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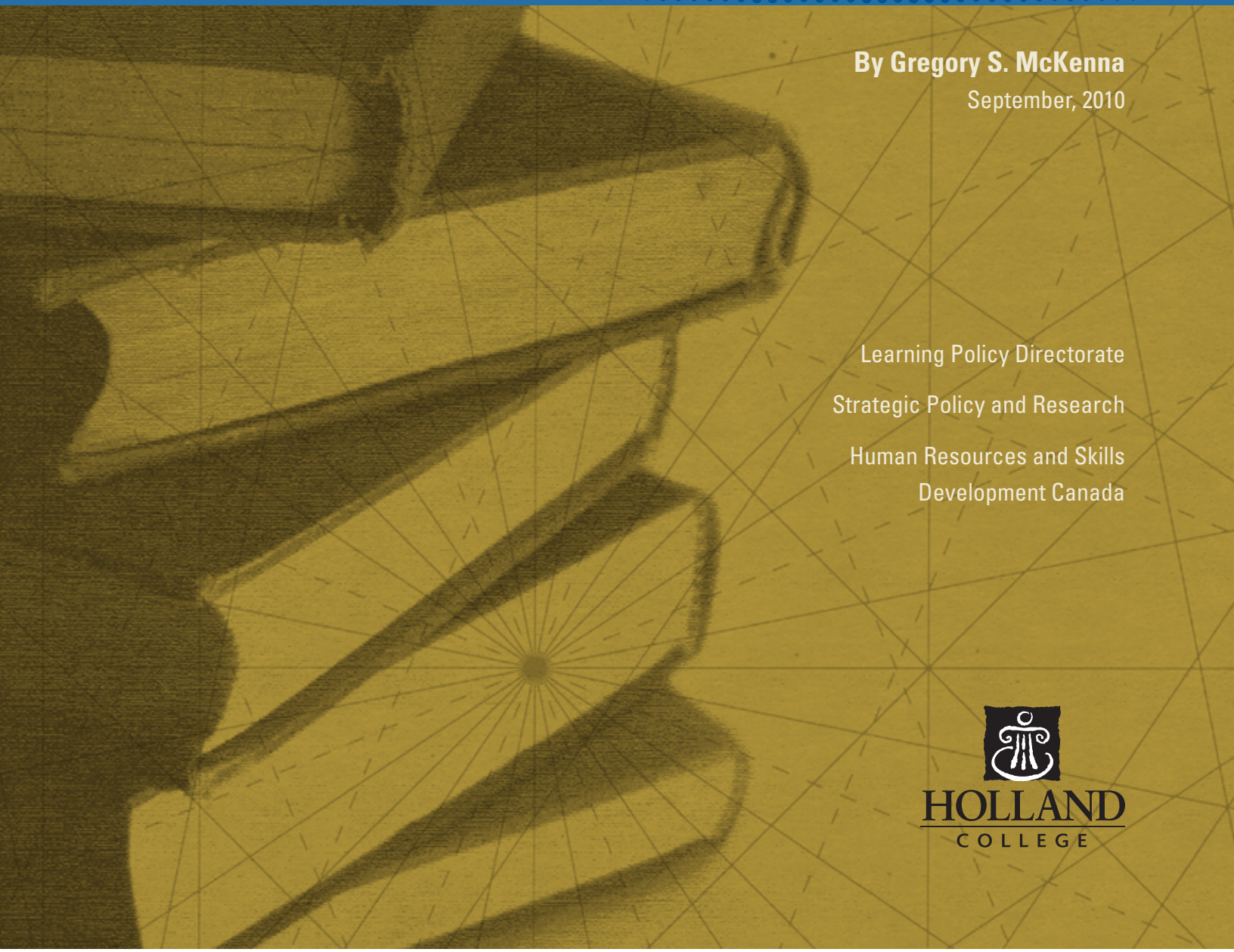
Can Learning Disabilities Explain Low Literacy Performance?



By Gregory S. McKenna

September, 2010

Learning Policy Directorate

Strategic Policy and Research

Human Resources and Skills Development Canada

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Abstract

The primary purpose of this report is to explore within the Canadian context the relationship between Self-Reported Learning Disabilities (SRLD) and low literacy performance using the Canadian portion of the public data set from the 2003 International Adult Literacy and Life Skills Survey (IALSS). Two primary research questions related to SRLD were asked: 1) What is the influence of SRLD status on prose literacy scores after controlling for a number of variables known to impact on prose literacy? and 2) Are variables most strongly associated with self-reported LD the same as those for low literacy skill? In answering the first question it was found that a difference of 33 points existed between the mean prose score of those with a SRLD and those without, in favour of those without. However, after controlling for a number of variables known to influence prose literacy the difference fell to approximately 15 points. Results from answering the second question indicate that higher levels of SRLD are present for, but not limited to, those:

1) in the younger age cohort,
2) with lower levels of education,
3) with various co-occurring disabilities, and
4) who received remedial reading while in school.

Moreover, remedial reading is the variable that most clearly differentiates those who report a LD compared to those who do not. Reporting a LD was predictive of whether remedial services were received and yet when looking at mean prose scores at each literacy level by LD status and Remedial services, little difference in outcomes was observed. The observed trends strongly suggest that both Learning Disability and low literacy should be recognized as being so closely related that differentiating between them given the current state of assessment procedures and intervention strategies is unnecessary and overly burdensome to both individuals and the larger education system as a whole. It needs to be acknowledged that LD is not the only reason for poorly developed reading skills and that it is better to provide assistance to all who need it by tailoring services according to need. This may have significant policy implications regarding the value of identification, diagnosis and funding related to those who meet the current definitional criteria for diagnosis of a Learning Disabilities.

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1 Introduction

Since its emergence as a diagnostic category through the early 1960's to the mid 1970's, learning disabilities have been increasingly associated with poor educational and employment outcomes. Concomitantly, there has been an increase in demand for specific remedial services and in many jurisdictions a requirement for formal diagnosis in order to receive such services. While this has resulted in an increase in funding for those with such issues it also creates a situation where services are directed to those with a formal diagnosis and a lack of support for those who struggle with various academic domains but who do not meet diagnostic criteria. Moreover, there are still a variety of contentious issues within the learning disability field related to prevalence rates and risk factors. This study was designed to determine if a self-reported learning disability had an impact on Prose literacy and to further determine if there are variables that are more strongly associated with the presence of a learning disability as compared to low literacy skill.

There are numerous and significant policy implications associated with issues related to diagnosis of learning disabilities. First, as a formal diagnostic category there are legal implications for educational institutions and employers related to the mandatory provision of accommodations and services. Second, the recognition of this disability as separate and unique to low literacy affects the nature and distribution of funding for services, grants, tax incentives and so forth. Third, it allows for government lobbying by individuals and organizations with a vested interested in the maintenance of the category. Fourth, it limits government's ability to pursue other means of allocating funding simply by the fact that set diagnostic criteria, formal recognition as a disability, and the strength and public impact that lobby groups can have through media posturing, creates a situation that significantly constrains the potential to pursue alternative approaches to addressing educational issues. As such, exploring the impact and variables associated with learning disabilities is essential to ensure that evidenced based decision making can occur and that clinical and policy "foreclosure" do not occur as a result of political ideology and vested interest.

2 Literature Review

Most research on learning disabilities (LD) is conducted on relatively small samples, with the majority of work being focused on school aged populations, and in particular those in the elementary school age/grade range. Thus, there has been little research available specifically focused on an adult population (Gottardo, Siegel, & Stanovich, 1997) as illustrated by an attempt at a meta-analytic review of research on remedial programs for adults that was unsuccessful due to the small number of studies, differing intervention strategies, different samples used, and methodological concerns (Torgerson, Porthouse, & Brooks, 2003).

In addition, it has been suggested that those working with the adult literacy community and those working with the adult learning disability community have typically had different pedagogical approaches, assumptions, target populations and interventions (Fowler, & Scarborough, 1993). However, accumulated evidence from research on children and adults suggests that this dichotomy may not be a useful approach. In particular, it has been repeatedly demonstrated within a school aged population that those meeting traditional definitions for reading disabilities do not differ in meaningful ways from those simply classified as poor readers. In both cases, primary deficits in cognitive-linguistic domains, such as phonological processing, have been identified (Felton, & Wood, 1992; Shaywitz, Fletcher, Holahan, & Shaywitz, 1992; Siegel, 1989; Vellutino, Scanlon, & Lyon, 2000). Bone, Cirino, Morris and Morris (2002) replicated this finding with an adult sample. Similarly, there does not appear to be any significant difference between the two groups, reading disabled and poor readers, with respect to response to phonologically based treatments (Kruidenier, 2002; Vellutino, et al., 2000). In essence, there appears to be a point of confluence where poor reading due to poverty of experience or specific reading disability leads to similar problems at the cognitive-linguistic level. However, to date there have been no large scale investigations designed to evaluate for meaningful differences between those with low literacy skills and those with a learning disability, particularly a reading disability, in an adult sample with particular reference to outcomes. It may be that if the same explanatory variables are linked to both LD and low literacy that these two solitudes may be better considered as a single issue or at least be recognized as being so closely related that differentiating between them given the current state of intervention strategies is unnecessary and overly burdensome to both individuals and the larger adult education system as a whole. This requires acknowledging that poor reading skills may arise for a myriad of reasons, not just the presence of a LD and that interventions can be successful regardless of the reason for poorly developed reading skills.

