

Developmental Dyslexia at the College Level

Zohra Mimouni
Collège Montmorency, Laval

Laura King
Cégep André-Laurendeau, Montréal

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Introduction

Developmental dyslexia, a learning disability that affects a person's reading and writing skills, is a serious concern for dyslexic students and their parents, as well as for educators and administrators working in teaching and training institutions. For dyslexic students, their concerns often transform into feelings of helplessness once they arrive at college, where they are confronted with failure due to their disability as well as a complete lack of assistance or intervention on both a psychological and educational level. In addition, dyslexic students often encounter a wall of misunderstanding, with teachers and administrative staff unable to help them because they are poorly or insufficiently informed or equipped to address this type of issue.

Scientific research in this field has shown that dyslexia is one of the causes of academic difficulty and dropping out. Numerous accounts from people living with dyslexia support these conclusions. Developmental dyslexia, once perceived as a shameful handicap that should be hidden away, has – thanks to research and, in part, to the media – recently emerged as an issue that must be openly discussed and addressed. The situation takes on heightened urgency as many potentially dyslexic youth – who have never been formally assessed and, as a result, have never received any assistance or support – become illiterate adults, criminal offenders or adults with social and vocational integration difficulties.

Recent studies have shown links between developmental dyslexia and illiteracy. Delahaie et al. (1998) examined the literacy skills of youth presenting with social and vocational integration difficulties. The researchers noted that 64% of these youth had reading difficulties. Even more troubling, however, is that, according to the language tests performed, 56% had a diagnosis of dyslexia that had never been detected or treated. Other researchers have noted that reading difficulties may represent a potential factor in behavioural and emotional problems among adolescents (Arnold et al., 2005). Others (Daniel et al., 2006; Bender et al., 1999) have noted a close association between reading problems, school dropout and suicidality among 15-year-old adolescents.

In the present study, we examine the nature and manifestations of developmental dyslexia among college students. Our assumption is that a better understanding of the processes that underlie dyslexia will help improve intervention among college students as they proceed through their academic career.

In an earlier study (Mimouni, 2006), a comprehensive assessment of the behavioural indicators of dyslexia in a college-level dyslexic sample was conducted. The data gathered enabled us to establish a preliminary profile of the cognitive and language characteristics of diagnosed dyslexic (DD) students. The most significant characteristics are indicated below. They are presented in descending order based on the response rate of 38 dyslexic students who were selected for the study based on a formal diagnosis of developmental dyslexia. Each characteristic is accompanied by its corresponding item number from the questionnaire.

- 58 (100%): The student has spelling difficulties.
- 62 (92%): The student does not notice his or her errors.
- 56 (90%): The student requires more time than his or her peers for reading tasks.
- 50 (87%): The student's reading is slow and hesitant.
- 66 (84%): The student requires more time than his or her peers for writing tasks.
- 36 (81%): The student has previously received services from a remedial teacher.
- 16 (76%): At least one family member has writing difficulties.
- 15 (74%): At least one family member has reading difficulties.
- 52 (68%): The student experiences fatigue when reading.
- 57 (61%): An oral version of the text to be read helps to facilitate comprehension.
- 30 (48%): The student has taken basic-level French courses.
- 25 (48%): The student has repeated college courses.
- 17 (45%): The student repeated a grade in elementary school.
- 23 (34%): The student has attended adult education classes.
- 19 (32%): The student did not finish high school in five years.
- 21 (3%): The student dropped out of high school.

Our observations indicated that dyslexic students reported difficulties in reading as well as in oral expression and writing. The most frequently endorsed indicator was that of spelling difficulties.

The data also permitted the identification of a group that had a language-difficulty profile similar to that of dyslexics. In fact, our observations indicated that, in the college sample, a significant number of students had a similar profile to that of the DD students, particularly among those enrolled in basic-level French courses and those who failed the French Exit Exam.

Research Objectives

The two objectives of this study were:

- 1) To characterize the manifestations of dyslexia at the college level through the administration of language tests that target processes involved in reading and writing;
- 2) To establish a dyslexic profile in order to recognize and detect potential cases of dyslexia among college students who are experiencing reading and writing difficulties.

