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Metacognitive Reading and Study Strategies and Academic Achievement of University Students With and Without a History of Reading Difficulties

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Abstract

University students who report a history of reading difficulties have been demonstrated to have poorer word reading and reading comprehension skills than their peers; yet, without a diagnosed learning disability, these students do not have access to the same support services, potentially placing them at academic risk. This study provides a comprehensive investigation of first-year academic achievement for students with a history of reading difficulties (n = 244) compared to students with no such history (n = 603). We also examine reported use of metacognitive reading and study strategies and their relations with GPA. Results indicate that students with a history of reading difficulties earn lower GPA and successfully complete fewer credits compared to students with no history of reading difficulty. These patterns varied somewhat by faculty of study. Students with a history of reading difficulties also reported lower scores across multiple metacognitive reading and study strategy scales, yet these scores were not associated with their academic performance. Together, these results demonstrate the importance of identifying students with a history of reading difficulties and that commonly used study strategy inventories have limited value in predicting their academic success.

Keywords

adults, at risk/prevention, metacognition

The number of students with diagnosed learning disabilities in universities has risen in the past two decades (Henderson, 1999; Lewis, Farris, & Greene, 1999; Sanford et al., 2011). In addition to students with diagnosed learning disabilities, an increasing number of students have reading skills similar to their peers with a learning disability but have never received a formal diagnosis (Corkett, Parrila, & Hein, 2006; Deacon, Cook, & Parrila, 2012; Jackson & Doellinger, 2002; Parrila, Georgiou, & Corkett, 2007). This second group—university students with a history of reading difficulties but without a diagnosed learning disability—do not have access to the same accommodations and support services as those with a diagnosis. Furthermore, they have been shown to have poorer academic performance than peers without a history of reading difficulties (Chevalier, Parrila, Ritchie, & Deacon, in press). We refer to this group here as students with a history of reading difficulties and provide a comprehensive examination of their academic achievement and reported use of metacognitive reading and study strategies. We compare these students to students without a history of reading difficulties. We do so to examine whether students with a

history of reading difficulties are, in fact, an academically vulnerable population in universities and, if so, whether trainable study strategies are likely candidates for successful interventions.

Multiple studies demonstrate that university students with a history of reading difficulties have poorer current reading skills than students without a history of reading difficulties (Corkett et al., 2006; Deacon et al., 2012; Deacon, Parrila, & Kirby, 2006; Kemp, Parrila, & Kirby, 2009). For example, Deacon et al. (2012) found that university students with a history of reading difficulties had word identification and timed reading comprehension scores three grade levels below those of peers with no history of reading difficulties. Furthermore, the word-level reading skills of students with a

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history of reading difficulties were comparable to those of students with diagnosed learning disabilities.

While reading skills of students with a history of reading difficulties may have sufficed to complete high school, difficulties with word-level reading and reading comprehension can lead to lower academic achievement in university given the central role reading plays in learning at university (Snow & Strucker, 2000; Taraban, Kerr, & Rynearson, 2004; Taraban, Rynearson, & Kerr, 2000). In line with this prediction, Chevalier et al. (in press) found that students with a history of reading difficulties earned lower first-year GPAs than student with no history of reading difficulties. This finding is at odds with studies reporting that students with diagnosed learning disabilities earn GPAs similar to their non-learning-disabled peers (Heiman & Precel, 2003; Hen & Goroshit, 2014; but see Witte, Philips, & Kakela, 1998). One possible explanation for this difference is that, in the absence of a diagnosis of a learning disability, students with a history of reading difficulties do not have access to accommodations and support services offered to those with a disability. Without the accommodations and support, their lower reading skills are likely to result in lower academic performance.

Existing studies raise a number of questions. One is whether students with and without a history of reading difficulties have comparable academic performance in specific disciplines, where reading demands may differ. A common speculation, based on anecdotal evidence, is that students with a history of reading difficulties have stronger academic performance in disciplines with lower reading demands. To our knowledge, this question has not been directly examined. The one study (Chevalier et al., in press) that evaluated academic performance of students with reading difficulties did so on an aggregate basis across all faculties. As such, we see a pragmatically important and empirically open question as to whether students with a history of reading difficulties in fact do better academically in disciplines with fewer reading demands.

Another question is whether students with a history of reading difficulties attempt and successfully earn fewer credit hours than students without a history of reading difficulties. Beyond simple academic performance, credit hours earned is an important measure of progress toward on-time degree achievement. To our knowledge, there are no available data on these metrics for students with a history of reading difficulties. In contrast, we know that students with diagnosed learning disabilities have been found to take fewer courses, complete their degree over more years, and have higher dropout rates than their non-learning-disabled peers (Murray, Goldstein, Nourse, & Edgar, 2000; National Council on Disability, 2004; Sitlington & Frank, 1990; Vogel & Adelman, 1992; Young & Browning, 2005). As such, two scenarios are plausible for students without a history of reading difficulties: They may attempt

fewer credit hours as a means of compensating for additional academic difficulty, or they may earn fewer of the attempted credit hours as a consequence of those difficulties. We examine credit hours attempted and earned below.

Metacognitive Reading and Study Strategies

To better understand academic performance of students with a history of reading difficulties, the second aspect of our study focuses on study strategies that have been linked to academic success among university populations. The term *study strategies* refers to cognitive, metacognitive, social-cognitive, and affective factors related to how students approach the tasks of acquiring and demonstrating knowledge in academic settings (Entwistle & McCune, 2004). Typical study strategies include the management of time, effort, attention, and emotions; approaches to processing information (e.g., elaboration, comprehension monitoring); and the use of social and informational supports. The literature on study strategies contains substantial differences in the constructs measured, the nomenclature used, and the operationalization of constructs (Biggs, 1993; Entwistle & McCune, 2004). We focus our review of literature on the constructs covered by the two measures of study strategies used in this study; these particular measures were chosen because they are established clinical tools (Saklofske, Reynolds, & Schwean, 2013; Taraban et al., 2004) and widely used in research with university students with learning difficulties (Chevalier et al., in press; Kirby, Silvestri, Allingham, Parrila, & La Fave, 2008; Kovach & Wilgosh, 1999; Proctor, Prevatt, Adams, Hurst, & Petscher, 2006; Reaser, Prevatt, Petscher, & Proctor, 2007). We describe each measure briefly before reviewing related empirical research.

