Learning and study strategies of university students who report a significant history of reading difficulties

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The self-reported study and learning strategies used by university students reporting a significant history of reading difficulties (HRD; N = 29) were compared to those of university students who reported no history of reading difficulties (NRD; N = 38). All participants were given a battery of standardized tests and completed a questionnaire that addressed demographic information; reading, spelling and educational experiences; and learning and study strategies. Significantly more HRD than NRD participants reported using study strategies at both the secondary and post-secondary level. No significant differences were found in reported use of learning strategies at the secondary level, but significantly more HRD participants reported participating in classroom discussions and using organizational strategies at the post-secondary level. The findings suggest that university students with a history of reading difficulties use study strategies and, at the post-secondary level, some learning strategies to a greater degree than students without such difficulties. We suggest that this is likely a means of compensating for their remaining reading problems.

Some individuals with significant reading acquisition problems are later able to complete academic tasks on par with their normally reading peers. Lefly and Pennington (1991) described this group as "compensated dyslexics" and estimated that 22% to 25% of children with developmental dyslexia will eventually compensate for their initial difficulties and a significant proportion of these individuals will subsequently pursue higher education. While some individuals with significant reading acquisition problems, however, have overcome their initial difficulties in learning to read, their success does not seem to be complete. Several studies have

indicated that they show persistent problems on tasks that require phonological processing (e.g., Pennington, Van Orden, Smith, Green, & Haith, 1990; Snowling, Nation, Moxham, Gallagher, & Frith, 1997). Phonological processing problems may, in turn, lead to slow word recognition (e.g., Bruck, 1990), poor spelling (e.g., Bruck, 1993; Lefly & Pennington, 1991), problems in learning foreign languages (e.g., Sparks & Ganschow, 1993), and, most significantly, slow text reading speed (Bruck, 1990, 1998; Gallagher, Laxon, Armstrong, & Firth, 1996; Lefly & Pennington, 1991). How individuals with a significant history of reading difficulties succeed in secondary and postsecondary education in spite of residual difficulties is largely unanswered question.

The current study examines whether university students who report a significant history of reading difficulties (HRD) but are successful in their studies report using different study and learning strategies than their peers who do not report any reading difficulties (NRD). As a group, the HRD participants show residual reading and writing difficulties (see e.g., Deacon, Parrila, & Kirby, 2006) but are able to somehow compensate for them so that their academic performance meets university expectations. The specific hypothesis that we examine is that the HRD participants use either different or a wider variety of learning and study strategies than the NRD participants.

Learning and study strategies are systematic processes used by a learner develop a deeper and broader understanding of a concept that involve the use of any behaviours, thoughts or actions during learning for the purpose of acquiring, integrating and storing in memory new knowledge and skills (Weinstein & Hume, 1998). A distinction is made here between learning and study strategies. In this paper, study strategies refer to activities (e.g., memorization, recopying notes, re-reading notes) that increase the familiarity and recall of main ideas and facts, whereas learning strategies refer to more active processes of elaboration (the process of linking and integrating new and old knowledge in a meaningful manner), comprehension monitoring (the process of assessing one's understanding of new and old knowledge), and organization (the process of locating and/or imposing a structural framework onto the information being learned) (Kiewra & DuBois, 1998; Weinstein & Hume, 1998).

To date, we are aware of only one study (Kirby, Silvestri, Allingham, Parrila, & Lafave (in press) that specifically examined learning and study strategies in this population. Kirby et al. reported that, compared to post-secondary students with no disabilities, students with reading disabilities reported significantly greater use of study aids and time management strategies. The opposite was true for some reading strategies (selecting main ideas) and for the use of test taking strategies. Additionally, Kirby et al. reported that university students with reading disabilities were significantly more likely to report a deep approach (Biggs, 1987; Biggs, Kember, & Leung, 2001) to learning than their normally reading peers.

In contrast to Kirby et al. (in press), most research with younger participants has shown that, in comparison to their peers, students with LD are less likely to employ or develop effective learning strategies (e.g., Wong, 1994). It is also known that at least some of these difficulties continue into postsecondary education (Heiman & Precel, 2003). In some studies, college students with LD have been shown to lack effective study and learning strategies (Bursuck & Jayanthi, 1993; Deschler, Schumaker, Alley, Warner & Clark, 1982; Policastro, 1993), whereas other studies have highlighted differences in selected approaches between students with and without LD. For example, Heiman and Precel (2003) found that university students with LD used study strategies that relied on writing (e.g., writing summaries) to a lesser degree than university students without LD to enhance information retention. Instead, the students with LD preferred to use other mnemonics, such as singing the text or making diagrams. In terms of understanding material, students with LD also preferred oral or visual explanations, whereas students without LD preferred written examples.

