elementary school students with LD vs. middle and high school students with LD). Ten studies were located in which within-study comparisons of male and female students with LD could be made. The difference in anxious symptomatology of female students with LD as compared to male students with LD was not statistically significant, $z = 1.45$, $p = .15$, and the magnitude of the nonsignificant difference between these groups was trivial ($d = .09$). We judged the number of studies ($n = 2$) in which both elementary school students with LD and middle and high school students with LD were included and data were disaggregated by grade level to be insufficient for conducting this analysis.

Table 2. Analyses of Moderator Effects

Moderator	*N*	*d*	Lower Limit	Upper Limit
Informant type				
Self-report	25	0.43	0.28	0.59
Parent report	16	0.63	0.43	0.83
Teacher report	23	0.81	0.65	0.98
Identification source				
School	44	0.56	0.44	0.68
Clinic or hospital	6	0.88	0.48	1.29
Special school	6	0.92	0.36	1.49
Researcher	2	0.32	0.14	0.50
Gender				
Male	23	0.50	0.32	0.69
Female	11	0.45	0.18	0.72
Grade				
Elementary	28	0.60	0.45	0.75
Middle or high school	10	0.54	0.30	0.79
Publication status				
Journal	32	0.70	0.55	0.85
Dissertation	26	0.51	0.35	0.68

We investigated the possible variation of results based on publication status in two ways. First, we compared the results of studies reported in peer-reviewed journals to those reported in dissertations. A statistically significant difference based on publication status was not found, although results were in the direction of published studies having larger effect sizes than dissertations, $Q_b = 2.64$, $df = 1$, $p = .10$. Second, we created a funnel plot using the results of all published studies (see Figure 1). In the presence of publication bias, the funnel is dense and generally symmetrical at the top, has some gaps in the middle, and has a gap at the left side of the bottom (Borenstein et al., 2009). The latter aspect of the funnel is interpreted as the

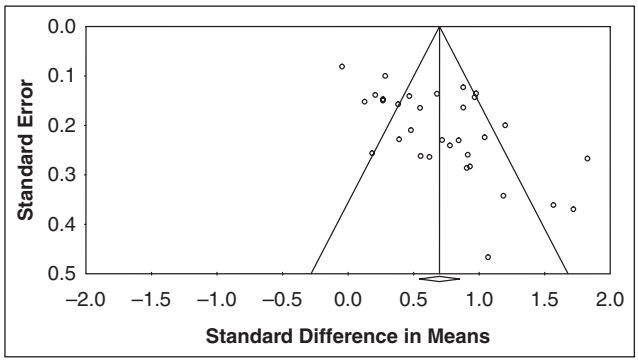

Figure 1. Funnel plot of published studies

main indicator of potential publication bias because studies with small sample sizes are unlikely to be published if effect sizes are small. Figure 1 displays a gap in the left bottom section of the funnel, indicating the possibility of publication bias. Another noteworthy aspect of the funnel is the cluster of studies at the top left outside of the funnel. These studies incorporated large samples that possessed increased power to detect statistically significant differences, despite only small effects.

Discussion

Our results confirm the common assumption that students with LD experience higher anxious symptomatology than do their non-LD peers. The overall effect size found in this study is statistically significant. Perhaps more important is the delineation of the magnitude of students with LDs' experience of higher anxious symptomatology in comparison to their non-LD peers. The overall effect size of .61 is classified as medium. This finding indicates that approximately 70% of students with LD experience higher anxious symptomatology than do non-LD students. Unquestionably, this finding suggests cause for concern that students with LD are at risk for potentially problematic anxiety-related distress. Although it is highly important to acknowledge students with LDs' heightened risk for problems associated with anxiety, it is also important to not exaggerate this risk. Our results do not indicate that the LD population, on average, experiences clinically significant anxious symptomatology. In fact, in none of the studies did samples with LD have mean scores in the clinically significant range, and the vast majority did not approach this level of severity. The higher mean anxiety scores of students with LD suggest that it is possible that they are more likely to experience clinically significant anxiety than non-LD students are, but our findings are unequivocal in indicating that the LD population, as a group, does not experience anxiety at this level of severity.

The overall effect size must be interpreted in light of the heterogeneous results of the included studies. When such heterogeneity exists, the overall effect size may be, and is perhaps likely to be, misleading, and factors that may explain such heterogeneous results should be explored (Rosenthal, 1995). Our moderator analyses illustrate intricacies in the research findings that must be considered to fully understand the relationship between LD and anxiety. The most interesting moderator variable discovered in this study is informant type. Our analysis of this moderator indicates that the magnitude of differences between students with and without LD on measures of anxiety significantly varies depending upon the person reporting the symptoms (i.e., self-report vs. parent report vs. teacher report).