Methodology

Participants

We specifically targeted students who answered the questionnaire (Mimouni, 2006; Mimouni & King, 2007) and selected them based on the following three criteria:

1. Students with a formal diagnosis of dyslexia (DD).
2. Students who did not have a formal diagnosis of dyslexia but had a similar profile to that of dyslexics based on their questionnaire responses (ND).
3. Students who did not present any signs of reading difficulties (NM), who served as the control group.

Whenever possible, effort was made to have an equal number of male and female participants, and to balance the groups according to gender. Furthermore, only students whose mother tongue was French were recruited. Table 1.1 presents the participants' mean age as well as the male/female distribution.

Table 1.1 Mean age and number of participants.

	DD n=28	ND n=53	NM n=38
Mean age	20.57	22.16	19.67
Female	16	23	19
Male	12	30	19

Measures

Commonly used tests were administered to evaluate students' silent reading, oral reading, phonological processing abilities, orthographic processing abilities, rapid naming skills, memory and visual processing abilities.

Some of the tests administered were taken from the BELEC battery of tests (Mousty et al., 1994) and the Odédys (Laboratoire Cogni-Sciences, 2002). The IREP's (Institut de recherche et d'évaluation psychopédagogique) reading tests (Test de lecture, 2000) and the DO 80 naming test (Deloche & Hannequin, 1997) were also administered. Finally, the Department of Psychology at Concordia University allowed us to use their version of the RAN, a rapid naming test.

Data Collection

The reading and writing tests were administered on an individual basis in two successive sessions of approximately one hour each, with a 15-minute break between the two sessions. To ensure that test administration was consistent, the oral presentation tasks were recorded on CD. A stopwatch was used for the timed tasks, and digital recorders were used during oral production tasks.

Results and profiles of the sample

It should be noted that, throughout our analyses, no significant gender differences emerged. Given the lack of differences between male and female students, these comparisons are not reported in the following analyses.

Silent Reading Skills

- Reading Age

Reading age is a widely used criterion in the diagnosis of dyslexia among children. A difference of 18 to 24 months between the expected reading level (i.e., that of normal readers) and the level observed is often an indicator of dyslexia. The World Health Organization defines dyslexia as an enduring written-language disorder characterized by a delay of at least 18 months in the individual's reading level compared to his or her chronological age.

According to Table 1.2, the reading age of DD and ND students on the reading and comprehension tasks is significantly greater than that of normal readers.

Table 1.2 Mean reading age (standard deviation) in years

	DD	ND	NM
Mean chronological age	20.57	22.16	19.67
IREP reading	11.28* (2.30)	12.32** (2.86)	17.05 (3.56)
IREP comprehension	11.96* (2.42)	12.69** (2.46)	16.76 (2.64)

* Significant difference between DD and NM $p < 0.001$

** Significant difference between ND and NM $p < 0.001$

- Text Comprehension

Table 1.3 shows the comprehension scores of the three groups. Not surprisingly, the normal readers did quite well on this task, achieving an average of 37 correct responses out of 44. In contrast, DD students demonstrated significant difficulty, as they correctly answered only slightly more than 50% of the questions (26 out of 44). The difference in performance between ND and DD students is not significant; however, their performance lagged significantly behind that of NM students.

Table 1.3 Text comprehension performance (IREP test): Mean scores in the allotted time

	DD	ND	NM
Comprehension (n=44)	25.79*	28.21**	37.24

* Significant difference between DD and NM $p < 0.001$

** Significant difference between ND and NM $p < 0.001$

In examining the results of the IREP comprehension test, we noted that many students did not complete the task in the allotted time, although all of the answers they did provide were correct. An examination of the responses revealed that 78% of DD and ND students did not answer more than 25% of the questions, compared to 15% of NM students. Furthermore, 64% of the DD students who did not complete 25% of the task obtained scores equal to or greater than 90%. These data underscore the need to provide extra time to dyslexic students during tests and exams.