To summarize, it is possible that university students with LD in general are less likely to use and develop effective learning and study strategies (see also Butler, 1995, 1998; Gettinger & Seibert, 2002). If this assumption is correct, then it would suggest that students with a significant history of reading difficulties will not use a variety of learning and study strategies but may repeatedly use the same strategies, even if ineffective, regardless of the characteristics of the task (Gettinger & Seibert, 2002). On the other hand, we know that these skills can be taught successfully (Butler, 1995, 1998), and

that at least some university students with reading difficulties report a greater use of strategies and a deep approach to learning (Kirby et al., in press). This suggests the possibility that the high-functioning HRD participants may be able to succeed in their post-secondary studies because they have been taught or have developed independently a variety of effective learning and study strategies that specifically meet their needs (see also Reis, McGuire, & Neu, 2000). We examined the self-reported learning and study strategies employed by university students with a significant history of reading difficulties during their secondary and post-secondary education in order to determine, first, what learning and study strategies they reported using and, second, whether these strategies were different from those reported by their peers without reading difficulties.

Method

Participants

The HRD group consisted of 29 participants (10 males and 19 females) who reported a significant history of reading difficulties and whose responses on the elementary education section of the Adult Reading History Questionnaire-Revised (Parrila, Corkett, Kirby, & Hein, 2003) indicated significant reading difficulties in childhood. Nine of the HRD participants had recent diagnoses of learning or reading disabilities and had received or were receiving services for learning disabled students. The average age of participants in the HRD group was 27.61 years ($SD = 7.90$). The participants in the HRD group were all deemed to be academically successful as they were either current university students who reported meeting the university's academic expectations (not failing courses) or they were recent university graduates (less than six months at the time of initial testing). The participants were recruited through solicitation letters sent by the university's student support services, announcements in undergraduate classes, and posters displayed throughout the campus that focused on students with a history of reading or spelling problems.

The control group (NRD) consisted of 38 participants (14 males and 24 females) who reported no history of reading problems. The average age of the ND participants was 24.68 years ($SD = 5.90$). The between-group

difference in age approached significance, $t(64) = 1.72$, p = .09, and resulted mainly from the participants with developmental dyslexia taking a longer time after high school to enroll at university. The ND group was recruited through announcements in undergraduate classes and through posters displayed throughout the campus and were all current university students. All participants reported English as their spoken language of preference and had normal or corrected-to-normal vision.

Examination of between group differences. As the classification of participants into HRD and NRD groups was based on self-reports, it was necessary to examine the validity of self-reports. All but two participants (one from each group) completed a battery of standardized and experimental tests. The standardized tests included the abridged Raven's Standard Progressive Matrices (Raven, 1976), the Peabody Picture Vocabulary Test – Third Edition (PPVT-III; Dunn & Dunn, 1997), the Peabody Individual Achievement Test – Spelling Recognition (PIAT-Spelling; Markwardt, 1989), the Wide Range Achievement Test 3 – Spelling (WRAT-3 Spelling; Wilkinson, 1993), the Comprehension subtest of the Nelson-Denny Reading Test (Brown, Fishco, & Hanna, 1993), and the Word Identification and Word Attack subtests of the Woodcock Reading Mastery Test – Revised (WRMT-R; Woodcock, 1987). The PIAT-Spelling and WRMT-R tests were presented in computer format, and the Nelson-Denny Comprehension subtest provided two indices: reading rate and reading comprehension with a 20-minute time limit. Because of this time limit, many H-FD participants did not answer all of the questions. To obtain an estimate of untimed reading comprehension ability, the percentage correct of all attempted questions was also calculated. The experimental tests included the Rosner Auditory Analysis Test (Rosner & Simon, 1971), a pseudohomophone choice test (participants had to choose between two nonwords the one that sounded like a real word), and rapid automatized naming (RAN) of digits (six digits – 2, 7, 4, 5, 3, and 8 – presented five times each in a semi-random order in a 4 by 9 matrix, resulting in a total of 36 stimuli) adapted from the Comprehensive Test of Phonological Processing (Wagner, Torgesen, & Rashotte, 1999).

The performance of HRD participants who had a recent diagnosis of learning/reading disabilities was compared first to the performance of HRD

participants who did not have a recent diagnosis to examine if the two groups could be combined. A MANOVA with all of the above standardized and experimental tasks as dependent variables indicated that the difference between the groups approached significance, Wilks' Λ = .235, $F(14, 11)$ = 2.55, p = .063. Subsequent ANOVAs, however, revealed that the WRAT-3 Spelling, $F(1, 24)$ = 5.52, p = .027, was the only task for which the two groups were significantly different (all other p values > .10). The WRAT-3 Spelling mean was 40.25 (SD = 5.18) for those with a recent diagnosis and 44.16 (SD = 3.10) for those without a recent diagnosis. All remaining analyses were performed with a single HRD group.