A number of variables have been demonstrated to have a robust influence on Prose literacy scores

including such things as: 1) gender, where it has been consistently shown that females demonstrate higher prose skills compared to males (Desjardins, 2005a), 2) age cohort, where younger cohorts tend to score higher than older cohorts (Desjardins, 2005a), 3) education level, where higher levels of education result in better scores (Desjardins, 2005b), 4) income, where higher income is associated with better scores (Desjardins, Werquin, & Dong, 2005), 5) parent level of education, where higher levels of parental education are linked to higher scores and 6) reading practices, where more reading is connected to higher scores (Willms, 2005).

In addition to the influence of LD on prose scores, it is also important to understand which variables are most strongly associated with LD in an adult population. As noted, there are relatively few studies focusing on adults compared to what is available in reference to children. As a result there are a number of unanswered questions and/or contentious issues relating to the prevalence, distribution and influencing factors associated with the reported presence of a learning disability, in large part due to the lack of evidence specific to the adult population. Four key variables can be identified in the research literature that have been relatively widely studied and yet continue to be debated due to conflicting or limited evidence. These are: gender, age, attained education level, and income/employment status as adults. The relationship of these variables to LD is either somewhat contentious or has been generally accepted as a matter of fact based upon the results of relatively few studies. As such, these four variables were selected for inclusion in the present study in order to clarify their relationship to self-reported LD in an adult population. The following is a brief review of each of these variables and a sampling of the related research findings:

- **Gender:** For many years the higher prevalence of LD in males was considered to be an established fact. However, more recently there has been increasing debate regarding this issue. For instance, Siegel and Smythe (2005) took the perspective that gender differences were an artifact of the definitional criteria used in diagnosing LD and they supported this perspective by citing a large scale longitudinal study of school aged individuals who were followed from kindergarten to grade 5. Their results demonstrated that although some gender differences were observable in kindergarten and grade 1, after that point there were essentially no measurable differences between genders. In contrast, Liederman, Kantrowitz, and Flannery (2005), argue that gender differences are present. They use a review of high quality studies and an associated critical analysis of these to support the contention that gender differences are not the product of definitional criteria, ascertainment bias, statistical artifacts and related concerns, but rather reflect actual differences due to gender.
- **Age:** Age, in and of itself, should not be related to the presence of a learning disability given that learning disabilities by definition are neurologically based and lifelong (Learning Disability Association of Canada, 2001). However, prevalence rates should rise based upon age cohort since Learning Disability as a formal diagnostic category was not established until the early 1960's. As such, the number of those over the

age of 45 who report a learning disability could be expected to be significantly lower than those under the age of 45. According to LDAC "The age of 44 was identified… since 'learning disability' was first applied in the early 1960's, and those identified by diagnosticians in the late 1960's and early 1970's are now in this age bracket." Interestingly, Mellard and Patterson (2008) in a study using 311 Adult Development Education (ADE) participants in the Midwestern states to identify differences between those reporting a LD with those who did not, found that those reporting LD were more likely to be in the 46 – 55 year old age bracket.

- **Education:** Given the educational struggles typically faced by those with LD it would be expected that academic outcomes would be lower as compared to peers. In particular it would be anticipated that fewer individuals with LD would graduate from high school and fewer still would go on to post-secondary education. Levine and Nourse (1998) in a review of the literature related to LD, gender, education and employment reported a number of methodologically sound studies that demonstrated that LD students were less likely than their peers to pursue post-secondary education. However, Mellard and Patterson (2008) found in a sample of adult education learners that those with LD were more likely to complete high school compared to those without LD. Though this tends to contradict most other studies it was suggested that those with a formal diagnosis may have received greater support from the school system that allowed them to reach graduation.
- **Income and Employment Status:** As with educational outcomes it would be anticipated that those with LD would be more likely to be unemployed and if working would be in either relatively low paying/skill jobs and/or perhaps face wage discrimination. Again Levine and Norse's (1998) review of the literature suggest that unemployment and low paying/skill jobs were present to a higher degree in those with LD, though significant methodological issues were identified in the research reviewed. Mellard and Patterson (2008) noted that participants in ADE programs with and without LD tended to demonstrate similar employment rates and similar status jobs. This would suggest that educational attainment and basic literacy skills may be the key factor in these issues as opposed to LD status per se. In addition, Dickinson and Verbeek (2002) analyzed a data set to determine if there was a wage differential between college graduates with and without a LD. Results showed a wage differential was present that did not appear to be related to overt discrimination, but rather the authors attributed the difference to productivity characteristics of the individuals.

Additional variables, variables of interest, were also identified since they have been associated with educational outcomes generally or they have been linked to LD but have been considerably less studied in reference to LD. These variables of interest include: 1) parents' education level – separated for father and mother, 2) self-reported co-occurring disabilities – hearing, speech, vision, and other lasting more than six months, 3) remedial reading activities while in school, and 4) reading practices

at home. The rationale for identifying each of these as variables of interest is as follows:

- **Parents' level of education:** First, it has been clearly established that genetics play a role in the development of a LD (Shaywitz, & Shaywitz, undated). As such, there may be a relationship between the level of education attained by parents and that attained by offspring. In addition, if clear gender differences in prevalence rates do exist in favour of males having higher rates of LD it would be expected that father's level of education would be a stronger predictor of LD status than mother's level of educational attainment. In addition, parental level of education has been shown to be a significant factor related to literacy levels, such that those with more highly educated parents tend to have higher literary scores (Kaplan, & Venezky, 1993; Willms, 2005). Interestingly, Mellard and Patterson (2008) found no difference between mothers' high school or post-secondary completion between those reporting, and those not reporting a LD.
- **Co-occurring disabilities:** A number of research studies have demonstrated that those with learning disabilities are more likely compared to those in the general population to have or to have had other disabilities, with speech and hearing disabilities being commonly identified. This is illustrated by Vogel and Holt (2003) who reviewed results from the first IALS (1994) survey and noted that within Canada 18% of those with a LD compared to 8.37% without reported a hearing disability and 11% versus 2.96% reported a speech disability. Similarly, Shapiro (undated) indicated that the presence of a hearing or speech impairment was a risk factor associated with reading disability. The co-occurrence of visual disabilities is less commonly reported, though Stein (2001) has theorized that a visual issue may underlay reading impairment, Solan, Shelly-Tremblay, Hanson and Larson (2007) concluded given the results of their study "…that a common linkage exists between reading comprehension, visual attention, and magnocellular processing." (p. 270), and a significantly higher rate of visual difficulties was noted in one study of ADE learners (Mellard, & Patterson, 2008). The "other disabilities" category was included given the range of disabilities that have been linked to LD and the observation by Vogel and Holt (2003) that 26% of LD compared to 10.98% of non-LD respondents endorsed this item.
- **Remedial reading:** Reading disabilities are the most common LD accounting for 80% of those reported (Shaywitz, & Shaywitz, undated). In addition, those with LD would tend to experience greater difficulty with academic material compared to the general population. As such, it was expected that those with a LD would be more likely to have been enrolled in remedial reading programs while in school. Such findings were noted by Mellard and Patterson (2008) where 75% of those with LD reported participating in remedial or special programs while in school. This translated into those with a LD being nine times more likely to have undergone such programs. However, evidence of this phenomenon is limited.

- **Reading practices at home:** These variables have been demonstrated to be significant factors in literacy skill attainment and retention in the adult population (Willms, 2005) and were included to evaluate their relationship to LD.

3 Research Questions

The public data set from the 2003 International Adult Literacy and Life Skills Survey (IALSS) provides data on self-reported LD in the Canadian adult population, thus providing a large stratified random sample representative of the population from which meaningful conclusions may be drawn from data analysis. This study was designed to answer two questions related to LD:

Question 1 **What is the influence of self-reported LD status on prose literacy scores after controlling for a number of variables known to impact on prose literacy?**

and

Question 2 **What variables are most strongly associated with self-reported LD?**

Enhanced understanding of the influence of LD on prose literacy once the other strong predictors of prose have been controlled will yield meaningful information for policy makers and stakeholders working within the LD field. In addition, a direct comparison of the variables related to self-reported LD will provide insight into the similarity of those with self-reported LD to those with low literacy skill. In particular, clearly demonstrating in a quantifiable manner the degree to which LD affects prose literacy and differentiating between those with self-reported LD and those with low literacy skill with no LD may lead to alterations in priorities and policy with respect to both early interventions and adult learners' needs. Of course it is recognized that LD is heterogeneous and can refer to difficulties in numerous cognitive domains. However, given that it is estimated that 80% of LDs are specific to reading (Shaywitz, & Shaywitz, undated) and a variety of other LDs (e.g. working memory, processing speed and so forth) would negatively impact on reading this paper will focus on LDs in the area of reading; though it is acknowledged that a relatively small percentage of those self-reporting LD may be referring to disabilities in unrelated domains such as mathematics.

4 Method

4.1 Data Source and Sample

The data used for these analyses were from the public use file of the 2003 International Adult Literacy and Life Skills Survey (IALSS) and utilized the Canadian data set. The sample was drawn so as to produce high quality probability samples of the non-institutionalized Canadian population 16 years of age and older. Stratified random sampling was used in which units with known demographic characteristics were used for the first stage in the sample design and in subsequent stages were randomly drawn from these units. This resulted in a representative sample with a known probability of selection. Population weights were derived to provide accurate estimates of population totals. Over 23,000 individuals from across all provinces and territories responded to the survey.[1] More specific details of this survey, the sampling design, measures used and so forth have been extensively described in *Building on Our Competencies: Canadian Results of the International Adult Literacy and Skills Survey* (Human Resources and Skills Development Canada, & Statistics Canada, 2005). For this study the total sample consisted of 22,276 respondents. The sub-sample who reported a LD consisted of 1,346 individuals. Exclusion from the study was based upon missing information on the self-reported LD variable.