The *Learning and Study Strategies Inventory* (LASSI; 2nd ed.; Weinstein & Palmer, 2002) was developed to measure trainable study strategies likely associated with academic success at university (Entwistle & McCune, 2004; Weinstein, 1987). As a result, the inventory examines a broad set of thoughts, beliefs, behaviors, attitudes, and motivations related to learning and studying. These are measured through 10 scales: Anxiety (worry about academic performance), Attitude (personal interest and value in achieving academic goals), Concentration (maintaining attention on academic tasks), Information Processing (rehearsal, elaboration, and organization of information to learn and remember), Motivation (self-discipline to exert necessary effort for academic tasks), Self Testing (comprehension monitoring and review), Study Aids (use of support materials and helping resources), Selecting Main Ideas (identification of important information), Test Strategies (effective preparation and demonstration of understanding on assessments), and Time Management (planning and prioritizing academic tasks; see the Method section for additional details on scales).

Given our focus on students with a history of reading difficulties, we were also interested in one specific subtype of study strategies: metacognitive reading strategies. The term *metacognitive reading strategies* refers to intentional and directed cognitive activities that readers can use to monitor, control, and evaluate meaning making in the reading process (Alexander & Jetton, 2000; Pressley, 2000; Pressley, Brown, El-Dinary, & Allferbach, 1995). While metacognitive reading strategies are related to many of the study strategies tapped by LASSI, LASSI scales do not exclusively focus on strategies while reading. To measure metacognitive reading strategies directly, we used the Analytic scale of the *Metacognitive Reading Strategies Questionnaire* (MRSQ-A; Taraban et al., 2004). MRSQ-A measures the extent to which students report using analytic reading strategies, such as reading to achieve goals, monitoring comprehension, making inferences, and drawing on and revising topic knowledge.

Self-Reported Study Strategy Use and Academic Achievement

Self-reported use of metacognitive reading and study strategies has been linked to academic achievement in general populations of university students. In a meta-analysis of 109 studies, Robbins et al. (2004) found that reported use of study strategies was a robust predictor of academic performance and retention. LASSI has been found to differentiate academically successful and unsuccessful university students (Marrs, Sigler, & Hayes, 2009), and individual LASSI scales and associated latent constructs have been found to be predictive of academic performance (Cano, 2006; Marrs et al., 2009; Ning & Downing, 2010; Yip & Chung, 2005). Similarly, MRSQ-A scores have been correlated with academic achievement in typical university populations (Taraban et al., 2004).

For students with reading difficulties, metacognitive reading and study strategies have been theorized to support academic performance (Butler, 1995; Levinson & Ohler, 1998; Wong, 1986). Metacognitive reading and study strategies may be particularly important for struggling readers as they may constitute behavioral and psychological means for coping with difficulties with word reading or reading comprehension (Parrila & McQuarrie, 2014). From this perspective, study strategies are a means of compensating for additional learning difficulty, and therefore students who experience difficulty with reading may report using more study strategies than typical readers (Corkett et al., 2006). In line with this prediction, students with a learning disability have been found to report higher performance on some LASSI scales compared to non-learning-disabled students; these include Study Aids (Kirby et al., 2008; Proctor et al., 2006), Time Management (Kirby et al., 2008), and Attitude (Kovach & Wilgosh, 1999). Furthermore, evidence

that awareness of and reported use of study strategies may compensate for learning difficulties is found in results indicating that metacognitive reading and study strategies have unique or stronger effects on achievement for students with learning disabilities compared to students with no learning disability (Ruban, McCoach, McGuire, & Reis, 2003; Trainin & Swanson, 2005).

On the other hand, reading and learning disabilities have been associated with inefficient or inadequate use or awareness of metacognitive strategies (Swanson, 1990; Torgesen, 1980). For example, compared to non-learning-disabled students, those with learning disabilities have been found to have lower LASSI scores on Motivation (Kovach & Wilgosh, 1999; Proctor et al., 2006; Reaser et al., 2007), Selecting Main Ideas (Kirby et al., 2008; Kovach & Wilgosh, 1999; Proctor et al., 2006), Test Strategies (Kirby et al., 2008; Kovach & Wilgosh, 1999; Proctor et al., 2006), Concentration (Proctor et al., 2006), Information Processing (Proctor et al., 2006), and Self Testing (Kovach & Wilgosh, 1999) and higher scores on Anxiety (Kovach & Wilgosh, 1999; Proctor et al., 2006). Thus, prior research conducted mostly on students with learning disabilities (as opposed to reading difficulties alone) has identified a somewhat inconsistent pattern of areas of relative strength and weakness.

The extent to which students with a history of reading difficulties report using study strategies and whether their reported strategy use is associated with academic achievement have been largely unexplored. We are aware of only two studies on the self-reported use of study strategies by university students with a history of reading difficulties. Corkett et al. (2006) found comparable reported use of a range of learning and study strategies for students with and without a history of reading difficulties; the only significant difference to emerge was in more frequent reported use of organizational strategies by students with a history of reading difficulties. Similarly, Chevalier et al. (in press) found that students with and without a history of reading difficulties reported similar levels of study strategy use, with two exceptions: Students with a history of reading difficulties had lower MRSQ-A and Selecting Main Idea scores than students with no history of reading difficulties. In this study, first-year GPA was positively associated with reported use of metacognitive reading strategies and negatively associated with reported use of review strategies for students with a history of reading difficulties. No significant relationships were found between several additional self-reported metacognitive and behavioral study strategies and GPA. It is notable though that only a subset of the LASSI scales were administered in this study; affective and motivational scales (Anxiety, Attitude, Concentration, Motivation) were excluded. In sum, the little available research on self-reported metacognitive reading and study strategy use by students with a history of reading difficulties indicates possible areas of both strengths and deficits relative to students

with no history of reading difficulties. Furthermore, there is preliminary evidence from a single study that reported metacognitive reading strategies may be associated with academic performance among students with a history of reading difficulties.