Next, a similar MANOVA was computed comparing HRD (all 29) and NRD groups. The results indicated that the two groups were significantly different, Wilks' Λ =.434, $F(14, 46)$ = 4.28, p < .001. Subsequent ANOVAs indicted that the HRD group performed significantly lower than the NRD group on all variables other than proportion correct on the Comprehension subtest of the Nelson-Denny Reading Test. The effect sizes (Cohen's d) were largest (between 1.33 and 1.42) for Word Attack, Word Identification, WRAT-3 Spelling, and Phonological Choice response time, and smallest (between .53 and .58) for Raven's, PPVT-III, and Phonological Choice accuracy. In general, these results are similar to those of earlier studies showing that university students with a history of reading disabilities can perform similarly to normal readers on reading comprehension tasks when time constraints are removed (e.g., Mosberg & Johns, 1994), but that they continue to struggle with spelling, decoding, word reading, reading speed, and phonological processing tasks (e.g., Aaron, 1989; Gallagher et al., 1996; Hatcher, Snowling, & Griffiths, 2002; Rack, 1997).

Questionnaire

Both groups completed a questionnaire that required participants to report (a) demographic information; (b) their reading, spelling, and educational experiences at elementary, secondary, and post-secondary school levels; and (c) their use of reading, writing, learning, study, and test taking strategies at elementary, secondary and post-secondary school levels. They had the option of completing the questionnaire at home or in the lab.

The questionnaire consisted of three main parts. The first part of the questionnaire addressed demographic information (e.g., gender, age, language background, education). The second and third parts of the questionnaire were each divided into three sections: (a) elementary education, (b) secondary education, and (c) post-secondary education. The second part of the questionnaire consisted of a modified Adult Reading History Questionnaire (Lefly & Pennington, 2000). The Adult Reading History Questionnaire was modified because it does not distinguish between levels of education such as elementary, secondary and post-secondary. This lack of differentiation between levels of education is potentially problematic when the questionnaire is administered to university students because, in the original format, the questionnaire may not be sensitive enough to the severity of the initial problems and to the types of problems that remain, even if a university student has compensated for his or her initial reading difficulties. The revised questionnaire poses parallel questions at each level of education to determine (a) at what point during one's education reading difficulties are experienced and (b) at what point during one's education reading difficulties are no longer experienced.

The elementary education section of the modified Adult Reading History Questionnaire was used to determine the presence of a significant history of reading difficulties and contained 12 questions pertaining to the participant's reading, spelling, and educational experiences. Each question required a response on a five-point Likert scale, with higher numbers corresponding to less favourable responses. The participant's score was calculated by dividing her or his total score by the maximum score (52). Thus, the lowest possible score was 0 and the highest possible score was 1. The mean for the HRD group was .56 (SD = .12; min = .37 and max = .70) and the mean for the NRD group was .17 (SD = .08; min = .00 and max = .29). Reliability (alpha) was .90. The secondary and post-secondary education sections of the modified Adult Reading History Questionnaire were not used in the current study.

The third part of the questionnaire consisted of a series of forced-choice items (no, yes, don't know) pertaining to the reading and writing difficulties experienced by the individual, and the reading, writing, test taking,

learning, and study strategies that he or she may have used. For this article, only the 46 learning and study strategy items in the secondary and post-secondary education sections are examined.

Results

The study and learning strategies at the secondary and post-secondary level were examined by comparing the HRD and NRD groups in three different ways. First, the reported use of *all* of the study and learning strategies, *some* of the study and learning strategies, or *none* of the study and learning strategies was examined using a chi-square analysis. As most participants reported using some of the strategies, we then compared by using an independent-samples *t* test whether the groups were different in terms of the mean number of reported study or learning strategies. Finally, item-by-item comparisons of the HRD and NRD participants' use and/or non-use of each specific study or learning strategy were made using a chi-square analysis. In these analyses, the infrequent "don't know" responses were pooled with the "did not use" responses. These analyses were completed to examine whether differences between the groups were particularly noteworthy on some specific strategies.

Secondary Education Study Strategies

The study strategies examined at the secondary education level were (a) memorizing information, (b) using mnemonics, (c) using imagery to remember information, (d) trying to recall oral information given in class, (e) recopying notes, (f) repeating facts over and over, (g) rereading notes, (h) rewriting notes, and (i) using flash cards. The reported use of these strategies is shown in Table 1.

First, the distribution of participants across three categories (reported using all of the study strategies, reported using a combination of the strategies, or reported using none of the strategies) was compared using a chi-square test. Six HRD participants and one NRD participant reported using all of the study strategies. The remaining 23 HRD participants and 37 NRD participants reported using one or more study strategies. A chi-square analysis revealed a significant difference, $\chi^2(1, N = 67) = 5.73$, $p = .017$,

between the groups, indicating that more HRD than NRD participants reported using all of the study strategies in secondary education.

Second, the mean number of strategies the HRD and ND participants reported using was compared. The mean number of reported study strategies for the HRD group was 5.97 (SD = 2.38; min = 1; max = 9), whereas the mean number for the ND group was 6.13 (SD = 1.86; min = 1; max = 9), $t(51.69)$ = .310, p = .758.