Table 1.4 Mean (standard deviation) scores and speed on word and non-word reading tasks

	Accuracy			Speed (seconds)		
	DD n=28	ND n=53	NM n=38	DD	ND	NM
Words (n=24)	5.73*~ (0.34)	5.80**~ (0.28)	5.94 (0.11)	6.45*~ (1.94)	5.43**~ (1.55)	3.94 (1.30)
Non-words (n=24)	4.37*~ (0.96)	4.59**~ (0.92)	5.50 (0.42)	12.15*~ (4.36)	10.46**~ (3.43)	7.53 (3.12)
Regular words (n=24)	5.74 (0.31)	5.88 (0.16)	5.97 (0.07)	4.82* (1.20)	4.25** (1.31)	3.03 (0.87)
Irregular words (n=24)	5.45 (0.56)	5.56 (0.44)	5.87 (0.21)	6.42* (2.63)	5.36** (2.19)	3.64 (1.55)
Frequent words (n=24)	5.93 (0.12)	5.89 (0.19)	5.97 (0.09)	5.93* (1.66)	5.14** (1.38)	3.71 (1.16)
Rare words (n=24)	5.29 (0.65)	5.52 (0.48)	5.83 (0.25)	7.75* (2.70)	6.51** (2.11)	4.47 (1.76)

* Significant difference between DD and NM ($p < 0.001$)
 ** Significant difference between ND and NM ($p < 0.001$)
 ~ Significant difference between words and pseudowords ($p < 0.001$)

Deficits in lexicality, regularity and frequency were often observed among dyslexic students. As illustrated in Table 1.4, contrary to normal readers, DD students' performance on the non-word reading task was significantly lower than their performance on the word reading task, both in terms of accuracy and speed. The difference in performance between the DD and NM groups was also significant, in terms of both accuracy and speed. ND students have similar characteristics to DD students in that their reading of non-words was also significantly lower than that of NM students, in terms of both accuracy and speed. No significant difference was observed in the oral reading scores of DD and ND students between regular and irregular words and between frequent and rare words; their performance was similar to that of NM students. However, we noted a significantly slower reading rate for irregular words and rare words, in both the DD and the ND groups.

Phonological Processing Abilities

Table 1.5 Mean (standard deviation) phonological processing scores

	DD	ND	NM
Phoneme suppression (n=9)	5.32* (2.66)	6.08** (2.48)	7.84 (2.27)
Phoneme fusion (n=10)	5.21* (2.89)	5.68** (2.86)	7.32 (2.66)
Syllable suppression (n=16)	15.50 (1.2)	15.87 (0.41)	15.58 (0.92)

* Significant difference between DD and NM $p < 0.001$

** Significant difference between ND and NM $p < 0.001$

Table 1.5 shows that DD and ND students have significantly weaker performances in two of the three phonological awareness manipulation tasks (phoneme suppression and phoneme fusion), compared to normal readers. These data are an indication of a phonological processing problem among DD and ND students.

Orthographic Processing Abilities

According to Table 1.6, DD students' orthographic processing abilities were significantly lower than those of NM and ND students for the dictation of irregular and regular words, as well as for the missing-word dictation. No differences were found between DD and ND groups for the dictation of regular words; however, ND students' writing of irregular and regular words during dictation and in missing-word dictation was slightly higher than that of DD students, but lower than that of normal readers. The difference was significant. As for the dictation of non-words, it is worth noting that the spelling of these words is somewhat open-ended since several spellings are possible and have been accepted as correct answers.

Table 1.6 Mean (standard deviation) dictation scores

	DD	ND	NM
Dictation of irregular words (n=10)	7.43* (1.34)	8.62** (1.18)	9.29** (1.03)
Dictation of regular words (n=10)	8.61* (1.25)	9.08 (1.29)	9.63*** (0.63)
Dictation of non-words (n=10)	7.96 (1.85)	8.53 (1.51)	9.08 (1.38)
Fill-in-the-blank dictation (n=70)	43.81* (10.08)	49.78** (6.96)	60.11*** (6.56)

* Significant difference between DD and NM ($p < 0.001$)

** Significant difference between ND and NM ($p < 0.001$)

*** Significant difference between DD and ND ($p < 0.001$)

Rapid Naming Skills

Completion times for the naming task provide an indication of an individual's ability to quickly associate a symbol with a name. According to the results of the naming tasks presented in Table 1.7, only the ND students were significantly slower in the rapid naming of images and colours, compared to normal readers. However, both DD and ND students were significantly slower than normal readers in the naming of letters, numbers and objects.