The key variable within the present study is self-reported LD. This was determined based upon participants' response to the question: "Did you ever have a learning disability?" This method of identifying a LD is different from the process involved in identifying a learning disability in a school or clinical setting, as well as being distinct from identification of a LD used in research studies (Vogel, & Holt, 2003). Nonetheless, this process of self identification has been widely used in research surveys and has been deemed a valid method of sample ascertainment (Gilger, cited in Vogel, & Holt, 2003).

4.2 Research Questions and Studied Variables

Question 1 **What is the influence of self-reported LD status on prose literacy scores after controlling for a number of variables known to impact on prose literacy?**

- **Dependent Variable:** Scores on the prose literacy scale. Prose literacy as assessed in the IALSS survey is defined as "…the knowledge and skills needed to understand and use information from texts including editorials, news stories, brochures and instruction manuals"

[1] Though the issue of representativeness of the sample to the Canadian population, especially at the lower end of the literacy distribution, may be raised, Statistics Canada has taken every precaution to avoid any issues that may negatively influence the samples representativeness.

(Human Resources and Skills Development Canada, & Statistics Canada, 2005, p. 13). Further, "Proficiency in each domain is measured on a continuous scale. Each scale starts at zero and increases to a theoretical maximum of 500 points. Scores along the scale denote the points at which a person with a given level of performance has an 80 percent probability of successfully completing a task at that level of difficulty" (Human Resources and Skills Development Canada, & Statistics Canada, 2005, p. 14).

- **Independent Variable:** Self-report of a learning disability. Self-report of a learning disability was coded as a dummy variable based upon response to a question specifically requesting this information.
- **Control Variables:** Analysis was adjusted for gender, age, education level, income, mother's education, father's education, and reading practices at home, as these variables have been demonstrated to have a robust association with prose literacy scores. Remedial reading in school was included because of the potential influence this may have on reading. Variables were utilized as they were provided in the public use file, that is, 1) gender was a dummy variable, 2) age was broken into cohorts 16–25, 26–35, 36–45, 46–55, 56–65, and older than 65, 3) education was broken into less than grade 7, some high school, completed high school, non-university post-secondary, and university, 4) income was broken into less than $8,000, $8,000.01–25,000, $25,000.01–50,000, and higher than $50,000.01, 5 & 6) mother's and father's education were coded as less than high school or high school and greater, 7) remedial reading in school was a dummy variable, and 8) reading practices at home were established based upon the response to a question regarding the number of books at home, less than 25, 25–100, and over 100. The number of books at home has been used as a proxy measure for reading practices at home in a variety of studies (Cunningham, & Stanovich, 1993; Kaplan, & Venezky, 1993; Senechal, LeFevre, Hudson, & Lawson, 1996; Senechal, LeFevre, Thomas, & Daley, 1998). Control variables for each of the imputations were also entered.

Question 2 What variables are most strongly associated with self-reported LD?

- **Dependent Variable:** Self-report of a learning disability. Self-report of a learning disability was coded as a dummy variable based upon response to a question specifically requesting this information.
- **Independent Variables:** A number of independent variables were entered into the equation, 1) gender was a dummy variable, 2) age was entered as a dummy variable 45 years of age and younger, over the age of 45, given the rationale provided in the literature review, 3) education, 4) income, 5 & 6) mother's and father's education, 7) reading practices at home were coded the same as for question one, 9, 10, 11 & 12) self-reported vision disability, hearing disability, speech disability and other disability were coded as dummy variables, and 13) participation in a remedial reading program in school was coded as a dummy variable.

5 Data Analysis and Results

5.1 Data Analysis

Question 1 **What is the influence of self-reported LD status on prose literacy scores after controlling for a number of variables known to impact on prose literacy?**

Considering the nature of the data, regression analysis was used in order to answer the research questions. For question 1 an OLS regression was utilized. Imputation was used to adjust for missing data and the imputations were then entered as control variables. Table 1 indicates which variables were imputed and how. In addition, percentages and tests of mean differences were used to illustrate variation between groups for selected variables in order to further elucidate the findings. In all cases weighted data were statistically analyzed.

Model: For question 1 it was anticipated that all control variables entered, with the exception of controls for imputations, would have a significant effect on prose literacy given results from previous research. It was further hypothesized that self-reported learning disability would account for a moderate amount of variance on prose literacy over and above that accounted for by the control variables.

TABLE 1

Imputation of Data

Variable	Coded	Imputed	Number
Education	Don't Know, Not Stated, Refused	Less than grade 7	3,314
Income	Don't Know, Not Stated, Refused	$8,000.00 or less	2,661
Mother's Education	Don't Know, Not Stated, Refused	Less than high school	1,794
Father's Education	Don't Know, Not Stated, Refused	Less than high school	2,213
Reading Practices	Don't Know, Not Stated, Refused	Less than 25	41
Vision Disability	Don't Know, Not Stated, Refused	No disability	1,854
Hearing Disability	Don't Know, Not Stated, Refused	No disability	1,852
Speech Disability	Don't Know, Not Stated, Refused	No disability	1,852
Other Disability	Don't Know, Not Stated, Refused	No disability	2
Remedial Reading	Don't Know, Not Stated, Refused	No remediation	27

5.2 Results

Question 1 **What is the influence of self-reported LD status on prose literacy scores after controlling for a number of variables known to impact on prose literacy?**

Table 2 outlines the *n* for selected control variables and percentages in reference to prose levels 1 through 4/5. As anticipated the variables appear to vary in relation to prose levels.

TABLE 2

Descriptive Statistics for Each of the Control Variables and Percentages in Reference to Prose Levels 1 Through 4/5

	n	Prose 1 Scores 0–225	Prose 2 Scores 226–275	Prose 3 Scores 276–325	Prose 4/5 Scores 326–500
Gender					
Male	10,183	48.26	47.39	45.67	38.08
Female	12,093	51.74	52.61	54.33	61.92
Age Group					
16–25	3,781	9.14	17.24	20.23	20.59
26–35	3,423	8.93	13.48	18.36	22.13
36–45	4,703	15.37	20.80	23.17	25.72
46–55	4,499	15.87	20.64	21.54	22.73
56–65	2,960	17.17	14.90	11.74	7.51
65+	2,910	33.53	12.94	4.96	1.32
Education					
Less than 7	956	17.58	1.43	0.12	0
Some high school	4,392	35.75	25.87	10.53	4.05
High school	5,793	17.95	29.85	30.18	19.80
PSE – not University	3,918	7.86	17.21	22.78	20.72
PSE – University	3,903	3.82	10.16	23.11	41.27
Missing	3,314	17.04	15.48	13.28	14.16
Income					
Less $8,000	4,350	21.60	21.09	18.63	15.09
$8,000.01–25,000	6,999	46.17	33.94	24.56	19.83
$25,000.01–50,000	5,436	14.50	25.10	28.82	27.40
$50,000.01 +	2,830	3.09	8.54	17.21	25.69
Missing	2,661	14.62	11.33	10.80	12

(Continued)

(Concluded)

	n	Prose 1 Scores 0–225	Prose 2 Scores 226–275	Prose 3 Scores 276–325	Prose 4/5 Scores 326–500
Mother's Education					
Less than high school	11,422	70.68	57.81	42.47	28.43
High school or +	9,060	14.19	32.72	52.84	69.33
Missing	1,794	15.13	9.47	4.69	2.24
Father's Education					
Less than high school	11,553	67.07	57.45	44.68	33.66
High school or +	8,510	16.24	30.53	48.71	63.31
Missing	2,213	16.69	12.03	6.61	3.03
Remedial Reading					
Yes	2,131	12.59	10.85	8.39	4.94
No	20,118	87.02	89.04	91.60	95.06
Missing	27	0.39	0.11	0.01	0

Table 3 outlines the *n* for selected control variables and percentages in reference to prose levels 1 through 4/5 for those with a LD. Once again the variables appear to vary in relation to prose levels.

TABLE 3

Descriptive Statistics for Those with a LD for Each of the Control Variables and Percentages in Reference to Prose Levels 1 Through 4/5.

	n	Prose 1 Scores 0–225	Prose 2 Scores 226–275	Prose 3 Scores 276–325	Prose 4/5 Scores 326–500
Gender					
Male	703	56.59	54.19	54.48	52.96
Female	643	43.41	45.81	45.52	47.04
Age Group					
16–25	344	19.16	30.93	30.18	25.81
26–35	244	10.90	18.60	30.18	25.81
36–45	300	24.78	22.09	18.95	16.13
46–55	216	17.05	14.88	14.04	24.19
56–65	133	12.65	9.53	5.26	8.06
65+	109	15.47	3.95	1.40	0

(Continued)