Finally, a chi-square analysis was used to compare the distribution of participants within each strategy. As indicated in Table 1, no significant differences were found (all p values > .10).

Table 1
The Number of Individuals Reporting Use of Study Strategies During Secondary Education

	HRD (n = 29)			NRD (n = 38)			
Study Strategy	Did not use	Used	Don't know	Did not use	Used	Don't know	$\chi^2(1)$
Memorized information	3	25	1	6	31	1	0.26
Used mnemonics (memory tricks)	9	18	2	6	31	1	3.18
Used imagery to remember information	6	22	1	12	26	0	0.45
Tried to recall what the teacher said in class when completing assignments or exams	2	24	3	4	33	1	0.22
Recopied your notes to help remember information	14	14	1	20	18	0	0.01
Repeated important facts over and over to yourself	5	22	2	4	33	1	1.35
Reread your notes	5	23	1	4	34	0	1.34
Rewrote your notes	14	14	1	21	16	1	0.25
Used flash cards	17	12	0	27	11	0	1.13

Note: HRD = History of Reading Difficulties; NRD = No Reading Difficulties.

In summary, while significantly more HRD than NRD participants reported using all of the study strategies during their secondary education, the HRD participants, as a group, did not report using a wider variety of study strategies than the NRD participants.

Learning strategies

Three types of learning strategies were examined: comprehension monitoring strategies, elaboration strategies, and organizational strategies. All of the HRD and the NRD participants reported using some learning strategies (see Table 2).

Table 2.
The Number of Individuals Reporting Use of Learning Strategies During Secondary Education

	HRD (*n* = 29)			NRD (*n* = 38)			
Learning Strategy	Did not use	Used	Don't know	Did not use	Used	Don't Know	$\chi^2(1)$
Comprehension Monitoring							
Used imagery to understand information	10	18	1	11	26	1	0.29
Asked yourself questions to make sure you knew the material	11	17	1	11	27	0	1.13
Completed practice exercises and end of chapter questions even when not assigned	18	10	1	31	6	1	3.16
Put important ideas into your own words	11	16	2	12	26	0	1.23
Participated in class-room discussions	8	21	0	13	25	0	0.34
Asked questions in Class	7	20	2	13	24	1	0.25
After having a test or assignment returned, reviewed mistakes, but did not correct mistakes	12	16	1	14	23	1	0.19

Table 2 (cont'd)

After having a test or assignment returned, reviewed mistakes and corrected mistakes	13	12	4	20	17	1	0.08
Elaboration							
Tried to put together the information from class with the information from the textbooks and readings	14	14	0	9	29	0	4.92*
Used what you learned from old assignments, tests, and textbooks to complete assignments	9	20	0	7	31	0	1.44
Organization							
Outlined chapters in Textbooks	19	9	0	20	17	1	1.07
Constructed outlines, charts, diagrams	17	11	1	24	13	1	0.10
Colour coded information	18	11	0	23	13	2	0.10

Note: HRD = History of Reading Difficulties; NRD = No Reading Difficulties.
$p < .05$

Comprehension monitoring. An examination of the number of participants who reported using *all* of the comprehension monitoring strategies, a *combination* of the comprehension monitoring strategies, or *none* of the comprehension monitoring strategies found that only two of the NRD participants reported using all of the comprehension monitoring strategies. The remaining 36 NRD participants and all of the HRD participants reported using one or more of the comprehension monitoring strategies. The difference between the groups was not significant, $\chi^2(1, N = 67) = .16$, $p = .210$.

The mean number of comprehension monitoring strategies that the HRD group reported using was 4.48 ($SD = 2.03$; min = 1; max = 7), compared to 4.58 ($SD = 1.73$; min = 1; max = 8) for the NRD group. The difference was not significant, $t(65) = .21$, $p = .835$. As indicated in Table 2, there was also no difference in the reported use of any of the specific comprehension strategies (all p values > .10).

Elaboration. Thirteen HRD participants and 26 NRD participants reported using both of the elaboration strategies, whereas eight HRD participants and eight NRD participants reported using one of them. The remaining eight HRD participants and four NRD participants reported not using either strategy. The difference between the groups was not significant, χ^2(2, N = 67) = 4.54, *p* = .103.

The mean for the HRD group was 1.17 (*SD* = .85; min = 0; max = 2) whereas the mean for the NRD group was 1.58 (*SD* = .68; min = 0; max = 2). This difference was statistically significant, *t*(65) = 2.17, *p* = .033. An examination of the frequency of use of the two elaboration strategies revealed that significantly more NRD participants than HRD participants reported relating information from their classes to information from textbooks and readings, χ^2(1, N = 66) = 4.92, *p* = .027. As indicated in Table 2, there was no difference in the reported use of old assignments, tests, and textbooks to complete assignments (*p* = .230).

Organization. Five HRD and five NRD participants reported using all of the organization strategies, 11 HRD and 19 NRD participants reported using one or more of the organization strategies, and the remaining 13 HRD and 14 NRD participants reported that they did not use any organizational strategies. The difference between the groups was not significant, χ^2(2, N = 67) = .73, *p* = .694.