Current Study

Prior research has identified a population of university students with a history of reading difficulties whose low reading skills (Corkett et al., 2006; Deacon et al., 2006; Deacon et al., 2012; Parrila et al., 2007) may place them at risk of lower academic performance and higher dropout (Chevalier et al., in press). We build on the little available empirical evidence on their academic performance (Chevalier et al., in press) to provide a comprehensive examination of first-year grade point average (GPA) and credit hours attempted and earned for students with and without a history of reading difficulties. We do so to determine whether students with a history of reading difficulties are in fact at risk of delayed graduation or dropout. Furthermore, we examine whether possible differences in academic achievement are university-wide or concentrated in particular academic domains where students' reading difficulties may be associated with greater challenges to academic success. Finally, we examine whether students with and without a history of reading difficulties differ in their reported use of metacognitive reading and study strategies (as measured by MRSQ-A and LASSI), and whether these reported strategies are associated with academic achievement.

Method

Participants and Procedures

All students entering their first year at a large Canadian institution were sent a series of emails from the university registrar in the month prior to the start of two consecutive academic years. These emails invited students to complete a brief questionnaire on their reading history (*Adult Reading History Questionnaire–Revised* [ARHQ-R]; see below) and demographic information, and sought permission for the research team to track their academic progress by accessing registrar records. Questionnaires were completed by students at their convenience using FluidSurveys, a web-based survey administration program. This resulted in 847 first-year university students whose preferred spoken and written language was English (response rate approximately 32%) completing the questionnaire. The total sample had a mean age of 18 years 7 months (*SD* = 20 months); 65.2% were female. Using criteria described below, 244 students (28.8% of the sample) were identified as reporting a history of reading difficulties and 603 students (71.2% of the sample) reported no history of reading difficulties. Students

with a history of reading difficulties had a mean age of 18 years 8 months (*SD* = 19 months); 55.3% were female. Students with no history of reading difficulties had a mean age of 18 years 7 months (*SD* = 20 months) and 69.1% were female.

At the completion of the initial questionnaire, students had the opportunity to complete an additional questionnaire consisting of LASSI and MRSQ-A. Of those who completed the first questionnaire, a subsample of 478 students whose preferred spoken and written language was English completed the additional questionnaire (response rate for students with and without a history of reading difficulties was 41.5% and 62.5%, respectively). Using criteria described below, 103 students (21.5% of the subsample) reported a history of reading difficulties and 375 students (78.5% of the subsample) reported no history of reading difficulties. Within the subsample, students with a history of reading difficulties had a mean age of 18 years 9 months (*SD* = 24 months); 65.3% were female. Students with no history of reading difficulties had a mean age of 18 years 7 months (*SD* = 17 months); 73.0% were female. The first-year GPA for students who did and did not complete the additional survey did not differ, both for students with a history of reading difficulties, $t(240) = 1.44$, $p = .153$, and for students with no history of reading difficulties, $t(599) = 0.31$, $p = .758$.

Following standard practice (e.g., Chevalier et al., in press; Parrila et al., 2007), students with scores greater than or equal to .37 on the ARHQ-R were identified as having a history of reading difficulties; students with scores less than or equal to .25 were identified as having no history of reading difficulties. Given our interest in examining our research questions for students with and without a history of reading difficulties and following on past studies (Chevalier et al., in press; Deacon et al., 2012; Parrila et al., 2007), students with scores greater than .25 and less than .37 (*n* = 191) were removed from analyses.

Measures

Reading history. Reading history was evaluated with the Elementary scale of ARHQ-R (Parrila, Corkett, Kirby, & Hein, 2003). This scale consists of eight items (α = .90) assessing the extent to which individuals report experiencing difficulty learning to read as children (e.g., "How much difficulty did you have learning to read in elementary school?"). Responses were indicated on a 5-point Likert-type scale with descriptors for each point on the scale. Mean scores were calculated and transformed to create a score that ranged from 0 (*no difficulty*) to 1 (*widespread difficulty*).

LASSI. Learning and studying strategies were evaluated with the *Learning and Study Strategies Inventory* (Weinstein & Palmer, 2002). The LASSI consists of 10 scales (eight items

per scale): Anxiety (α = .88; e.g., "When I am studying, worrying about doing poorly in a course interferes with my concentration"), Attitude (α = .69; e.g., "I only study the subjects I like" [reverse scored]), Concentration (α = .88, e.g., "My mind wanders a lot when I study" [reverse scored]), Information Processing (α = .79; e.g., "I try to find relationships between what I am learning and what I already know"), Motivation (α = .82; e.g., "When work is difficult I either give up or study only the easy parts" [reverse scored]), Self Testing (α = .83; e.g., "I stop periodically while reading and mentally go over or review what was said"), Study Aids (α = .67; e.g., "I try to find a study partner or study group for each of my classes"), Selecting Main Ideas (α = .87; e.g., "I have difficulty identifying the important points in my reading" [reverse scored]), Test Strategies (α = .77; e.g., "I have difficulty adapting my studying to different types of courses" [reverse scored]), and Time Management (α = .85; e.g., "I set aside more time to study the subjects that are difficult for me").

Metacognitive reading strategies. Metacognitive reading strategies were evaluated with the Analytic scale of the *Metacognitive Reading Strategies Questionnaire* (Taraban et al., 2004). The MRSQ-A consists of 16 items assessing the extent to which students reported using metacognitive analytic strategies while reading (e.g., "As I read along, I check whether I had anticipated the current information"). The scale had good internal reliability (α = .85).