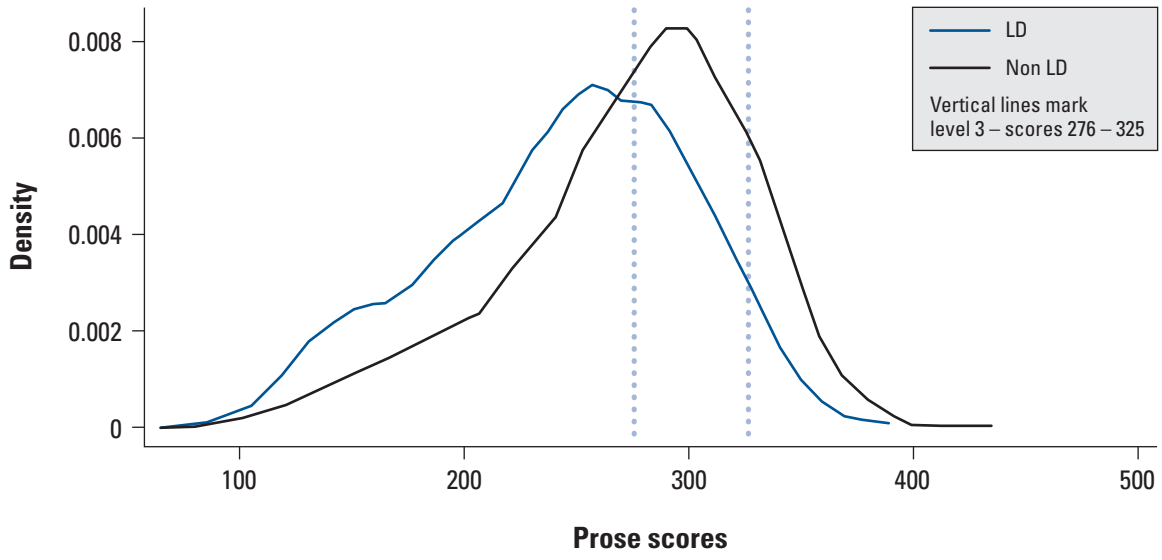
(Concluded)

	n	Prose 1 Scores 0–225	Prose 2 Scores 226–275	Prose 3 Scores 276–325	Prose 4/5 Scores 326–500
Education					
Less than 7	163	24.43	5.12	0.70	0
Some high school	421	37.96	34.88	18.25	4.84
High school	274	12.13	25.81	27.37	25.81
PSE – not University	126	2.28	11.40	18.60	17.74
PSE – University	79	0.35	3.72	14.04	33.87
Missing	283	22.85	19.07	21.05	17.74
Income					
Less $8,000	390	31.81	30.47	23.86	16.13
$8,000.01–25,000	502	42.00	36.28	32.28	24.19
$25,000.01–50,000	200	8.96	16.74	21.75	24.19
$50,000.01 +	81	2.46	6.74	10.18	14.52
Missing	173	14.76	15.77	11.93	20.97
Mother's Education					
Less than high school	645	61.34	45.35	29.47	27.42
High school or +	545	21.44	43.95	66.32	72.58
Missing	156	17.23	10.69	4.21	0
Father's Education					
Less than high school	685	63.09	49.07	34.04	29.03
High school or +	456	15.47	37.21	57.89	69.35
Missing	205	21.45	13.72	8.07	1.61
Remedial Reading					
Yes	565	39.37	41.16	50.18	33.87
No	776	59.75	58.84	49.82	66.13
Missing	5	0.88	0	0	0

Figure 1 provides the distribution of individuals with and without a self-reported LD based upon prose levels. It is apparent that those with a LD typically have lower literacy scores compared to those without a LD. The mean prose score for those with LD is 235.75 and the mean prose scores without a LD is 268.92 a difference of 33.17 points. A comparison of these means indicates the difference is significant, $t = -21.53(22274)$, $p > .0001$. This figure also demonstrates that substantial numbers of adults who score low do not have a LD. In addition, it illustrates that despite a LD a large number are able to score high on the IALSS assessment.

FIGURE 1

Prose Scores for LD and Non LD
Comparison of Kernel Density Estimate



kernel = epanechnikov, bandwidth = 11.9916

Table 4[2] presents the relationship between the dependent variable – Prose literacy – the control variables,[3] and the independent variable – self-reported LD, resulting from this regression analysis.[4] All of the control variables were significantly related to prose literacy. It is apparent that age, level of education, parent level of education, receiving remedial reading when in school, and number of books at home, all has a strong influence on literacy skills. The independent variable, self-reported LD, retained significance despite controlling for a large array of variables that have been clearly demonstrated to influence prose literacy. Though, it should be noted that LD alone does not have a high degree of explanatory power as can be seen by the relatively low value of the adjusted R^2 in regression 1. Given that results suggest that LD is related to literacy development and that other variables may contain greater explanatory power, further exploration through answering question 2 is justified.

TABLE 4

Abbreviated Display of Regressions with Prose Literacy as the Dependent Variable.[a]

	Regression Model											
	1		3		4		6		7		13	
	coef	se	coef	se	coef	se	coef	se	coef	se	coef	se
LD	29.2	3.0	35.0	2.7	20.2	2.3	21.0	2.2	17.6	2.3	15.5	2.1
Gender			4.0	1.2	3.6	1.1	4.3	1.0	4.1	1.0	3.4	1.0
Age 26–35			3.8	1.8	-11.2	1.8	-4.7	1.7	-5.0	1.7	-4.6	1.7
Age 36–45			-7.8	1.9	-18.4	1.8	-8.0	1.8	-8.5	1.7	-11.0	1.7
Age 46–55			-11.7	1.8	-19.2	1.7	-6.9	1.7	-8.0	1.7	-11.9	1.7
Age 56–65			-31.7	2.2	-31.6	2.0	-17.5	2.1	-18.9	2.1	-22.8	2.0
Age 65 +			-69.1	2.1	-55.0	1.9	-41.5	1.9	-43.0	1.9	-43.0	1.9
Less than Grade 7					-68.8	2.5	-63.3	2.4	-63.4	2.4	-61.9	2.7
Some High School					-25.0	1.6	-21.6	1.6	-21.6	1.6	-19.0	1.5
PSE Non-University					16.0	1.4	14.2	1.4	14.2	1.4	12.0	1.3
PSE University					32.7	1.5	27.0	1.5	26.9	1.5	23.0	1.4
Mother's Education							18.7	1.2	18.6	1.2	15.1	1.2

(Continued)

[2] This is an abbreviated table see annex for full regression table.

[3] Due to the collinearity of education and income, income was run separately with the same model. Given the similarity in results only the former is presented. The income regression is available from the author.

[4] Although there is a potential problem with endogeniety it was not possible to identify an instrumental variable to correct for this issue.

(Concluded)

	Regression Model											
	1		3		4		6		7		13	
	coef	se	coef	se	coef	se	coef	se	coef	se	coef	se
Father's Education							6.0	1.2	6.0	1.2	3.6	1.2
Remedial Reading									-9.8	1.9	-10.5	1.8
25–100 books											21.3	1.6
100+ books											36.4	1.5
Cons	244.9	2.9	254.1	2.8	270.9	2.6	249.7	2.8	254.9	2.9	237.1	3.0
Number of Observations	22,276		22,276		22,276		22,276		22,276		22,276	
Adjusted R^2	0.016		0.198		0.385		0.415		0.417		0.474	
Log-Likelihood	-120,795		-118,506		-115,544.7		-114,996.1		-114,949		-113,797.4	

Note: All shown coefficients p<0.01

[a] A full version of this regression table is in the Annex, pages 39–43.

A post regression VIF analysis where all values fell between, 1.00 and 2.23 (mean VIF = 1.54), and inspection of the correlation matrix of the regression coefficients with correlations ranging from .0002–.25, provide no indication of multi-collinearity.

5.3 Data Analysis

Question 2 What variables are most strongly associated with self-reported LD?

For question 2 a Probit regression was utilized since the dependent variable was dichotomous. In addition, percentages and tests of mean differences were used to illustrate variation between groups for selected variables in order to further elucidate the findings. Note that unless otherwise specified weighted data were statistically analyzed.

Model: For question 2, table 5 describes the anticipated relationships.

TABLE 5

Describing the Anticipated Relationship Between Variables and Probability of LD.

Variables	Probability of LD
Gender	Male > Female
Age	Younger > Older
Education	Less Educated > More Educated
Income	Lower Income > Higher Income
Parental Education	Less Educated > More Educated
Disability	
Hearing	Hearing Disabled > Non Disabled
Speech	Speech Disabled > Non Disabled
Other	Other Disability > No Other Disability
Vision	Vision Disability = Non Vision Disability
Remedial Reading	With Remediation > Without Remediation
Reading at Home # of books	Less Reading > More Reading

5.4 Results

Question 2 What variables are most strongly associated with self-reported LD?

Table 6 outlines the *n* and percentage distribution of LD versus non LD respondents in reference to selected control variables. It is notable that higher levels of self-reported LD are present for, but not limited to, those 1) in the younger age cohort, 2) with lower levels of education, 3) with various disabilities, and 4) who received remedial reading while in school. Moreover, it would appear that remedial reading is the variable that most clearly differentiates those who report a LD compared to those who do not. Further investigation of those participating in remedial reading programs while in school indicates that a relatively small percentage, approximately 26%, of those who participated in such programs reported a LD.

Given the apparent relationship between remedial programming and LD and the potentially significant impact that remedial programming could have on prose literacy the association between LD status, participation in remedial programming and prose literacy was explored.

Figure 2 uses kernel density plots to illustrate the differences between the prose scores of those reporting a LD who received remedial reading versus those reporting a LD who did not receive remedial reading, with the distribution of the entire Canadian sample provided as a reference. It would appear that remedial interventions have a positive influence on prose literacy, with the greatest benefit going to those in level 1. In comparison Figure 3 presents kernel density plots to demonstrate the differences

TABLE 6

Descriptive Statistics and Percentages of LD Versus Non LD Respondents for Selected Control Variables.