The mean number of organizational strategies that the HRD group reported using was 1.07 (*SD* = 1.16; min = 0; max = 3) whereas the mean for the NRD group was 1.13 (*SD* = 1.07; min = 0; max = 3). There was no significant difference in the mean reported usage of these strategies, *t*(65) = .229, *p* = .820. As indicated in Table 2, there was also no difference in the reported usage of any individual organization strategy (all *p* values > .10).

In sum, the only significant difference in reported use of learning strategies during secondary school was that more NRD participants than HRD participants reported relating information from their class lectures to information from textbooks and readings.

Post-Secondary Education Study Strategies

The study strategies examined at the post-secondary education level were (a) memorizing information, (b) using mnemonics, (c) using imagery to recall information, (d) trying to recall oral information given in class, (e) recopying notes, (f) repeating facts over and over, (g) rereading notes, and (h) using flash cards. Table 3 displays the reported use of these study strategies.

An examination of the number of HRD participants and NRD participants who reported using *all* of the study strategies, a *combination* of the study strategies, or *none* of the study strategies indicated that 14 HRD and 3 NRD participants reported using all of the study strategies. The remaining 15 HRD and 35 NRD participants reported using one or more of the study strategies. Overall, there was a significant difference between the groups, $\chi^2(1, N = 67) = 14.16$, $p < .001$, with more HRD than NRD participants reporting use of all study strategies.

Table 3
The Number of Individuals Reporting Use of Study Strategies During Post-Secondary Education

	HRD (*n* = 29)			NRD (*n* = 38)			
Study Strategy	Did not use	Used	Don't know	Did not use	Used	Don't know	$\chi^2(1)$
Memorized information	2	27	0	5	33	0	0.69
Used mnemonics (memory tricks)	7	21	1	4	33	1	2.19
Used imagery to remember information	5	23	1	10	28	0	0.29
Tried to recall what the teacher said in class when completing assign-ments or exams	0	29	0	2	36	0	1.57
Recopied your notes to help remember information	5	24	0	14	24	0	3.11

Table 3 (cont'd)

Repeated important facts over and over to yourself	2	27	0	4	33	0	0.30
Reread your notes	0	29	0	1	37	0	0.78
Used flash cards	7	22	0	26	12	0	12.90***

Note: HRD = History of Reading Difficulties; NRD = No Reading Difficulties.
*** *p* < .001

The mean number of these strategies that the HRD group reported using was 6.97 (*SD* = 1.24; min = 4; max = 8) whereas the mean for the NRD group was 6.21 (*SD* = 1.51; min = 1; max = 8). The difference was significant, *t*(67) = -2.18, *p* = .032. When examining the use of each individual study strategy, a significantly higher proportion of HRD participants than NRD participants reported using flash cards as a study strategy, χ^2(1, N = 67) = 12.90, *p* < .001. As indicated in Table 3, there was no significant difference in the use of the remaining study strategies (all *p* values > .10).

In summary, the HRD participants, as a group, reported using a wider variety of study strategies in their post-secondary education than the NRD participants. In specific, significantly more HRD than ND participants reported using flash cards as a study strategy.

Learning Strategies

Comprehension monitoring. The comprehension monitoring strategies examined were the same as those described for the secondary education level. An examination of the number of HRD participants and NRD participants who reported using *all* of the comprehension monitoring strategies, a *combination* of the comprehension monitoring strategies, or *none* of the comprehension monitoring strategies, found that three HRD and two NRD participants reported using all of these strategies. The remaining HRD and NRD participants reported using one or more comprehension strategy. The difference between groups was not significant, χ^2(1, N = 67) = .62, *p* = .433.

The mean number of comprehension monitoring strategies that the HRD group reported using was 6.03 (*SD* = 1.35; min = 1; max = 8) whereas the mean for the NRD group was 5.26 (*SD* = 1.93; min = 1; max = 8). The

difference approached significance, t (67) = -1.93, p = .071. When the reported use of each individual comprehension monitoring strategy was examined, a significantly larger proportion of HRD participants than NRD participants reported participating in classroom discussions, $\chi^2(1, N = 67) = 3.88$, and completing practice exercises and end of chapter questions even when these were not assigned, $\chi^2(1, N = 67) = 3.90$ (both ps < .05). As indicated in Table 4, there was no significant difference in the reported use of the remaining comprehension monitoring strategies (all p values > .10).

Elaboration. Eighteen HRD participants and 18 NRD participants reported using all of the elaboration strategies. The remaining 11 HRD and 20 NRD participants reported using one or more of the elaboration strategies. Overall, there was no significant difference between the groups, $\chi^2(2, N = 67) = 1.96$, $p = .375$.

The mean number of these strategies the HRD group reported using was 2.59 (SD = .57; min. = 1; max. = 3). The respective number for the NRD group was 2.37 (SD = .71; min. = 0; max. = 3). The difference was not significant, $t(67) = -1.35$, $p = .182$. As indicated in Table 4, there was also no significant difference in the reported use of each individual elaboration strategy (all p values > .10).