Academic achievement and demographic information. Academic achievement was measured by three variables: (a) first-year cumulative GPA (range = 0–4.3; in this scale, GPAs of 4.0, 3.0, 2.0, and 1.0 have the letter grade equivalents of A, B, C, and D, respectively); (b) number of first-year credit hours attempted, which refers to the number of enrolled credit hours, excluding those courses from which students withdrew without penalty (i.e., within the first three weeks of a semester); and (c) number of first-year credit hours earned. Academic achievement, gender, and age were based on registrar records. Participants self-reported preferred spoken and written language.

Results

Data were first screened for normality, linearity, homogeneity and univariate and multivariate outliers. The faculties were then grouped into three categories: (a) science, technology, engineering and mathematics (STEM), which included faculties of agriculture, computer science, engineering, and science; (b) the faculty of arts and social sciences, which included social sciences and humanities departments; and (c) professional faculties, which included the faculties of architecture and planning, health professions, journalism, and management. Four students were associated with more than one faculty and were excluded from analyses involving faculty.

Table 1. Frequencies of Students With and Without a History of Reading Difficulties by Faculty.

Faculty	No history of reading difficulties		History of reading difficulties	
	n	%	*n*	%
STEM	350	72.9	130	27.1
Arts and social science	161	78.9	43	21.1
Professional programs	90	56.6	69	43.4

Note. STEM includes faculties of agriculture, computer science, engineering, and science. Professional includes faculties of architecture and planning, health professions, journalism, and management.

To determine if students with and without a history of reading difficulties were distributed equally across faculties, we conducted a 2 (reading history: with vs. without history of reading difficulties) × 3 (faculty category: STEM vs. arts and social sciences vs. professional programs) chi-square test. For the entire sample, students with a history of reading difficulties were nonrandomly distributed across faculty categories, $\chi^2(2, N = 843) = 23.18$, $p < .001$ (see Table 1 for descriptives). Students with a history of reading difficulties were underrepresented in STEM and especially arts and social science faculties and overrepresented in professional programs. Follow-up analyses were conducted separately for males and females, resulting in a similar pattern as for the combined sample. Chi-square results were similar for the subsample of students with LASSI and MRSQ-A data.

Group Differences in Academic Achievement

We then examined whether students with and without a history of reading difficulties differed in their first-year cumulative GPA. For the sample of students with GPA and ARHQ-R scores, results from a 2 (history versus no history of reading difficulties) × 3 (faculty categories) ANOVA indicated there was a significant main effect of reading history status, $F(1, 852) = 17.63$, $p < .001$, a significant main effect of faculty, $F(2, 852) = 18.97$, $p < .001$, and a nonsignificant reading history status by faculty interaction, $F(2, 852) = 2.71$, $p = .067$ (see Table 2 for details). Tukey tests indicated that GPAs in arts and social sciences were significantly lower than in STEM faculties and professional programs, which were similar to each other. Students with a history of reading difficulties earned lower GPAs than students with no history of reading difficulties. Given that the reading history status by faculty interaction approached significance and given our planned research question as to GPA achievement of our two groups by faculty, we explored this trend further with post hoc *t* tests. Compared to students with no history of reading difficulties, those with a history of reading

Table 2. First-Year GPA of Students With and Without a History of Reading Difficulties by Faculty.

| | No history of reading difficulties | | | | History of reading difficulties | | | |
| | GPA | | Course credits | | GPA | | Course credits | |
Faculty	M	SD	Mdn attempted	Mdn earned	M	SD	Mdn attempted	Mdn earned
STEM	3.17	0.88	30	30	2.86	0.94	30	28.5
Arts and social science	2.72	1.17	30	30	2.26	1.12	24	21
Professional programs	3.02	0.82	30	30	3.17	0.47	30	30
All	3.03	0.97	30	30	2.84	0.91	30	27

Note. STEM includes faculties of agriculture, computer science, engineering, and science. Professional includes faculties of architecture and planning, health professions, journalism, and management.

difficulties had lower GPAs in STEM faculties, $t(478) = 3.56$, $p < .001$, and in arts and social sciences, $t(202) = 3.08$, $p = .002$); GPAs for the two groups were not significantly different in professional programs, $t(157) = .698$, $p = .486$, in which GPAs for students with a history of reading difficulties were slightly higher than GPAs for students without a history of reading difficulties. The same analyses conducted with the subsample of students with LASSI and MRSQ-A data revealed a similar pattern of results.

Next, we examined whether students with and without a history of reading difficulties differed in the number of first-year credit hours attempted and earned (see Table 2). We used nonparametric Mann–Whitney U tests because the number of credit hours attempted and earned were not distributed normally. Students with a history of reading difficulties did not differ in the number of credit hours they attempted in their first year ($Mdn = 30$, range = 3 to 33) from students with no history of reading difficulties ($Mdn = 30$, range = 3 to 39), $U = 70,042$, $p = .230$, $r = .040$. However, students with a history of reading difficulties earned fewer credit hours in their first year ($Mdn = 27$, range = 0 to 33) than students with no history of reading difficulties ($Mdn = 30$, range 0 to 39), $U = 66,661$, $p = .024$, $r = .076$.

To summarize, students with a history of reading difficulties tended to earn lower first-year GPAs than students with no history of reading difficulties, with the largest difference in performance emerging for students in the faculty of arts and social sciences. While students with and without a history of reading difficulties attempted the same course load during their first year, students with a history of reading difficulties successfully completed on average three fewer credit hours, which is the equivalent of one course.