	LD (*n*)	Non LD (*n*)	LD (%)	Non LD (%)
Gender				
Male	703	9,480	52.23	45.29
Female	643	11,450	47.77	54.71
Age Group				
45 years or less	888	11,019	65.97	52.65
46 +	458	9,911	34.03	47.35
Education				
Less than 7	163	793	12.11	3.79
Some high school	421	3,971	31.28	18.97
High school	274	5,519	20.36	26.37
PSE – not University	126	3,792	9.36	18.12
PSE – University	79	3,824	5.87	18.27
Unknown	283	3,031	21.03	14.47
Mothers Education				
Less than high school	645	10,777	47.92	51.49
High school or +	545	8,515	40.49	40.68
Unknown	156	1,638	11.59	7.82
Fathers Education				
Less than high school	685	10,868	50.89	51.93
High school or +	456	8,054	33.88	38.48
Unknown	205	2,008	15.23	9.59
Hearing Disability				
Yes	250	2,044	18.57	9.77
No	967	17,163	71.84	82.00
Unknown	129	1,723	9.58	8.23
Speech Disability				
Yes	192	441	14.26	2.11
No	1,025	18,766	76.15	89.66
Unknown	129	1,723	9.58	8.23
Vision Disability				
Yes	176	1,847	13.08	8.82
No	1,040	17,359	77.27	82.94
Unknown	129	1,723	9.65	8.23

(Continued)

(Concluded)

	LD (*n*)	Non LD (*n*)	LD (%)	Non LD (%)
Other Disability				
Yes	484	3,803	35.96	18.17
No	862	17,125	64.04	81.82
Missing	0	2	0	0.01
Remedial Reading				
Yes	565	1,566	41.98	7.48
No	776	19,342	57.65	92.41
Missing	5	22	0.37	0.1
Number of Books				
Less than 25	448	4,133	33.28	19.75
25–100	412	7,176	30.61	34.29
Over 100	480	9,586	35.66	45.80
Missing	6	35	0.45	0.16

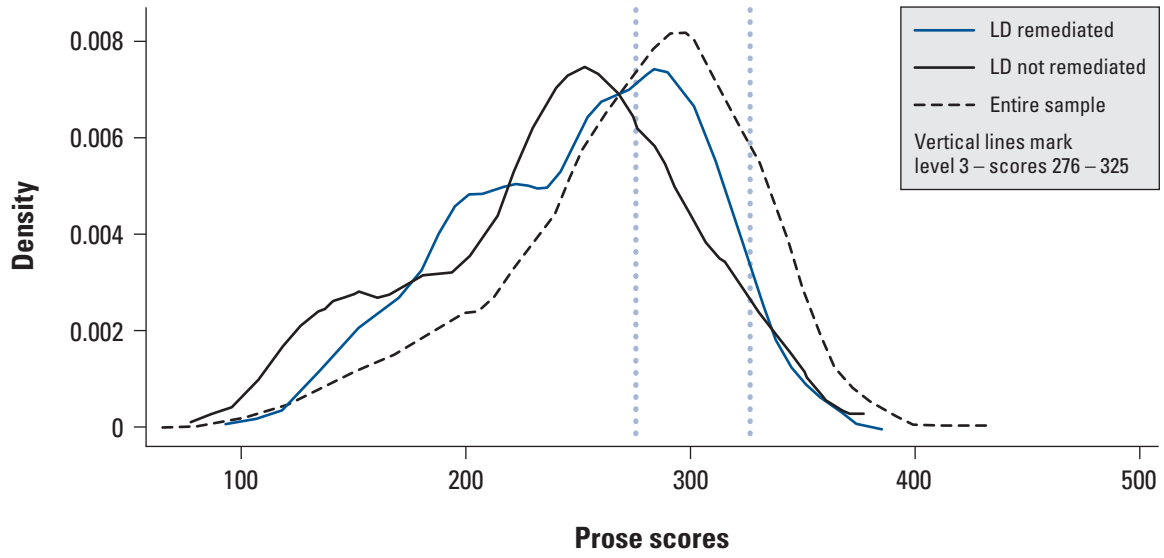
between the prose scores of those who did not report a LD who received remedial reading versus those who did not report a LD who did not receive remedial reading, with the distribution of the entire Canadian sample provided as a reference. As expected those with no LD who did not receive remedial reading essentially matched the distribution of the entire Canadian sample. Those with no LD who engaged in remedial programs continued to have, to a minor extent, lower prose literacy scores compared to the entire Canadian sample.

A comparison of the effects of remediation for those with and without a LD suggests similar outcomes for both sub-samples. Table 6 depicts the percentage of those at each prose level who received remediation while in school according to LD status. It is noteworthy that a markedly higher percentage of LD respondents reported receiving remedial services while in school compared to non-LD respondents. For instance at Prose level 1 almost 40% of those with a LD received remedial services, thus about 60% of those with a LD did not receive remediation. In contrast, only a little over 9% of those at Prose level 1 who did not have a LD received remedial services, leaving about 91% of those at Prose level 1 without a LD having received no remedial services despite their very low level of functioning in this domain.

Figures 2 and 3 Prose scores of LD and non LD with and without remediation with Canadian sample distribution as reference.

FIGURE 2

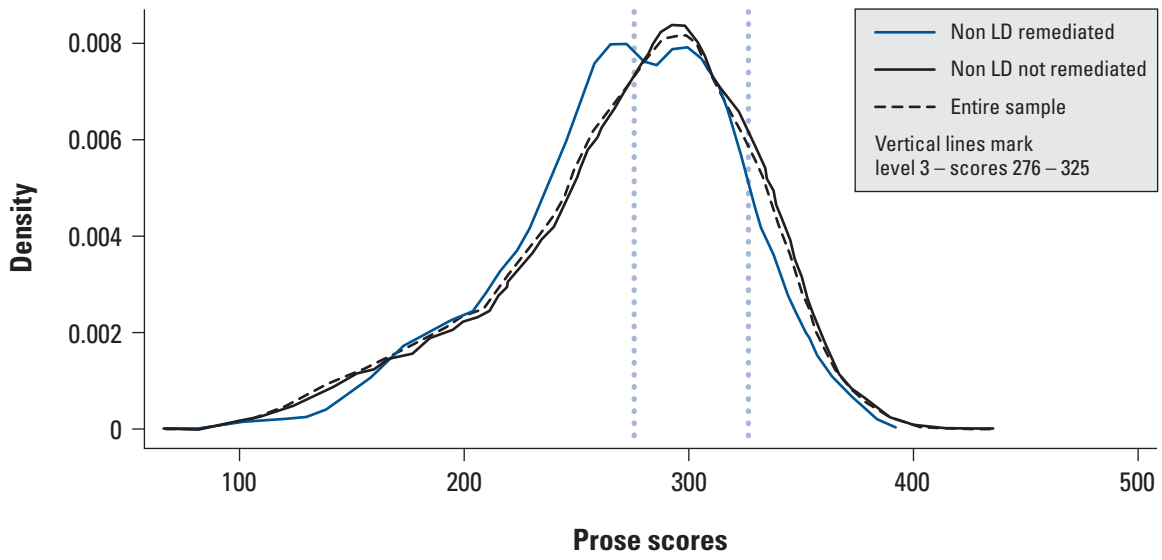
Prose Scores of LD Groups
Comparison of Kernel Density Estimate



kernel = epanechnikov, bandwidth = 13.2431

FIGURE 3

Prose Scores of Non LD Groups
Comparison of Kernel Density Estimate



kernel = epanechnikov, bandwidth = 9.9259

Mean prose scores at each prose level of those 1) with and without a LD who reported no remedial reading, and 2) with and without LD who reported remedial reading in school are also provided in table 7. An ANOVA with prose scores as the dependent variable and LD status and Remedial status as independent variables was performed to test for mean differences. Overall results were significant, F = 66.23 (6), $p > .0001$. LD status alone was not significant F = .67 (1), $p > .41$, remedial status approached significance, F = 2.11 (3), $p > .097$ and there was a significant interaction between LD status and Remedial status, F = 10.31 (2), $p > .0001$. Follow up t-tests were performed to elucidate the noted differences. Note that for these analyses weighted data could not be used. The only significant difference was noted between LD remediated and LD not remediated at Level 1 prose, t = 2.99 (562), $p > .003$.

TABLE 7

Percentage of Those at Each Prose Level Who Were Remediated According to LD Status and Mean Scores and Significance of LD and Non LD with and without remediation.

LD Status	Prose Level 1	Prose Level 2	Prose Level 3	Prose Level 4/5
LD	39.36	41.16	50.17	33.87
Non LD	9.02	0.01	6.79	4.34
	Means Level 1	**Means Level 2**	**Means Level 3**	**Means Level 4/5**
LD Remediated	186.00	253.38	296.57	341.70
Non LD Remediated	187.71	252.92	298.69	342.58
LD Not Remediated	177.84	251.04	298.46	343.45
Non LD Not Remediated	185.64	253.51	299.58	344.32
Significant Difference	YES	NO	NO	NO

Finally, table 8 presents a summary of the main association between the dependent variable, self reported LD, the independent variables and control variables based upon the probit analysis. Note that for theoretical reasons, reported in the literature review, variables in addition to those used in the first regression were included in this analysis (e.g. various disability categories) and the addition of these variables helps to address concerns related to issues of multi-collinearity. The full regression table is available from the author. Significant relationships were noted for age, educational levels, Mothers' education, hearing disability, speech disability, other disability, number of books in the household, and participation in a remedial reading program in school.

These results begin to refine the current state of knowledge regarding the relationship between LD and a variety of variables that have been found in previous studies to be related to LD, as well as providing evidence for the relationship between LD and other variables that have been less studied or have been noted in clinical practice to appear to have a link to LD.

TABLE 8

Abbreviated Regression Table for Learning Disability.