Table 4.
The Number of Individuals Reporting Use of Learning Strategies During Post-Secondary Education

	HRD (n = 29)			NRD (n = 38)			
Learning Strategy	Did not use	Used	Don't know	Did not use	Used	Don't know	χ^2 (1)
Comprehension							
Used imagery to Understand information	8	20	1	10	28	0	0.11
Asked yourself questions to make sure you knew the material	1	28	0	6	32	0	2.68

Table 4 (cont'd)

Completed practice exercises and end of chapter questions even when not assigned	8	20	1	19	17	2	3.90
Put important ideas into your own words	3	26	0	5	33	0	0.12
Participated in class-room discussions	5	24	0	15	23	0	3.88*
Asked questions in class	8	21	0	13	25	0	0.34
After having a test or assignment returned, reviewed mistakes, but did not correct mistakes	14	14	1	17	20	0	0.22
After having a test or assignment returned, reviewed mistakes and corrected mistakes	7	22	0	16	22	0	2.36
Elaboration							
Tried to put together the information from class with the inform-ation from the text-books and readings	2	27	0	1	37	0	0.70
Used what you learned from old assignments, tests, and textbooks to complete assignments	1	27	1	4	34	0	0.26
Organization							
Outlined chapters in textbooks	7	22	0	20	18	0	5.55*
Constructed outlines, charts, diagrams	7	22	0	13	25	0	0.80
Colour coded information	11	18	0	19	19	0	0.97

Note: HRD = History of Reading Difficulties; NRD = No Reading Difficulties.
$p < .05$

Organization. The organizational strategies examined were the same as those examined at the secondary education level. Thirteen HRD and 9 NRD participants reported using all of the organization strategies, 14 HRD

participants and 21 NRD participants reported using one or more of the organization strategies, and the remaining 2 HRD and 8 NRD participants reported that they did not use any of the organizational strategies. Overall, the difference between the groups was not significant, $\chi^2(2, N = 67) = 4.60$, $p = .100$.

On average, the HRD group reported using 2.14 ($SD = .95$; min = 0; max = 3) organization strategies whereas the respective number for the NR groups was 1.63 ($SD = 1.08$; min = 0; max = 3). This difference was significant, $t(67) = -2.00$, $p = .049$. An examination of the reported use of the individual organization strategies revealed that a significantly larger proportion of HRD participants than NRD participants reported writing outlines for chapters in textbooks, $\chi^2(1, N = 67) = 5.55$, $p = .018$. As indicated in Table 4, there was no significant difference, however, in constructing outlines, charts, and diagrams, or in the use of colour coding information (both p values > 0.10).

To summarize, significantly more HRD than NRD participants reported taking part in classroom discussions and using organizational strategies, namely, outlining chapters in textbooks.

Discussion

The current study examined whether successful university students with a history of reading difficulties (HRD) differ from their normally reading peers (NRD) in terms of what learning and study strategies they use and to what extent they use these strategies. The specific hypothesis that we examined was that the HRD participants use either different or a wider variety of learning and study strategies than the NRD participants.

While some past research (e.g., Bursuck & Jayanthi, 1993, Wong, 1994) has indicated that students with learning disabilities use less effective learning and/or study strategies than students without learning disabilities, it is not clear whether such findings generalize to successful university students (e.g., Kirby et al., in press). The results of the current study indicate that successful university students with a history of reading problems, and with clearly poorer current performance level on many reading tasks, reported

using some study strategies to a greater extent than normally reading students, both at the secondary level and at the post-secondary level. In addition, there was no difference in the use of learning strategies at the secondary level; however, a significantly larger proportion of HRD participants reported using organizational strategies and participating in classroom discussions at the post-secondary level.

Most adults who experienced significant reading acquisition difficulties as children continue to experience significant reading difficulties throughout their lives (Bruck, 1998; Scarborough, 1984). Despite HRD participants' ability to achieve academic success at the post-secondary level, they displayed significant differences in reading speed, timed reading comprehension, word reading, and spelling, when compared to the NRD participants. These remaining reading problems could lead one to expect that the HRD participants would use learning and study strategies that rely on writing or reading to a lesser degree than what is true for the NRD participants (e.g., Heiman & Precel, 2003). In the current study, however, the HRD participants, like the NRD participants, reported extensive use of strategies that were writing or reading based. This finding is noteworthy because it is contrary to assumptions surrounding the characteristics of specific reading problems, such as developmental dyslexia (e.g., the avoidance of written material). The fact that the HRD participants did not appear to avoid the use of learning or study strategies that relied on writing or reading suggests, that despite their ongoing reading and writing difficulties, they either felt comfortable enough with their literacy skills to not avoid relying on these strategies when they were deemed useful, or they saw no alternatives to these strategies. This result raises two partially overlapping questions that future studies should address: Is the use of writing and reading based strategies a result of study skills training courses that at least some of the participants had attended, and what motivates HRD participants to rely on these strategies?