The extant literature on cross-informant agreement appears pertinent to the interpretation of our findings, although an important caveat should be kept in mind. Researchers conducting cross-informant agreement studies have made within-study comparisons of parent, teacher, and self-reports, whereas we have made between-study comparisons. That is, our informant type analysis reflects comparisons of parent, teacher, and self-reports across different samples rather than comparisons of these reports when each informant rated the same sample. Therefore, our results do not indicate differences in agreement among informants; rather, they indicate different levels of anxious symptomatology among students with LD depending on whose perspective is considered. Despite this important difference, a cautious interpretation of our results within the context of the cross-informant agreement literature appears defensible.

Overall cross-informant agreement tends to be low to moderate. Achenbach, McConaughy, and Howell (1987) conducted a meta-analysis of this literature and found the mean correlation between self-report and the reports of other informants to be .22, with higher agreement for externalizing problems than for internalizing problems. Researchers investigating cross-informant agreement among ratings of anxious symptomatology in particular have found generally poor agreement (Choudhury, Pimentel, & Kendall, 2003; Frick, Silverthorn, & Evans, 1994; Grills & Ollendick, 2003; Safford, Kendall, Flannery-Schroeder, Webb, & Sommer, 2005). Many studies have indicated that school-aged individuals self-report more internalizing symptoms than parents or teachers report for them (Angold et al., 1987; Bird, Gould, & Staghezza, 1992; Edelbrock, Costello, Dulcan, Kalas, & Conover, 1985; Epkins, 1996; Herjanic & Reich, 1997; Stanger & Lewis, 1993; Youngstrom, Loeber, & Stouthamer-Loeber, 2000), although some have indicated that parents report more internalizing symptoms for their children than the children report for themselves (Briggs-Gowan, Carter, & Schwab-Stone, 1996; Frick et al., 1994; Krain & Kendall, 2000). Teachers tend to report lower levels of internalizing symptomatology among their students not only in

comparison to students' self-reports but also in comparison to parents' reports for their children (Stanger & Lewis, 1993; Youngstrom et al., 2000). This tendency may be one of the reasons teacher reports are regarded as less useful than are parent and self-reports for assessing children's internalizing symptomatology (Loeber, Green, & Lahey, 1990).

Our results are similar to those of cross-informant agreement studies in that the level of anxious symptomatology among school-aged students with LD appears to differ considerably depending on whose perceptions are assessed. The direction of these differences, however, is opposite that of most cross-informant agreement studies. We found that the magnitude of anxious symptomatology differences between students with and without LD was large when teachers' perceptions were investigated, medium when parents' perceptions were investigated, and small when the students' self-reports were investigated. Results from the investigation of the three informant types indicate that individuals with LD experience higher levels of anxious symptomatology than do non-LD individuals, but the level of symptomatology differs based on the eye of the beholder.

Different levels of anxious symptomatology dependent on informant type beg the question of which informant should be most relied upon in diagnostic decision making about internalizing problems. An easy answer to this important diagnostic question is unlikely because a gold standard does not exist for determining internalizing psychopathology (Safford et al., 2005). At least four approaches to interpretation have been proposed. The most liberal approach is to consider any positive report from any informant to indicate that the child experiences problematic internal distress. Within this approach, all interpretive weight is attributed to the informant who reports the highest level of symptoms. Two other approaches involve apportioning the majority of interpretive weight to specific informants, regardless of the nature of the report. Within one of these approaches, children are considered to be the best or most accurate sources of information because the internal distress they potentially experience may not be observable by their parents and teachers (Angold et al., 1987; Edelbrock, Costello, Dulcan, Conover, & Kalas, 1986; Herjanic & Reich, 1997). Those taking the other of these approaches rely more heavily on adult reports, particularly parent reports, when making diagnostic decisions about internalizing problems. Clinicians tend to take this approach; they have been found to perceive parent reports to be more useful than children's self-reports (Loeber et al., 1990) and to rely most heavily on parent reports when making childhood anxiety disorder diagnoses (Grills & Ollendick, 2003; Krain & Kendall, 2000; Rapee, Barrett, Dadds, & Evans, 1994). The final approach incorporates all viewpoints; those taking this approach do not assume that one informant type is better than another. According to Achenbach et al. (1987), this approach implies "no royal road or preeminent gold standard" (p. 228). Rather, divergent information across informants is considered a valid reflection of variant behavior across settings and situations (Achenbach et al., 1987; Stanger & Lewis, 1993).