	Regression Model									
	2		3		6		10		23	
	coef	se	coef	se	coef	se	coef	se	coef	se
Gender	-0.017***	0.01	-0.014***	0.01	-0.014***	0.01	-0.013***	0.01	-0.01	0.00
Age	-0.039***	0.01	-0.049***	0.01	-0.046***	0.01	-0.051***	0.01	-0.027***	0.01
< Grade 7			0.136***	0.03	0.143***	0.03	0.112***	0.02	0.093***	0.02
Some High School			0.047***	0.01	0.048***	0.01	0.039***	0.01	0.028***	0.01
PSE Non-Univ			0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01
PSE Univ			-0.034***	0.01	-0.035***	0.01	-0.028***	0.01	-0.020***	0.01
Mother's Education					0.012*	0.01	0.01	0.01	0.012**	0.01
Father's Education					0.00	0.01	0.00	0.01	0.01	0.01
Visual Disability							0.01	0.01	0.01	0.01
Hear Disability							-0.049***	0.01	-0.042***	0.01
Speech Disability							-0.138***	0.02	-0.100***	0.02
Other Disability							-0.064***	0.01	-0.053***	0.01
Remedial Reading									0.169***	0.02
Book 25–100									-0.023***	0.01
Book 100+									-0.019***	0.01
Number of Observation	22,276		22,276		22,276		22,276		22,274	
Pseudo R^2	0.019		0.066		0.067		0.136		0.233	
Log-Likelihood	-4,998.37		-4,757.12		-4,750.50		-4,401.31		-3,908.39	

Note: *** p<0.01, ** p<0.05, * p<0.1

6 Discussion of Results

This study was undertaken in order to provide information on LD specific to an adult population in Canada by using the public data set from the 2003 International Adult Literacy and Life Skills Survey (IALSS). The goal was to answer two questions: 1) What is the influence of self-reported LD status on prose literacy scores after controlling for a number of variables known to impact on prose literacy? and 2) What variables are most strongly associated with self-reported LD?

For Question 1 What is the influence of self-reported LD status on prose literacy scores after controlling for a number of variables known to impact on prose literacy?

The results provided evidence that literacy scores are negatively influenced by a self-reported LD. This is in keeping with a number of studies that have demonstrated that those with LD have poorer reading skills compared to those who do not have a LD (e.g. Bone et al. 2002). However, these previous studies typically used smaller sample sizes and were not able to control for the same range of confounding variables. Thus, the present analysis lends significant support to these findings. However, considering a literacy level consists of 50 points, it is important to note that on average the difference between the prose literacy scores of those with and without a LD is approximately 15 points after controlling for other variables.

For Question 2 What variables are most strongly associated with self-reported LD?

The results further elucidate the relationship between LD and a variety of variables found in previous studies to be related to LD. In addition, it provides evidence for the relationship between LD and other less studied variables or variables that have been noted in clinical practice to appear to have a link to LD. Reviewing each of the variables in turn the following was noted:

- Gender was not found to be a significant factor associated with LD which was in opposition to the hypothesized relationship predicting that males would demonstrate a higher probability of a self reported LD. These findings add significant support to the perspective that gender differences found in many studies, often utilizing relatively small sample sizes, may be explained by various sources of bias including referral bias, definitional criteria used, and statistical artifacts (Liederman, et al. 2005; Siegel, & Smythe, 2005). This finding suggests that more emphasis needs to be placed on universal screening either formal or informal, to ensure early identification of reading difficulties in both genders.
- Age was determined to be significantly associated with LD. Those in the older age cohort (46 years old +) were 2.7% less likely of reporting a LD. The split in age was based upon research done by LDAC (2007) using the following rationale: "The age of 44 was identified as the

upper end of the research for two reasons. The term "learning disability" was first applied in the early 1960's, and those identified by diagnosticians in the late 1960's and early 1970's are now in this age bracket". Despite this, according to the IALSS data, of those in the older age groups, 46–55, 56–65 and 65 and older, approximately 4.8, 4.5, and 3.8% respectively, self-report a LD. This level of consistency across these older age groups is remarkable considering the date of emergence of the diagnostic label of LD. More interesting is the progressive increase in the percentage of individuals reporting a LD at each 10 year interval, 6.3% of those aged 36–45, 7.1% of those aged 26–35, and 9.1% of those 16–25. The steadily increasing percentage of the population reporting a LD may be a factor of the increased recognition of LD as a diagnostic category combined with increased demand for formal diagnosis in order to attain needed remedial and accommodative services. The author speculates that with the adoption of a new broader definition of LD by LDAC in 2002 that the percentage of Canadians reporting a LD will continue to increase over the next decade and will likely exceed the estimated prevalence rate endorsed by LDAC of 10% of the general population. This may have significant public policy implications since as the number of people with LD expands so to will the demand for related services – services that educational institutions and workplaces are legally obliged to provide.

- Educational attainment was also found to be significantly associated with LD, as hypothesized. Using a benchmark of High School completion it was found that those with less than grade 7 education and those with only some high school education had a 9.3% and 2.8% greater chance of reporting a LD respectively. Those with non-university post-secondary education were not different from those who completed high school. In contrast, those with a university education were 2% less likely to report a LD. This apparent association to early school departure is critical to explore given the clear links between this and a host of negative personal and social outcomes including unemployment, low income, poor health and so forth (Boothby, 2002; Green & Riddell, 2001; McIntosh, & Vignoles, 2001; McMullen, 2005; Rudd, Moeykens, & Colton, 1999). It is interesting to note that no difference in prevalence rates was apparent between those with High School and those with non-university PSE. This suggests that learners with a LD who complete high school are choosing to continue their studies at the college level as opposed to the University level. This may reflect 1) the perception that university programs are more challenging than college programs, 2) the attractiveness of the practical learning environment offered at the college level, compared to the more theory based learning that is associated with university educations, 3) the typically shorter duration of college programs compared to University programs and 4) the more direct link to employment derived from college based training programs compared to university programs. These issues may be especially meaningful for those who may have experienced greater struggle in school settings. In addition having public school educators promote college education to the same degree that University education is promoted

may contribute to greater retention of LD students and greater transition to PSE.

- Income was significantly associated with LD, when education level was removed from the regression, such that those with higher annual income, $25,000.01 – $50,000 and 50,000.01 and higher, were less likely (2.0 and 2.5%) to report a LD. However, given the relationship between education and income, common sense would dictate that education would be the most pressing issue, since it typically precedes employment and largely dictates the nature and therefore the wages associated with a job. In addition, productivity characteristics may further explain any remaining wage differences. For instance, Dickinson and Verbeek (2002) found that for college graduates in the U.S.A. there was a wage differential between college graduates with and without a LD that did not appear to be related to overt discrimination, but rather to different productivity characteristics of the individuals. These productivity characteristics may be explained by level of literacy skills.
- Father's education was not associated with LD. The predictive value of Mother's educational level, though small, was fairly consistent as the model was further specified. Those who reported that their mother's education was high school or greater had a 1.2% higher chance of reporting a LD compared to those whose mother had less than high school education. This is in contrast to the hypothesized relationship where it was suggested that those whose parents had lower levels of education would be more likely to self report the presence of a learning disability and that this would be more likely to occur with father's education being lower. The lack of connection to father's education may be at least partially explained by the lack of gender differences related to self reported LD. It is curious that higher levels of maternal education would be more strongly associated with LD. Since intuitively one would expect that given the genetic component of LD combined with the noted association of poorer levels of education with LD that parents of those reporting LD would have a higher probability of having a LD themselves and this would have negatively influenced their educational attainment. However, such findings may be explained by the possibility that a higher level of education by the mother would 1) lead to greater awareness of LD in general and 2) increased concerns about off-spring who are struggling in the education system, which may in turn lead to a referral and diagnostic bias. This is reinforced by findings that suggest that mothers' are typically more directly involved in their children's educational issues compared to fathers (Murray et al. 2006). This further supports the need to provide services to those families with lower levels of educational attainment.
- Consistent with the hypothesis reading practices, as measured by the reported number of books at home, were associated with self reported LD. Those reporting 25–100 or more than 100 books at home had a reduced chance of reporting a LD, 2.3% and a 1.9% respectively. This suggests that continuing to work toward increased literacy practices at home may be one means of enhancing literacy skill.

- Strong and robust associations to LD were noted for the presence of comorbid reports of hearing disabilities (-4.2%), speech disabilities (-10.0%), and other disabilities (-5.3%). By definition LD is not diagnosed if academic difficulties are caused by other disabilities such as hearing, speech, vision and other impairments. Nonetheless, the co-occurrence of disabilities and a resultant dual diagnosis is possible (LDAC, 2002). A number of studies have attempted to explore the relationship between LD and other disabilities such as those mentioned above (Raitano et al. 2004; White, et al. 2006). Likewise, some theories of LD suggest that the underlying components of a LD are the same as, or closely linked to, those underlying issues associated with disabilities related to speech or vision (White et al. 2006). However, most research attempting to explore these issues is plagued by small sample sizes and tends to utilize school-aged participants. Thus, findings are not necessarily robust, nor are they easily generalizable to other populations and settings. The findings from the present study make an important contribution to our understanding of comorbid diagnosis in these domains considering the sample size and composition. There are at least two interpretations of these results. The first is it suggests that educators need to remain alert to the possibility of multiple diagnoses when working with individuals who experience the noted disabilities. Such alertness may be important since attempting to address the educational concerns of learners may change with the co-occurrence of another disability and failing to recognize a dual-diagnosis may lead to stalled educational advancement and increased frustration for both learner and instructor. Moreover, as implied, the remedial process may become more complicated and require alternate approaches as well as greater intensity, frequency and duration. The second is related to the definition of LD and the link between the diagnosis of a LD and the ability to receive remedial services. If an individual has a speech or hearing disability this is bound to affect reading skill given the importance of accurate decoding (phonics skills) to reading and reading development. If this underlying phonics skill is negatively influenced by a speech or hearing disability it would seem that the diagnosis should remain within these realms, for instance, "a speech/hearing disability that is negatively influencing phonics/reading skill". However, given the high percentage of dual diagnosis it would appear that clinicians are opting to diagnose two separate disabilities. This may be directly linked to issues of funding and receipt of remedial services contingent upon particular diagnosis; it may reflect the lack of clear definitional criteria, it could be due to shortfalls in the referral process within institutional settings such as poor communication/interaction within multi-disciplinary teams surrounding differential diagnosis, and/or the order of service delivery within such teams, or some combination of all of these factors. Regardless, this is a significant issue at the policy level, in terms of 1) requiring particular diagnosis to attain service despite the domain through which the difficulties manifest themselves being identical (in our example difficulties with phonics/reading) and 2) with respect to the workings of multi-disciplinary teams within institutional settings.