Group Differences in LASSI and MRSQ-A Scores

For the subsample of students who completed the metacognitive reading and study strategy measures, we next examined whether students with versus without a history of reading difficulties differed in their reported use of strategies. A

one-way MANOVA comparing students with and without a history of reading difficulties on MRSQ-A and 10 LASSI scales indicated a significant effect of group, $F(11, 477) = 5.40$, $p < .001$. Post hoc significance tests were controlled for false discovery rates using the Benjamini and Hochberg (1995) procedure. Full results are presented in Table 3. Compared to students with no history of reading difficulties, students with a history of reading difficulties had lower scores on multiple scales, including Attitude, Concentration, Information Processing, Motivation, Selecting the Main Idea, Testing Strategies, Anxiety (indicating greater anxiety), and Metacognitive Reading Strategies. Effect sizes for significant differences ranged from small to medium ($d = .26–.65$). There were no significant differences between groups on Self Testing, Study Aids, and Time Management.

Reported Strategy Use and GPA

For the subsample of students who completed the strategy measures ($n = 478$), we examined bivariate correlations among the 10 LASSI scales, MRSQ-A, and GPA (see Table 4). For students with a history of reading difficulties, none of the individual LASSI and MRSQ-A scales were significantly correlated with GPA. By contrast, for students with no history of reading difficulties, several LASSI and MRSQ-A scores show significant positive—though weak—correlations with first-year GPA. Given the observed differences in the correlations and prior literature indicating that strategy use may be differentially related to achievement for students with learning difficulties (e.g., Trainin & Swanson, 2005), we proceed with separate regression analyses for students with and without a history of reading difficulties. Regression analyses address our research question regarding the extent to which LASSI and MRSQ-A scales explain unique variance in first-year GPA.

Factor analyses. Given the strong correlations among LASSI scales, we used factor analyses to reduce multicollinearity in regression analyses. Prior research (Chevalier et al., in

Table 3. Comparison of Mean LASSI and MRSQ-A Scores for Students With and Without a History of Reading Difficulties.

Measure	No history of reading difficulties		History of reading difficulties		F	MSE	p	d
	M	SD	M	SD				
Anxiety	3.35	0.93	2.99	0.89	12.35	10.50	<.001*	.41
Attitude	4.09	0.52	3.96	0.47	5.58	1.45	.019*	.26
Concentration	3.58	0.72	3.34	0.65	9.49	4.77	.002*	.35
Info. Processing	3.84	0.63	3.65	0.56	7.92	2.97	.005*	.32
Motivation	4.14	0.62	3.94	0.48	9.18	3.24	.003*	.36
Selecting Main Ideas	3.79	0.66	3.36	0.66	34.13	15.05	<.001*	.65
Self Testing	3.16	0.79	3.09	0.71	0.75	0.45	.387	.09
Study aids	3.23	0.68	3.32	0.60	1.46	0.64	.228	.19
Time Management	3.14	0.81	3.15	0.67	0.00	0.00	.947	.01
Test Strategies	3.90	0.57	3.56	0.54	29.67	9.41	<.001*	.61
MRSQ-A	3.77	0.52	3.53	0.51	16.81	4.54	<.001*	.47

Note. LASSI = *Learning and Study Strategies Inventory*; MRSQ-A = Analytic scale of the *Metacognitive Reading Strategies Questionnaire*.
*Significant at $p < .05$ after adjusting for multiple tests using the Benjamini and Hochberg (1995) procedure.

Table 4. Bivariate Correlations Among GPA and LASSI and MRSQ-A Scores for Students With (Above Diagonal) and Without (Below Diagonal) Reading Difficulties.

Measure	1	2	3	4	5	6	7	8	9	10	11	12
1. Anxiety		.240*	.491*	.083	.162	.520*	−.141	.071	.603*	.247*	−.036	.167
2. Attitude	.232*		.536*	.302*	.617*	.451*	.185	.250*	.527*	.505*	.286*	−.043
3. Concentration	.321*	.608*		.208*	.440*	.599*	.296*	.145	.610*	.624*	.267*	.050
4. Info. Processing	.171*	.322*	.348*		.354*	.392*	.460*	.477*	.195*	.248*	.628*	.105
5. Motivation	.151*	.668*	.586*	.388*		.415*	.392*	.400*	.449*	.533*	.478*	.120
6. Selecting Main Idea	.450*	.396*	.518*	.330*	.365*		.222*	.256*	.716*	.370*	.412*	−.025
7. Self Testing	.051	.438*	.483*	.502*	.526*	.350*		.424*	.059	.464*	.548*	−.077
8. Study Aids	.043	.469*	.426*	.367*	.511*	.158*	.547*		.120	.361*	.419*	.006
9. Test Strategies	.489*	.478*	.603*	.334*	.513*	.702*	.412*	.222*		.407*	.250*	.119
10. Time Management	.173*	.535*	.705*	.311*	.614*	.336*	.571*	.503*	.476*		.314*	.073
11. MRSQ-A	.097	.363*	.362*	.660*	.462*	.427*	.523*	.340*	.395*	.324*		.007
12. GPA	.167*	.180*	.221*	.178*	.260*	.051	.106*	.161*	.170*	.199*	.118*	

Note. LASSI = *Learning and Study Strategies Inventory*; MRSQ-A = Analytic scale of the *Metacognitive Reading Strategies Questionnaire*. Students with a history of reading difficulties (*n* = 103) are shown above the diagonal; students with no history of reading difficulties are shown below the diagonal (*n* = 375).

press) indicated substantial differences in correlations among LASSI scales for students with and without a history of reading difficulties. To ensure that factor analyses allowed for empirical differences between the two groups, we conducted separate factor analyses for students with and without a history of reading difficulties. Prior factor analytic studies of LASSI have identified three latent factors (Cano, 2006; Olaussen & Braten, 1998; Olejnik & Nist, 1992; Olivárez & Tallent-Runnels, 1994; Prevatt, Petscher, Proctor, Hurst, & Adams, 2006). Accordingly, in separate analyses for students with and without a history of reading difficulties, we extracted three factors using principle axis factoring with a direct Oblimin rotation; factor scores were saved using the Bartlett method (Field, 2013; Osborne & Costello, 2005).