In addition, there were no significant differences in HRD participants' reported use of imagery when compared to NRD participants. This suggests that the HRD participants in this study were not compensating for their reading difficulties through a reliance on learning and study strategies that

are visually based. This result does not support the popular notion of dyslexics as visual learners (e.g., Davis, 1994).

Previous research (Butler, 1998; Gettinger & Seibert, 2002) has suggested that individuals with learning disabilities are unlikely to develop effective strategies, and to plan and evaluate their methods of studying. It is interesting to note that the HRD participants reported using flash cards and outlining chapters in textbooks more than the NRD participants during their post-secondary education, but did not report using these strategies more during their secondary education. This suggests that the HRD participants may be required or taught to do more than the NRD participants to adjust their strategies to meet the learning demands of a post-secondary education (see also Reis et al., 2000). However, these results need to be replicated in a longitudinal study on incoming university students with reading difficulties before firmer conclusions can be drawn.

Based on the present findings, further research is needed on at least three different issues. First, although both the HRD and NRD participants in the current study reported using study and learning strategies, there may be a difference in the timing and conditions under which students with reading problems use study strategies versus learning strategies when compared to normal readers. To better understand the effects of specific learning tasks on the selection and use of different strategies, an experimental study is needed. For example, a significant between group difference may be discovered in use of writing- and reading-based strategies if the context for their use is examined. Second, further research is required to determine whether university students with reading problems who are not academically successful use different learning and study strategies, or the same strategies differently, than successful students with reading problems. Third, previous studies (e.g., Butler, 1995, 1998) have suggested that courses that instruct students in learning and study strategies have positive effects for all students, including students with learning disabilities. Further research is needed to determine how such courses could be beneficial to students with reading problems. Finally, additional research is needed to examine other methods of compensation that may be used by university students with reading difficulties.

This study has some important limitations. First, the number of participants was limited and did not allow examination of differences between study majors. It seems clear that to capture the diversity within the population of students with reading problems, there is a need to conduct studies with larger samples and examine whether the study and learning strategies needed for successful completion of courses vary as a function of the topic. To achieve this objective, it would also be necessary to collect academic achievement data that was not done in this study in any detail. Second, the questionnaires, including the one used in this study, are always limited in scope. It is likely that the questionnaire used in this study missed important study and learning strategies simply because they were not included. Open-ended questions may have generated information on additional strategies but more studies using in-depth interviews (e.g., Reis et al., 2000) are likely needed to inform questionnaire development before a more complete picture emerges. Finally, the study was conducted in one university. Local circumstances, such as access to study and learning strategy instruction, may compromise the generalizability of the findings. As always, replications are needed.

References

Aaron, P. G. (1989). Qualitative and quantitative differences among dyslexic, normal and nondyslexic poor readers. *Reading and Writing, 1,* 291-308.

Biggs, J. B. (1987). *Student approaches to learning and studying*. Melbourne, Australia: Australian Council for Educational Research.

Biggs, J., Kember, D., & Leung, D. Y. P. (2001). The revised two-factor Study Process Questionnaire: R-SPQ-2F. *British Journal of Educational Psychology, 71,* 133-149.

Brown, J. I., Fishco, V. V., & Hanna, G. (1993). *Nelson-Denny Reading Test*. Chicago: Riverside Publishing Company.

Bruck, M. (1990). Word-recognition skills of adults with childhood diagnoses of dyslexia. *Developmental Psychology, 26,* 439-454.

Bruck, M. (1993). Component spelling skills of college students with childhood diagnoses of dyslexia. *Learning Disability Quarterly, 16,* 171-181.

Bruck, M. (1998). Outcomes of adults with childhood histories of dyslexia.

In C. Hulme & R.M. Joshi (Eds.), *Reading and Spelling: Development and Disorders* (pp. 179-200). Mahwah, NJ: Erlbaum.

Bursuck, W. D., & Jayanthi, M. (1993). Strategy instruction: Programming for independent study skills usage. In S. A. Vogel & P. B. Adelman (Eds.), *Success for college students with learning disabilities* (pp. 177-205). New York: Springer-Verlag.

Butler, D. L. (1995). Promoting strategic learning by postsecondary students with learning disabilities. *Journal of Learning Disabilities 28*, 170-190.

Butler, D. L. (1998). The strategic content learning approach to promoting self-regulated learning: A report of three studies. *Journal of Educational Psychology, 90*, 682-697.

Davis, R. D. (1994). *The gift of dyslexia: Why some of the smartest people can't read and how they can learn*. Burlingame, CA: Ability Workshop Press.

Deacon, S., Parrila, R., & Kirby, J. R. (2006). Processing of derived forms in high-functioning dyslexics. *Annals of Dyslexia, 56*, 103-128.