Depending on the interpretive approach to which one subscribes, our results could be considered as evidence that individuals with LD may underreport symptoms of anxiety or that adults may overreport them. Little to no empirical evidence is available to support either possibility, although reasonable theoretical explanations can be provided for both. A metacognitive explanation supports the possibility that students with LD may underreport anxious symptomatology. The ability to reflect on emotional experience and to inform others of one's emotions is partially dependent on metacognitive abilities (Safford et al., 2005). Individuals with LDs' metacognitive difficulties are well documented (Wong, 1991) and may prevent them from accurately interpreting their emotional states. Secondary reaction theory's intuitive appeal potentially provides support for the possibility that adults may overreport symptoms of anxiety for individuals with LD. Parents and teachers observe their children or students with LD struggling to learn and perhaps assume, albeit reasonably, that they must also experience feelings of internalized distress such as embarrassment and anxiety.

Without a gold standard for validating internalizing psychopathology, it will be difficult for researchers and practitioners to determine the true level of anxious symptomatology experienced by students with LD. Both underreporting and overreporting are possible, but neither is justifiable as an a priori assumption. Differences between informants' reports may also accurately reflect symptom variation across specific settings and contexts. Therefore, all informants may contribute valid information even if their reports differ. Judgments on how to weight divergent information should be made on a case-by-case basis after considering a complex array of information, taking into account both personal and environmental characteristics influencing the reports of each source.

Another moderator that was valuable in explaining the study's heterogeneous results was the setting in which the students with LD were identified. The differences in anxious symptomatology between students with LD identified in clinic/hospital and special school settings compared to public school settings approached statistical significance, with the trend in the direction of the former experiencing higher levels of anxiety than the latter. The effect size was large for those identified in special schools and clinic/hospital settings and medium for those identified in public school settings. These findings may be due to varying severity levels of LD. Students who are seen in clinic/hospital settings are likely to be more severely disabled and

to have a greater variety of problems than those in public schools (Horn, O'Donnell, & Vitulano, 1983). This is also likely the case for those students who are served in schools that specialize in the treatment of LD. The results of this analysis must be interpreted cautiously, however, because the effect sizes generated for the clinic/hospital and special school comparisons were based on only six studies each.

Our results support the possibility of publication bias in the literature on anxiety and LD. *Publication bias* refers to a phenomenon in which the published literature is not representative of all completed studies on a topic (Rothstein, Sutton, & Borenstein, 2005). It generally refers to the tendency for studies in which the null hypothesis has been rejected to be more likely to be published than studies with statistically insignificant findings. The funnel plot analysis of the published studies indicates missing published studies in which small samples were used and small effect sizes were found. Additionally, though not statistically significant, the trend of findings was in the direction of larger effect sizes in published studies ($d = .70$) than in dissertations ($d = .51$). These results are consistent with publication bias found in other literature bases (see Dickersin, 2005, for a review) and illustrate the value of including unpublished works in meta-analyses. According to Rothstein et al. (2005), publication bias is perhaps the greatest threat to the validity of meta-analyses. Although some have argued against the inclusion of unpublished studies due to potentially inadequate quality (e.g., Weisz, Weiss, Han, Granger, & Morton, 1995), others have argued that a priori exclusion of such studies is problematic and may lead to a missed opportunity for reducing threat to validity (e.g., Borenstein et al., 2009). Our inclusion of unpublished studies may have led to a reduced threat to the validity of our results.

The moderator analyses for gender and grade level did not yield statistically significant findings. Additionally, the results of the within-study analysis of gender indicate that male and female students with LD do not experience significantly different levels of anxious symptomatology. This finding is different than would be predicted based on research using non-LD samples, in which females have been found to experience a higher prevalence rate of anxiety disorders than males do (Lewinsohn, Gotlib, Lewinsohn, Seeley, & Allen, 1998). The results of our grade-level moderator analysis should not be interpreted as evidence that elementary school students with LD and middle and high school students with LD experience similar levels of anxious symptomatology. Rather, the magnitude of difference between elementary school students with and without LD and the magnitude of difference between middle and high school students with and without LD are similar. Because of an insufficient number of studies, we were unable to directly compare elementary school students with LD and middle and high school students with LD. Research using non-LD samples has indicated that problems with anxiety tend to increase with age (Costello & Angold, 1995).