For students without a history of reading difficulties, three factors explained a total of 59.6% of the variance. For these students, the factor loadings indicated that each scale loaded moderately to strongly on one of the three factors with no strong cross loadings (see Table 5). We adopt Olivárez and Tallent-Runnels's (1994) terminology in labeling the factors. LASSI Factor 1 was characterized by Attitude, Motivation, Time Management, Concentration, and Study Aids scales. Factor 1 was labeled Affective/ Effort-Related Activities because these scales tap affect (attitude and motivation) or effort-related strategies, such as managing time, ignoring distractions (concentration), and seeking help when necessary (study aids). LASSI Factor 2 was characterized by Selecting the Main Idea, Test Strategies, and Anxiety scales; Factor 2 was labeled

Table 5. Pattern Matrix Factor Loadings for LASSI Scores for Students With and Without a History of Reading Difficulties.

Measure	No history of reading difficulties			History of reading difficulties		
	Factor			Factor		
	1	2	3	1	2	3
Anxiety	.041	**.590**	−.068	.007	**.718**	−.060
Attitude	**.768**	.074	−.063	**.533**	.240	.059
Concentration	**.732**	.248	−.050	**.610**	**.401**	−.098
Info. Processing	.003	.147	**.543**	−.108	.142	**.818**
Motivation	**.756**	−.001	.065	**.566**	.081	.216
Selecting Main Ideas	−.012	**.743**	.235	.058	**.716**	.332
Self Testing	.110	−.025	**.808**	**.407**	−.279	**.458**
Study Aids	**.512**	−.235	.311	.150	−.047	**.556**
Test Strategies	.225	**.703**	.124	.234	**.765**	.001
Time Management	**.759**	−.012	.054	**.851**	−.029	−.025
Correlations among factors						
1. Effort-related activities						
2. Anxiety-related activities	.410			.388		
3. Cognitive-Related Activities	.676	.210		.481	.082	

Note. LASSI = *Learning and Study Strategies Inventory.* Factor loadings > .4 are in bold to highlight factor structure.

Anxiety-Arousing Activities because these scales measure anxiety directly or indirectly through assessing experienced difficulty with essential academic tasks (e.g., identifying key ideas and demonstrating knowledge on assessments). LASSI Factor 3 was characterized by Self Testing and Information Processing; Factor 3 was labeled Cognitive-Related Activities because these scales tap cognitive (information processing) or metacognitive (self-testing) strategies used during independent study. The pattern of factor loadings for students without a history of reading difficulties resembled the factor structure found in previous studies (Cano, 2006; Olaussen & Braten, 1998; Olivárez & Tallent-Runnels, 1994; Prevatt et al., 2006), with the exception of Study Aids, which has tended to load on the Cognitive-Related Activities factor.

For students with a history of reading difficulties, three factors explained a total of 59.2% of the variance. The LASSI factor structure for students with a history of reading difficulties roughly resembles the factor structure found for students with no history of reading difficult (described above), with two exceptions (see Table 5). First, for students with a history of reading difficulties, two scales had substantial cross-loadings: the Concentration scale had moderate loadings on the Affective/Effort-Related Activities and Anxiety-Arousing Activities factors, and the Self Testing scale had moderate loadings on the Affective/Effort-Related Activities and Cognitive-Related Activities factors. Second, for students with a history of reading difficulties, the Self Testing scale loaded with the Cognitive-Related Activities factor, consistent with prior literature (e.g., Cano, 2006; Olivárez & Tallent-Runnels, 1994).

Reported strategy use as a predictor of GPA. For students without a history of reading difficulties, a multiple regression was conducted with GPA regressed simultaneously on Affective/Effort-Related Activities, Anxiety-Arousing Activities, Cognitive-Related Activities, and MRSQ-A scores (see Table 6). Results indicated that the four predictors jointly accounted for 7.1% ($p < .001$) of variance in GPA and that only Affective/Effort-Related Activities predicted significant unique variance in GPA. For students with a history of reading difficulties, the same multiple regression indicated that all predictors in the regression collectively accounted for a nonsignificant 1% ($p = .918$) of variance in GPA (see Table 6).

Discussion

In the current study, we examined the academic achievement and study strategies of an underresearched population of university students: those who report difficulty learning to read as children. We compared first-year GPA, credit hours attempted and earned, and reported use of metacognitive reading and study strategies of students with and without a history of reading difficulties. Our findings indicated that, in general, students with a history of reading difficulties had lower academic achievement than students with no such history. Furthermore, they attempted the same number of credit hours but successfully completed fewer. In addition, students with a history of reading difficulties reported using fewer metacognitive reading and study strategies than students with no history of reading difficulties, and their reported strategy use was not associated with

Table 6. Multiple Regression of GPA on LASSI Factors and Metacognitive Readings Strategies for Students With and Without a History of Reading Difficulties.

Independent variable	No history of reading difficulties			History of reading difficulties		
	R^2	β	*p*	R^2	β	*p*
	.070		<.001	.010		.918
Affective/Effort-Related Activities		.277	<.001		.018	.875
Anxiety-Arousing Activities		.015	.789		.092	.348
Cognitive-Related Activities		−.072	.293		.022	.879
MRSQ-A		.039	.542		−.028	.849

Note. LASSI = *Learning and Study Strategies Inventory*; MRSQ-A = Analytic scale of the *Metacognitive Reading Strategies Questionnaire*. Dependent variable = first-year GPA. Regressions include a constant.

academic performance. As we elaborate below, our results demonstrate that students with a history of reading difficulties are clearly academically vulnerable, and that LASSI and MRSQ-A measures fail to account for what helps these students succeed. We think that our results demonstrate the importance of identifying these students in a university setting and in continuing to pursue ways in which to best support them.

Group Differences in Academic Achievement

Our results indicated that students with a history of reading difficulties earned significantly lower first-year GPAs than students with no history of reading difficulties, as suggested in the one prior study (Chevalier et al., in press). Critically, these findings stand in sharp contrast to prior research documenting that students with diagnosed learning disabilities earn GPAs similar to those of non-learning-disabled peers (Heiman & Precel, 2003; Hen & Goroshit, 2014). This difference may reflect the fact that students with a history of reading difficulties do not have access to the same accommodations and advising as do students with diagnosed learning disabilities.