Moreover, there appears to be a significant issue with the LDAC definition of LD considering the noted lack of specificity surrounding the origin of difficulties and a relatively poorly articulated means by which to apply the exclusionary criteria such that "unnecessary" dual diagnosis are avoided.

- Finally, participation in a remedial reading program in school was strongly associated with self-reported LD. In fact, participation in a remedial reading program is the strongest predictor, with a 16.9% increased probability, of a self-reported learning disability even after controlling for numerous confounds.

The influence of remedial reading programs on those with LD was illustrated in figure 2 where it can be seen that those who received remediation tended, as a group, to out perform those who did not, and yet their scores remained lower than the entire sample. Similarly, according to figure 3 non LD individuals who were remediated also remained below the performance of the entire sample. Comparing the two remediated groups at each level of literacy indicates that a much higher percentage of those with a LD are being provided with remedial services compared to those without a LD, despite similar levels of reading skill. This strongly suggests a referral bias in favour of those with a diagnosis of LD, which reflects poorly on policy makers who establish such criteria and on advocacy groups who push for diagnostic requirements in an environment where the goal should be to assist all learners develop their skills to their highest potential regardless of diagnosis. Diagnostic/assessment services may prove valuable in refining the specific nature of intervention programs provided to individuals, however intervention should not be contingent on a specific diagnosis of LD, nor should services be withheld until a formal assessment and diagnosis is complete.

However, it is also important to note that the only significant difference noted was between those with a LD who were remediated compared to those with a LD who were not remediated who were at Level 1 prose literacy. Thus, it would appear that in general, differences between the LD and non-LD groups, with and without remedial services, in terms of prose literacy scores are largely negligible. This appears especially true for the bulk of respondents who are functioning above level 1. At the lowest level of literacy it would appear that those with LD who receive remedial reading in school demonstrate performance commensurate with non-LD peers and higher levels of performance compared to non-remediated LD peers; yet the mean score for this LD remediated group remains solidly in Level 1. In general, it is likely given the results of intervention studies utilizing a pre/post test design, that remedial interventions benefit those who participate (Elbaum, Vaughn, Hughes, & Moody, 2000; McKenna, McMillan, & Dempsey, 2004; McKenna, & Violato, 2003), however, the mean scores of adults who reported participating in remediation versus those who reported not participating tend not to be significantly different. This would suggest the need to provide additional alternative supports such as accommodations to those in settings where reading prose is critical for success and/or providing remedial programming to adults to bolster limited skills. These results also call into question the need to diagnose a LD given the similarity of performance

of those with and without a self-reported LD on prose literacy.

Overall, these results help to clarify the relationship between self-reported LD and a variety of variables that have been previously established, through research or clinical practice, to be associated with LD. Policy implications are significant when considering the impact LD has on educational attainment as well as when recognizing the concordance between LD and hearing, speech and "other" disabilities. However, the most significant findings are 1) an apparent need for additional alternative supports for those with low literacy and 2) the lack of apparent utility of labelling individuals with a LD when considering the very similar levels of functioning with prose literacy of those with and without a LD, and what would appear to be similar outcomes in terms of prose literacy levels for those with and without a LD who receive remediation. This finding is consistent with recent research on the response to intervention of those who do and do not meet traditional criteria for a LD in the area of reading (Stuebing et al., 2009).

These trends have significant policy implications at both the micro and macro levels. Firstly, within schools, school districts, and the provinces, decisions need to be made regarding the distribution of resources. The current trend toward requiring extensive psycho-educational assessment and diagnosis by a trained professional requires large cash expenditures to retain those appropriately trained, as well as leading to long waiting times for students to acquire these diagnostic services prior to receiving remedial services. Moreover, the characteristics of those with the most common difficulty, phonological awareness and reading difficulties, and the interventions that can successfully address these deficits are widely known, such that classroom teachers are generally able to identify those with difficulties and special education services are able to implement programming that has been generally demonstrated to effectively address and remediate these difficulties if the interventions are locally available. In short, simple and inexpensive methods are available to identify children at risk for reading difficulties and, children and adults with reading problems; while specific, effective interventions can be made available if appropriate funding is allocated. Shifting resources from diagnostics to provision of service would allow for increased investment in remedial services, better programming and likely better outcomes for those who are experiencing difficulties.

Secondly, within the provincial and federal systems it may be prudent to move away from allocating financial resources, such as grants, tax incentives, funding for specific service and so forth, based upon formal diagnosis. Rather, services may be better provided and more equitably distributed to all who require intervention by focusing on issues of need based upon performance as identified by front-line workers (regular and special education teachers) or through population estimates adjusted for demographic characteristics. Again this would have the effect of providing more equitable access to all who require assistance. Related to this would be for Federal and/or Provincial governments to provide funding for the development of brief screening tests of reading skills (e.g. speed and accuracy of basic decoding and word identification

skills and perhaps of reading comprehension) designed to be used by front line workers that provide Canadian Normative data. Inexpensive screening tools created within a Canadian context would likely go far in reducing the cost, both in time and money, and increase the effectiveness and efficiency of identification of those with reading difficulties.

Given the number of individuals with low literacy skills, a significant concern is that only a relatively small percentage are receiving remedial services while in school (7.5% of the general population and 42% of those with a self-reported LD). The need for increasing the quality and provision of remedial reading services to those with relatively poor literacy skills while in school is supported given related research on this topic (Elbaum, Vaughn, Hughes, & Moody, 2000; McKenna, McMillan, & Dempsey, 2004; McKenna, & Violato, 2003). Yet, the need to specifically identify individuals as LD or non LD does not appear to be a meaningful exercise given the noted outcomes for these groups in the present study.

The categorization of LD was a significant step leading to the provision of services to those who were unable to access needed supports because, despite academic difficulties, they could not be categorized with the diagnostic labels available at that time in history. That situation has now been addressed; recognition and services are now available. However, history repeats itself in that now the rigidity associated with diagnosis has resulted in other large segments of the population being unable to access services since they do not meet diagnostic criteria and yet they struggle academically. New labels are not the answer, since it will simply recreate the same inequities. Rather a moving away from service provision based upon diagnosis has a greater probability of meeting the needs of a wider more diverse group of the population. Of course such suggestions will be met with hostility and fear by those who have a vested interest in the area of LD. However, this will largely be grounded in concerns about the loss or reduction of needed services. Actively allying these fears through implementation of remedial programming and continued support will go far to addressing these issues.

7 Key Findings and Policy Implications

Literacy

Key Findings

- Literacy scores are negatively influenced by a self-reported LD.
- The average difference between the prose literacy scores of those with and without a LD is approximately 15 points after controlling for other variables.

Policy Implications

- Those with a self-reported LD tend on the whole to score lower than those without a diagnosis, however, upon further analysis this relationship is only significant at level 1 prose.

Gender and Age

Key Findings

- Gender was not found to be a significant factor associated with LD.
- Age was determined to be significantly associated with LD and there was a progressive increase in the percentage of individuals reporting a LD at each 10 year interval. It is likely that the percentage of Canadians reporting a LD will continue to increase over the next decade and will likely exceed the estimated prevalence rate endorsed by LDAC of 10% of the general population, largely as a result of the current definition.

Policy Implications

- More emphasis needs to be placed on universal screening to ensure early identification of reading difficulties in both genders.
- With the progressive increase in the percentage of individuals reporting a LD at each 10 year interval combined with the new broader definition of LD provided by LDAC, the number of people with LD will likely continue to expand and along with this the demand for related services – services that educational institutions and workplaces are legally obliged to provide. The financial implications of this will likely be significant.

Education and Income

Key Findings

- Educational attainment and level of income were found to be significantly and negatively associated with LD.
- Father's education was not associated with LD.
- Mother's educational level, though small, was associated with LD, with higher levels of education being more predictive of a LD.

Policy Implications

- The apparent association of LD to early school departure is critical to explore given the clear links between this and a host of negative personal and social outcomes.
- It appears that learners with a LD who complete high school are choosing to continue their studies at the college level as opposed to the University level. Working toward having school personal express the same esteem for College and University PSE and emphasising the key differences in the nature of the training experience and job outcomes may lead to more individuals with LD remaining in school and pursuing PSE.
- Given the largely uni-directional relationship between education and income and literacy scores and income, policy implications lean largely on issues of early and continuing education.
- The relationship between lower levels of mother's education and less self-reported LD suggests more support needs to be provided to those families with lower levels of educational attainment in order to ensure early identification and intervention.