Limitations

Our results should be interpreted in light of the following limitations. For those studies in which information was not provided on the grade level of participants, we imputed grade levels to these samples by using the reported age ranges. Because age and grade level are generally well matched, we believe this was a justifiable approach; however, we acknowledge its imprecision and the potential for some samples to have been slightly misclassified. Additionally, the generalizability of our findings is limited by the incorporation of only one conceptualization of LD. Any generalization of our findings to groups identified by alternative approaches should be done cautiously and conservatively. Finally, some of our moderator analyses were limited by low power to detect statistically significant differences because of small numbers of studies. Although results of the studies were highly heterogeneous, most data were not disaggregated in ways that permitted the examination of our moderator variables. Therefore, those moderator analyses with small numbers of studies should be interpreted cautiously.

Implications for Research and Practice

Sufficient research evidence exists to conclude that students with LD are at greater risk for experiencing problems with anxiety than are non-LD students. Future researchers should direct their focus to determining the mechanisms that underlie this increased risk rather than determining whether students with LD are at risk. Furthermore, protective factors that may prevent students with LD from developing problems with anxiety should be explored. Finally, it would likely be beneficial to investigate the effects of treatments for anxiety problems on the academic achievement of students with LD.

Regarding implications for practice, our results suggest the need for the screening of possible anxiety by those evaluating students with LD. The use of only self-report assessment measures is likely insufficient because individuals with LD may underreport their symptoms. Incorporating both parent- and teacher-report screeners in assessments of students with LD is unlikely to provide redundant information to that obtained through self-report and provides a more comprehensive clinical picture. Those conducting these assessments will likely encounter low cross-informant agreement. The identification of anxiety will require an assessment approach that uses not only objective test scores but also considerable clinical judgment to interpret cross-informant differences and to distinguish between normal and clinically significant anxious symptomatology. Practitioners may benefit from

keeping the following in mind when determining how to apportion interpretive weight. First, some individuals who are anxious may respond in a socially desirable manner to self-report anxiety measures because they are often overly concerned about self-presentation and being evaluated by others (Kendall & Flannery-Schroeder, 1998). This tendency may lead to underreporting of symptoms. Second, metacognitive difficulties may lead to inaccurate self-reporting in either direction. If the particular individual with LD is suspected of metacognitive difficulties that negatively affect accurate self-reporting, less interpretive weight should be ascribed to this information. Third, adults' reports of children's anxiety have been shown to be affected by their own internal distress, which may result in overly sensitive reporting of children's symptoms (Frick et al., 1994). Finally, the possibility that parents may overreport symptoms to obtain services for their children should also be considered (Krain & Kendall, 2000).

If individuals with LD are judged to experience significantly higher than normal anxious symptomatology, treatment should be provided to address these symptoms. First and foremost is the importance of early intervention. When anxious symptoms are not addressed early, they tend to become more severe and to lead to other forms of psychopathology such as depression (Cicchetti & Toth, 1998). Fortunately, several empirically supported approaches for treating anxiety are available. Of the psychotherapeutic approaches, cognitive-behavioral therapy has received the most empirical support for treating anxiety (American Academy of Child and Adolescent Psychiatry, 2007). Several researchers have found that cognitive-behavioral therapy can be cost-effectively implemented through a group format and in school settings (Dadds, Spence, Holland, Barrett, & Kaurens, 1997; Muris, Mayer, Bartelds, Tierney, & Bogie, 2001), although it should be highlighted that severe problems with anxiety may require individualized treatment. Parent training supplemental to cognitive-behavioral therapy has been found to enhance treatment efficacy (Barrett, Dadds, & Rapee, 1996).

A final practical implication of our results relates to the training of professionals who work with individuals with LD. Teachers may not be adequately trained to address the emotional needs of students with LD (Bryan & Bryan, 1977). Students in teacher education programs should be provided training not only in instructional strategies for students with LD but also in strategies for coping with and reducing anxiety. School counselors and psychologists should be trained to screen for potential anxiety problems in students with LD; to treat students with LD who experience elevated anxiety; and to consult with teachers, administrators, and parents regarding strategies to reduce anxiety. All school professionals should be aware of the possibility that a student's LD may not only be associated with learning difficulties but also significant emotional distress. Problems with anxiety should be not be regarded as inevitable, however, because the majority of students with LD who experience higher anxious symptomatology than non-LD students do not experience these symptoms at clinically significant levels.

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