Perhaps most important, the current study documents for the first time the very real impacts that poorer academic performance has for students with a history of reading difficulties. These students earned fewer credit hours in their first year compared to students without a history of reading difficulties. Both groups attempted a full load of 10 courses in their first year, but students with a history of reading difficulties failed or dropped an average of one course across their first year of university. Recall that this excludes courses that were dropped without penalty at the start of the semester. This rate of failure for students with a history of reading difficulties may indicate lack of self-awareness about what constitutes a feasible course load. Many disability advisors recommend reducing course load as a way of coping with the additional academic challenges that are associated with learning difficulties (e.g., Brinckerhoff, Shaw, & McGuire, 1992; Drover, n.d.).

Without a diagnosed disability, students with a history of reading difficulties are unlikely to receive similar advice. Earning fewer credit hours than the number attempted can have several negative implications. If this trend continued over 4 years, students with a history of reading difficulties would fail or drop out of four courses on average, thereby extending students' time at university by at least a semester. Furthermore, failing to earn credits in prerequisite courses may interfere with typical course sequences, leading to additional delays in attaining a degree or graduating. Retaking failed courses increases the total cost of a university education, adding to potential financial barriers to graduation. Finally, attempting but not succeeding in courses may be discouraging and demotivating. Together, these effects may lead to higher dropout rates for students with a history of reading difficulties.

The current study further extends research on the academic achievement of this population by documenting a numerical trend toward an achievement gap between students with and without a history of reading difficulties that differs by academic faculty. The gap was largest in the arts and social sciences, where students with a history of reading difficulties earned a mean GPA of 2.26 (C+ equivalent) while students with no history of reading difficulties earned a mean GPA of 2.73 (B– equivalent). This pattern raises questions of how reading demands differ by faculty and how differential reading demands influence the choices, experiences and compensation strategies of students with a history of reading difficulties. Others have argued that university courses and faculties make differential demands on reading abilities (Bell & Perfetti, 1994; Bray, Pascarella, & Pierson, 2004) and that students with reading difficulties may face particular academic challenges in the humanities and social sciences (Heiman & Precel, 2003). When academic performance by faculty is considered alongside enrolment by faculty, our results suggest that students with a history of reading difficulties may self-select into faculties in which they will have greater academic success. Students with a history of reading difficulties were overrepresented in professional programs (i.e., architecture and planning,

health professions, journalism, and management) where they earned GPAs that were comparable to students with no history of reading difficulties, and were underrepresented in arts and social sciences and STEM faculties, where they earned lower GPAs. It is unclear why students with a history of reading difficulties may self-select in this way or how the academic demands and supports of different faculties contribute to the differential pattern of enrolment and achievement by faculty. We speculate that prior difficulty with reading-intensive disciplines like science, history, and English may steer students with a history of reading difficulties toward professional programs. In addition, the clear career applications of professional programs may attract students who foresee possible reading-related challenges in university. Other factors, such as differences in admissions criteria, may shape these patterns. Understanding how reading skills relate to degree and career choices and academic achievement in different disciplines merits attention in future research.

Group Differences in Reported Study Strategies and Their Relations With Academic Achievement

We found that student with a history of reading difficulties had lower scores than students with no such history on many measures of metacognitive reading and study strategies. This pattern is generally consistent with prior research on students with a history of reading difficultly (Chevalier et al., in press) and students with learning disabilities (Heiman, 2006; Heiman & Precel, 2003; Kirby et al., 2008; Kovach & Wilgosh, 1999; Reaser et al., 2007). Our results are not clearly aligned with those of Corkett et al. (2006), who reported few differences between students with and without a history of reading difficulties, though substantial differences in sample size, measures, and analyses make a comparison difficult.

Perhaps most intriguing, mean scores for metacognitive reading and study strategies were not associated with academic performance for students with a history of reading difficulties; again, this pattern is consistent with prior research on students with diagnosed learning disabilities (Reaser et al., 2007). Our results are only partially consistent with those of Chevalier et al. (in press), which are based on a comparable sample with the same measures. Like Chevalier et al., we found that LASSI scales were generally not significantly correlated with first-year GPA for students with a history of reading difficulties. Unlike the results of the current study, however, Chevalier et al. found that metacognitive reading strategies predicted first-year GPA. These discrepant results may reflect the heterogeneous nature of the population of students with a history of reading difficulties. Prior research on this population has documented wide variability in reading performance profiles (McGonnell, Parrila, & Deacon, 2007; Parrila et al., 2007), which may be

associated with different compensatory study strategies. This heterogeneity underscores the importance of replication studies with this population. In sum, our results indicated that while LASSI and MRSQ-A captured differences in reported metacognitive reading and study strategy use, these measures did not predict academic achievement for this population.

There are several possible reasons why LASSI and MRSQ-A may fail to predict academic achievement for students with a history of reading difficulties. First, if self-reported strategy use accurately reflected actual strategy use, nonsignificant correlations between reported strategy use and GPA may reflect the use of unique, and possibly unconventional, study strategies that are not captured in how LASSI and MRSQ-A operationalize metacognitive reading and study strategies. Similarly, compared to students with no reading difficulty, those with a history of reading difficulties may be more heterogeneous with regard to which strategies support academic success for individual students, resulting in nonsignificant correlations among reported strategy use and GPA at the level of the group. That is, as a group students with a history of reading difficulties may use different or more variable strategies to achieve academic success.