Reading Practices

Key Findings

- Reading practices, as measured by the reported number of books at home, were associated with self reported LD, with fewer books being more predictive of a LD.

Policy Implications

- Continued support of home literacy practices may be one means of enhancing literacy skill.

Related Disabilities

Key Findings

- Strong and robust associations to LD were noted for the presence of comorbid reports of hearing disabilities, speech disabilities, and other disabilities. Visual disabilities were not associated with LD.

Policy Implications

- Addressing the manifestation/symptoms should be the area of focus as opposed to diagnosis or differential diagnosis of particular disabilities.
- Frameworks for the interactions within multi-disciplinary teams should be established to limit unnecessary dual diagnosis.

Remedial Services in School

Key Findings

- Participation in a remedial reading program in school was the strongest predictor of self-reported LD.
- A much higher percentage of those with a LD are being provided with remedial services compared to those without a LD, despite similar levels of reading skill.
- In general, differences between the LD and non-LD groups, with and without remedial services, in terms of prose literacy scores are largely negligible.

Policy Implications

- Address the referral bias in favour of those with a diagnosis of LD to receive remedial programming, by focusing on the goal to assist all learners develop their skills to their highest potential regardless of diagnosis. Intervention should not be contingent upon a specific diagnosis of LD, nor should services be withheld until a formal assessment and diagnosis is complete.
- Provide additional alternative supports such as accommodations to those in settings where reading prose is critical for success and/or providing remedial programming to adults to bolster limited skills.
- Address the need for additional alternative supports for those with low literacy.
- Eliminate the need to label individuals with a LD considering the very similar levels of functioning with prose literacy of those with and without a LD, and similar outcomes for those who do and do not receive remedial services.
- Re-direct incentives related to diagnosis to the provision of services based upon need.
- Invest in the development of Canadian screening measures to facilitate identification of those requiring services.

Annex

TABLE 1

Regression Table for Prose

	Regression Model					
	1		2		3	
	coef	se	coef	se	coef	se
LD	29.146***	2.973	28.983***	2.965	35.012***	2.679
Gender			2.005	1.358	4.032***	1.204
Age 26 – 35					3.751**	1.847
Age 36 – 45					-7.780***	1.926
Age 46 – 55					-11.657***	1.765
Age 56 – 65					-31.739***	2.236
Age 65 +					-69.126***	2.059
Less than Grade 7						
Some High School						
PSE Non-University						
PSE University						
Mother's Education						
Father's Education						
Remedial Reading in School						
25 – 100 Books in Household						
100+ Books in Household						
Education Imputation						
Mother's Education Imputation						
Father's Education Imputation						
Remedial Reading in School Imputation						
Books in Household Imputation						
Cons	244.901***	2.890	244.034***	2.968	254.145***	2.822
Number of Observations	22,276		22,276		22,276	
Adjusted R^2	0.016		0.016		0.198	
Log-Likelihood	-120,794.72		-120,790.99		-118,505.87	

(Continued)

(Continued)

	Regression Model					
	4		5		6	
	coef	se	coef	se	coef	se
LD	20.150***	2.251	21.036***	2.244	20.990***	2.225
Gender	3.645***	1.059	4.229***	1.032	4.347***	1.028
Age 26–35	-11.198***	1.785	-5.636***	1.722	-4.672***	1.728
Age 36–45	-18.374***	1.771	-9.470***	1.743	-7.987***	1.751
Age 46–55	-19.222***	1.662	-8.786***	1.715	-6.884***	1.736
Age 56–65	-31.600***	1.988	-19.275***	2.070	-17.518***	2.099
Age 65 +	-55.043***	1.868	-43.264***	1.927	-41.477***	1.948
Less than Grade 7	-68.807***	2.456	-64.115***	2.427	-63.284***	2.440
Some High School	-24.954***	1.612	-22.259***	1.574	-21.622***	1.572
PSE Non-University	16.010***	1.422	14.531***	1.393	14.155***	1.385
PSE University	32.691***	1.487	28.037***	1.453	27.035***	1.451
Mother's Education			21.014***	1.159	18.731***	1.234
Father's Education					6.045***	1.220
Remedial Reading in School						
25–100 Books in Household						
100+ Books in Household						
Education Imputation						
Mother's Education Imputation						
Father's Education Imputation						
Remedial Reading in School Imputation						
Books in Household Imputation						
Cons	270.902***	2.585	252.569***	2.775	249.727***	2.819
Number of Observations	22,276		22,276		22,276	
Adjusted R^2	0.385		0.413		0.415	
Log-Likelihood	-115,544.73		-115,033.55		-114,996.08	

(Continued)

(Continued)

	Regression Model					
	7		8		9	
	coef	se	coef	se	coef	se
LD	17.637***	2.309	16.054***	2.134	15.526***	2.136
Gender	4.057***	1.027	3.406***	0.986	3.375***	0.986
Age 26–35	-5.049***	1.713	-4.551***	1.670	-4.700***	1.669
Age 36–45	-8.507***	1.732	-11.159***	1.677	-11.109***	1.675
Age 46–55	-8.023***	1.727	-12.138***	1.663	-11.968***	1.662
Age 56–65	-18.913***	2.092	-23.394***	2.020	-22.837***	2.020
Age 65 +	-42.965***	1.944	-44.256***	1.849	-43.065***	1.859
Less than Grade 7	-63.365***	2.439	-55.465***	2.432	-61.810***	2.674
Some High School	-21.564***	1.564	-18.694***	1.514	-18.991***	1.515
PSE Non-University	14.217***	1.383	11.922***	1.341	11.953***	1.341
PSE University	26.851***	1.450	22.871***	1.397	23.018***	1.396
Mother's Education	18.550***	1.228	14.966***	1.169	14.852***	1.170
Father's Education	5.976***	1.211	3.826***	1.157	3.793***	1.157
Remedial Reading in School	-9.757***	1.896	-10.447***	1.789	-10.561***	1.791
25–100 Books in Household			21.538***	1.560	21.191***	1.562
100+ Books in Household			36.720***	1.537	36.237***	1.539
Education Imputation					55.078***	2.671
Mother's Education Imputation						
Father's Education Imputation						
Remedial Reading in School Imputation						
Books in Household Imputation						
Cons	254.887***	2.923	236.538***	2.955	237.293***	2.957
Number of Observations	22,276		22,276		22,276	
Adjusted R^2	0.417		0.469		0.474	
Log-Likelihood	-114,949.40		-113,910.89		-113,810.27	

(Continued)

(Continued)

	Regression Model					
	10		11		12	
	coef	se	coef	se	coef	se
LD	15.561***	2.139	15.517***	2.143	15.543***	2.143
Gender	3.400***	0.983	3.421***	0.984	3.371***	0.984
Age 26–35	-4.711***	1.670	-4.693***	1.669	-4.646***	1.668
Age 36–45	-11.113***	1.676	-11.094***	1.675	-11.094***	1.675
Age 46–55	-11.983***	1.661	-11.981***	1.661	-11.938***	1.662
Age 56–65	-22.849***	2.020	-22.851***	2.019	-22.798***	2.018
Age 65 +	-43.118***	1.860	-43.101***	1.860	-43.085***	1.861
Less than Grade 7	-61.867***	2.684	-61.932***	2.687	-61.839***	2.689
Some High School	-19.034***	1.518	-19.018***	1.520	-18.969***	1.519
PSE Non-University	11.965***	1.341	11.931***	1.339	11.952***	1.339
PSE University	23.040***	1.396	23.003***	1.396	23.018***	1.396
Mother's Education	14.964***	1.192	15.053***	1.200	15.079***	1.200
Father's Education	3.799***	1.157	3.592***	1.196	3.574***	1.196
Remedial Reading in School	-10.550***	1.791	-10.518***	1.791	-10.544***	1.791
25–100 Books in Household	21.185***	1.561	21.162***	1.558	21.173***	1.558
100+ Books in Household	36.241***	1.538	36.198***	1.532	36.228***	1.532
Education Imputation	55.049***	2.678	55.203***	2.684	55.198***	2.686
Mother's Education Imputation	1.032	2.227	1.872	2.542	1.901	2.541
Father's Education Imputation			-1.599	2.255	-1.586	2.255
Remedial Reading in School Imputation					-47.063***	17.297
Books in Household Imputation						
Cons	237.137***	2.967	237.324***	2.966	237.286***	2.966
Number of Observations	22,276		22,276		22,276	
Adjusted R^2	0.474		0.474		0.474	
Log-Likelihood	-113,809.82		-113,808.87		-113,799.15	

(Continued)

(Concluded)

	Regression Model 13	
	coef	se
LD	15.550***	2.142
Gender	3.407***	0.985
Age 26 – 35	-4.590***	1.669
Age 36 – 45	-11.048***	1.674
Age 46 – 55	-11.895***	1.661
Age 56 – 65	-22.794***	2.017
Age 65 +	-43.046***	1.860
Less than Grade 7	-61.856***	2.688
Some High School	-18.966***	1.519
PSE Non-University	11.955***	1.339
PSE University	23.020***	1.396
Mother's Education	15.054***	1.200
Father's Education	3.570***	1.196
Remedial Reading in School	-10.532***	1.791
25 – 100 Books in Household	21.304***	1.569
100+ Books in Household	36.357***	1.542
Education Imputation	55.239***	2.686
Mother's Education Imputation	1.868	2.542
Father's Education Imputation	-1.669	2.258
Remedial Reading in School Imputation	-47.032***	17.307
Books in Household Imputation	11.209**	4.743
Cons	237.117***	2.972
Number of Observations	22,276	
Adjusted R^2	0.474	
Log-Likelihood	-113,797.35	

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