Deschler, D. D., Schumaker, J. B., Alley, G. R., Warner, M. M. & Clark, F. L. (1982). Learning disabilities in adolescent and young adult populations: Research implications. *Focus on Exceptional Children, 15*(1), 1-12.

Dunn, L. M. & Dunn, L. M. (1997). *Peabody Picture Vocabulary Test-Third Edition*. Circle Pines, MS: AGS Publishing.

Gallagher, A. M., Laxon, V., Armstrong, E., & Frith, U. (1996). Phonological difficulties in high-functioning dyslexics. *Reading and Writing, 8*, 499-509.

Gettinger, M., & Seibert, J. K. (2002). Contributions of study skills to academic competence. *School Psychology Review, 31*(3), 350-365).

Hatcher, J., Snowling, J. M.,& Griffiths, Y. M. (2002). Cognitive assessment of dyslexic students in higher education. *British Journal of Educational Pyschology, 72*, 119-133.

Heiman, T., & Precel, K. (2003). Students with learning disabilities in higher education: Academic strategies profile. *Journal of Learning Disabilities, 36*, 248-285.

Kiewra, K. A., & DuBois, N. F. (1998). *Learning to learn: Making the transition from student to life-long learner.* Needham Heights, MA: Allyn & Bacon.

Kirby, J., Silvestri, R., Allingham, B., Parrila, R., & Lafave, C. (in press). Learning strategies and study approaches of college and university students with dyslexia. *Journal of Learning Disabilities*.

Leftly, D. L., & Pennington, B. F. (1991). Spelling errors and reading fluency

in compensated adult dyslexics. *Annals of Dyslexia, 41*, 143-162.

Lefly, D. L., & Pennington, B. F. (2000). Reliability and validity of the Adult Reading History Questionnaire. *Journal of Learning Disabilities, 33*, 286-296.

Markwardt, F. C., Jr. (1989). *Peabody Individual Achievement Test – Revised*. Circle Pines, MN: American Guidance Service.

Mosberg, L., & Johns, D. (1994). Reading and listening comprehension in college students with developmental dyslexia. *Learning Disabilities Research & Practice, 9*, 130-135.

Parrila, R., Corkett, J., Kirby, & Hein, S. (2003). *Adult Reading History Questionnaire-Revised*. A copy of the questionnaire can be obtained by contacting rauno.parrila@ualberta.ca.

Pennington, B. F., Van Orden, G. C., Smith, S. D., Green, P. A., & Haith, M. M. (1990) Phonological processing skills and deficits in adult dyslexics. *Child Development, 61*, 1753-1778.

Policastro, M. M. (1993). Assessing and developing metacognitive attributes in college students with learning disabilities. In S. A. Vogel & P. B. Adelman (Eds.), *Success for college students with learning disabilities* (pp. 151-176). New York: Springer-Verlag.

Rack, J. (1997). Issues in the assessment of developmental dyslexia in adults: Theoretical and applied perspective. *Journal of Research in Reading, 20*, 66-76.

Raven, J. C. (1976). *Standard Progressive Matrices*. Oxford: Oxford Psychologists' Press.

Reis, S. M., McGuire, J. M., & Neu, T. W. (2000). Compensation strategies used by high-ability students with learning disabilities who succeed in college. *Gifted Child Quarterly, 44*, 123-134.

Rosner, J., & Simon, D. P. (1971). The auditory analysis test: An initial report. *Journal of Learning Disabilities*, 4, 40-48.

Scarborough, H. S. (1984). Continuity between childhood dyslexia and adult reading. *British Journal of Psychology, 75*, 329-348.

Snowling, M., Nation, K., Moxham, P., Gallagher, A., & Frith, U. (1997). Phonological processing skills of dyslexic students in higher education: A preliminary report. *Journal of Research in Reading, 20*, 31-41.

Sparks, R. L., & Ganschow, L. (1993). The effects of multisensory structured language instruction on native language and foreign language aptitude skills of at-risk high school foreign language learners: A replication and follow-up study. *Annals of Dyslexia, 43*, 194-216.

Wagner, R., Torgesen, J., & Rashotte, C. (1999). *Comprehensive Test of Phonological Processing (CTOPP)*. Austin, TX: PRO-ED.

Weinstein, C. E. (1988, March). *Executive control processes in learning: Why knowing about how to learn is not enough*. Adapted from an invited address presented at the annual meeting of the National Association for Development Education, Orlando, Florida.

Weinstein, C. E., & Hume, L. M. (1998). *Study strategies for lifelong learning*. Washington, DC: American Psychological Association.

Wilkinson, G. (1993). *Wide Range Achievement Test – Third Revision (WRAT-3)*. Wilmington, DE: Jastak Assoicates.

Wong, B. Y. L (1994). Instructional parameters promoting transfer of learning strategies in students with LD. *Learning Disability Quarterly, 17*, 110-120.

Woodcock, R. W. (1987). *Woodcock Reading Mastery Test – Revised.* Circle Pines, MN: American Guidance Service.

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