A second explanation for why the measures of reading and study strategies did not predict achievement for students with a history of reading difficulties is based on the self-reported nature of the measures. Students with a history of reading difficulties may lack awareness of the strategies they use and how these strategies influence outcomes. This interpretation aligns with prior literature that has documented metacognitive differences between students with and without learning disabilities (Wong, 1986). For example, students with learning disabilities have been found to report overly optimistic self-beliefs that are not in line with behavior (Klassen, 2002). As we discuss below, clearly more research is needed to understand how students with a history of reading difficulties strategically meet the academic demands of university and how actual use of strategies relates to self-reports for this population.

A third explanation is that self-report questionnaires like LASSI and MRSQ-A ask respondents to report on their study strategy use in general, largely ignoring how different contexts may result in the use of different study strategies. This limitation of self-report study strategy questionnaires (Biggs, 1993; Winne & Perry, 2000) may be particularly relevant for students with a history of reading difficulties, whose strategies may be more varied across contexts as they compensate for specific reading demands.

Limitations

The implications of the findings of the current study should be considered in tandem with the following limitations.

First, although self-report questionnaires facilitate research on study strategy use among large samples, the use of study strategy inventories has been critiqued for several reasons (Biggs, 1993; Zimmerman, 2008). Among these criticisms is the fact that study strategy questionnaires like the LASSI and MRSQ-A require that respondents report on aggregated behaviors across contexts, even as the meaning of a given strategy may be context dependent and different contexts may elicit different study strategies (for discussions, see Biggs, 1993; Winne & Perry, 2000). In addition, as noted above, self-reported measures of study strategies rely on students' self-awareness of the strategies they use, and therefore may be a poor proxy for actual strategy use for those that lack such self-awareness. Examining the actual study strategy used by students with and without a history of reading difficulties in specific contexts constitutes an important direction for future research with this population.

Second, metacognitive reading and study strategies were measured at the start of university, and therefore may have been based on students' study strategies in high school. Since study strategies are likely to change as students adapt to new demands of university, research that examines study strategies at later or multiple time points may be more predictive of academic success (Cromley & Azevedo, 2007).

Third, we did not have access to students' actual disability status; therefore we cannot specify the number of students in our sample with diagnosed learning disabilities. However, the use of accommodation services—which are used primarily by students with diagnosed disabilities and therefore serve as a rough proxy—suggests the number of students with diagnosed learning disabilities was low. Only 3% of students with a history of reading difficulties and 3% of those with no history of reading difficulty in the full sample used accommodation services once or more in their first year.

Implications for Research and Practice

Our study identifies many directions for future research. With regard to academic achievement, longitudinal research is needed to examine the long-term consequences of earning lower grades and fewer credit hours on degree attainment. In addition, it would be useful to examine whether ARHQ-R scores are better predictors of academic vulnerability in university than traditional predictors such as prior achievement. While GPA is an important metric of academic success, it is a singular and narrow measure of achievement. Research examining a broader set of academic and personal outcomes, such as academic integration, academic satisfaction, and well-being hold promise for developing a broader perspective on what constitutes achievement for students with a history of reading difficulties. With regard to metacognitive reading and study

strategies, more research is needed to identify or develop instruments that can help identify malleable skills that are associated with achievement in students with a history of reading difficulties. Undoubtedly, future investigations that use a broader set of methods and data sources will provide a more complete picture of the reading and study strategies that support success for students with a history of reading difficulties. Interviews, observational methods, think aloud protocols, log data or other behavioral measures of study strategies are likely to bear fruit that standardized self-report questionnaires cannot (see Zimmerman, 2008, for a discussion). Finally, variables beyond those measured by the LASSI and MRSQ-A are clearly implicated in the academic success of students with a history of reading difficulties. For example, recent research has identified the importance of personal attributes such as resilience and use of social networks in supporting academic success among students with a history of reading difficulties (Corkett, Hein, & Parrila, 2008; Stack-Cutler, Parrila, Jokisaari, & Nurmi, 2015; Stack-Cutler, Parrila, & Torppa, 2014).

The current study has two important clinical implications for postsecondary settings. First, our study raises serious questions about the usefulness of the LASSI as a diagnostic tool. Administering the LASSI at the start of university did not predict first-year academic achievement for students with a history of reading difficulties, consistent with prior research (Chevalier et al., in press). For students with no history of reading difficulties, LASSI scales explained a small amount of variance (7%) in GPA, again consistent with prior research in North American and European samples (Cano, 2006; Chevalier et al., in press; cf. Reaser et al., 2007). Given that LASSI has been widely adopted by colleges and universities—more than 2,200 institutions worldwide (H&H, n.d.)—the very modest relationships between LASSI scales and GPA are both surprising and concerning. The time and expense universities currently spend on administering the LASSI may be better directed to other measures that have more predictive power.

A second and critical practical implication of our study is the clinical value of using self-reported reading history to identify a group of students that is academically vulnerable. Our results show that students who self-reported a history of reading difficulties were at greater academic risk—earning lower grades and successfully completing fewer attempted credit hours—than the general university population. With only eight items, the Elementary scale of the ARHQ-R appears to be both an effective and efficient screening tool for universities wishing to identify students who are likely to face additional academic difficulty. Furthermore, our results suggest that academic difficulties related to a history of reading difficulties may be particularly relevant for students in arts and social sciences faculties.

In conclusion, the current study found that compared to students with no history of reading difficulties, those with a

history of reading difficulties earned lower first-year GPAs and successfully earned fewer credit hours of those attempted, indicating that students with a history of reading difficulties may be at risk of higher dropout rates. Students with a history of reading difficulties earned lower GPAs in STEM faculties and arts and social sciences—faculties in which they were underrepresented relative to students with no history of reading difficulties—but not in professional programs, where they were overrepresented. Students with a history of reading difficulties reported less use of many metacognitive reading and study strategies than peers without a history of reading difficulties; yet the reported strategy use was not associated with academic performance for students with a history of reading difficulties. Results indicated that LASSI and MRSQ-A may have limited value as predictors of academic success for students with a history of reading difficulties. Research is needed to identify more robust indicators of success for this academically vulnerable population.

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Declaration of Conflicting Interests

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