Table 1.7 Mean (standard deviation) naming speed (in seconds)

	DD	ND	NM
Rapid naming of images n=80	164.82 (37.88)	189.19** (63.76)	138.29 (32.84)
Rapid naming of letters	26.68* (5.72)	27.85** (8.83)	19.37 (4.68)
Rapid naming of numbers	26.32* (6.23)	24.92** (6.71)	19.16 (3.73)
Rapid naming of objects	51.00* (11.30)	46.45** (9.11)	38.61 (8.24)
Rapid naming of colours	34.21 (6.63)	36.47** (8.85)	29.71 (6.48)

* Significant difference between DD and NM $p < 0.001$

** Significant difference between ND and NM $p < 0.001$

Memory

Reading involves short-term verbal memory that allows one to maintain information while it is being articulated. The results of the memory tasks are presented in Table 1.8, and indicate that ND students experienced difficulty in the repetition of non-words. In fact, their average success rate did not exceed the 65% threshold, and their performance was significantly lower than that of normal readers. Forward and backward digit repetition was a difficult task for the DD and ND groups, who performed significantly lower than normal readers in forward and backward spans. These data indicate a deficiency in the short-term verbal memory of DD and ND students.

Table 1.8 Memory skills

	DD n=28	ND n=53	NM n=38
Repetition of non-words (n=40)	28.32* (4.33)	25.94** (5.53)	31.74 (3.02)
Forward span (n=8)	5.75* (1.04)	5.74** (0.97)	6.47 (1.28)
Backward span (n=8)	4.32* (1.09)	4.52** (1.30)	5.42 (1.51)

* Significant difference between DD and NM $p < 0.001$

** Significant difference between ND and NM $p < 0.001$

Visual Processing Abilities

The three groups did not have any difficulty with the lexical decision task, thus demonstrating unimpaired visual processing abilities.

Discussion

First, our research indicates that our language test results confirm the conclusions of several other studies carried out prior to this study on the subject of dyslexic children (e.g., Castles and Coulthart, 1993; Valdois, 2000) and on dyslexic university or college students (e.g., Ramus, 2003; Cirino et al., 2005; Miller et al., 2006).

If we compare these data with data on dyslexic children (Sprenger-Charolles & Colé, 2003), we can conclude that some of the language deficiencies observed in childhood carry on through adolescence and adulthood, despite ten years of education at the primary and secondary levels, despite many years of exposure to written and spoken language, and – we would like to highlight – despite assistance and intervention from remedial teachers and speech-language pathologists. Dyslexic students continue to display reading deficits in terms of both accuracy and speed. Their oral production is characterized by deficits in lexicality, regularity and frequency, particularly in the reading and repetition of non-words. Their difficulties are reflected in a high rate of reading errors and in lengthy performance

time, compared to normal readers. Furthermore, their phonological processing abilities and short-term memory remain deficient. The strongest and most frequent indicator of dyslexia is found in spelling, which is severely affected in some cases.

This study also enabled us to confirm our hypothesis regarding the presence of potential dyslexia cases in the un-diagnosed college population, particularly among students who experience difficulties in their French, Philosophy and English as a Second Language courses. We note that their performance profiles are, in fact, similar to those of dyslexics in terms of both accuracy and speed of reading and writing. These observations lead us to question the necessity of dyslexia screening in this population before guiding students to assistance and support structures, as is currently the case in many colleges. These students must be identified upon their arrival at college in order for them to fully benefit from the most appropriate pedagogy and support measures.

Conclusion:

Our findings point to the following profile of dyslexia at the college level:

- a difference in reading age of more than two years compared to normal readers
- slight deficit in the ability to read words
- deficit in the ability to read non-words
- slowness in reading words
- noticeable slowness in the reading of non-words, irregular words and rare words
- severe deficit in phonological processing abilities
- deficiency in short-term verbal memory
- severe deficit in orthographic abilities

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