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The Effects of Extended Time on the Writing of Students with Learning Disabilities:
Maximum Potential or Differential Boost?

by

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Abstract

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Extended time is the most common accommodation requested by post-secondary students with learning disabilities (LD; Lovett, 2010; Ofiesh, 2000; Zuriff, 2000). However, this accommodation has been the topic of much debate (see: Lovett, 2010). Two theories have emerged on this topic, the Maximum Potential Thesis and the Differential Boost Hypothesis (Sireci, Scarpati & Li, 2005; Zuriff, 2000). The current study examines these theories within the context of writing to investigate the performance of students with LD and their non-LD peers. The results do not show support for either theory, when it comes to essay writing across a qualitative dimension (WIAT-II Essay Composition). However, there does appear to be some evidence for the Differential Boost Hypothesis in the areas of word count, which could be considered a quantitative measure of performance. Compared to their performance under regular time conditions, with extended time students with LD wrote more than twice as many additional words compared to their non-LD peers. This research is important so that empirically-informed accommodations for students with LD can be implemented. Recommendations for future research are provided.
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Dedication

To my parents Vince and Lorrie Goegan, I couldn’t have done this without you. Thank you for all of your support along the way.

I also dedicate my thesis to fellow individuals with LD. Never give up on your dreams.
Introduction

Extended time is the most common accommodation requested by post-secondary students with learning disabilities (LD; Lovett, 2010; Ofiesh 2000; Ofiesh, Hughes, & Scott, 2004; Zuriff, 2000). Research in this area has examined various subjects (e.g., reading, mathematics) and age groups (e.g., elementary, high school). Based on the research that has been conducted, two theories have emerged regarding the efficacy of extended time: The Maximum Potential Thesis (MPT) and the Differential Boost Hypothesis. The MPT suggests that extended time is an appropriate accommodation for students with LD because they are benefiting from extended time. Conversely, students without LD do not benefit from additional time and therefore are already performing at their “maximum potential” (Lovett, 2010, p. 622; Stretch & Osborne, 2005; Zuriff, 2000). However, evidence for this theory is not consistently found in the research (e.g., Zuriff, 2000). The Differential Boost Hypothesis suggests that all students benefit from extended time to some degree, but that there is a differential boost in scores for students with LD whose performance improves significantly more than students without LD (Fuchs & Fuchs, 2001; Lewandowski, Lovett & Rogers, 2008; Sireci, Scarpati & Li, 2005). This theory has been more consistently found in the research (e.g., Sireci et al., 2005). However, the research that has examined these theories has not been extensive and consistent findings are difficult due to the various ages, course content and time conditions that have been examined.

Furthermore, research on the effects of extended time on the writing quality of students with LD is extremely limited. The lack of research on extended time in writing is surprising given that students with LD continue to experience challenges with writing even when they have developed ways to compensate for reading difficulties (Li & Hamel, 2003). Furthermore,
students with LD in higher education have reported that writing is an area of great academic concern (Hatcher, Snowling, & Griffiths, 2002). Therefore, because writing is an area of ongoing difficulty and personal concern for students with LD, investigating accommodations for writing difficulties within the frameworks of MPT and Differential Boost is important.

Writing is a cognitively demanding task that engages multiple linguistic and cognitive processes within a limited Working Memory system (WM; Berninger & Amtmann, 2003; McCutchen, 1996). The roles of these various processes in writing have been examined in students with LD at the post-secondary level, but there has been little investigation of whether students’ writing improves when given extended time. Based on a review of the literature examining writing of post-secondary students with LD, it appears that a lack of automaticity in lower-order aspects of writing (e.g., handwriting fluency) uses up WM resources available to perform the higher-order aspects of writing (e.g., organization) for these students (Connelly, Dockrell, & Barnett, 2005; Connelly, Campbell, MacLean, & Barnes, 2006; Harrison, 2009).

Extended time is provided as an exam accommodation at post-secondary institutions presumably to allow students the opportunity to demonstrate their knowledge on a topic (Ofiesh, Hughes & Scott, 2004) without having to reduce the quality of their writing because of the speed and efficiency necessary under time constraints (Lindstrom, 2007). However, this presumption has not been empirically validated in the research, but rather extrapolated from what is known about LD and writing and exam accommodations separately and through anecdotal evidence.

Therefore, this thesis begins by defining LD and describing the linguistic and cognitive profiles of students with LD. Next, the literature is reviewed focusing on the accommodation of extended time generally, and then examines the MPT and Differential Boost theories and the research that has been conducted within these frameworks. Next, a contemporary theory guiding
the proposed research—the *Functional Writing System*—that elucidates the cognitive, linguistic, and literacy processes and skills required when writing is described (Berninger & Amtmann, 2003). Following the description of the *Functional Writing System*, a review of the research on writing of students with LD elucidates the challenges these students face when it comes to writing. Finally, the role of extended time in the context of writing for LD students is extrapolated from what is known about each of these areas individually to provide a framework for the current study. The issue of providing students with extended time to complete exams is an important area of consideration, as more students with LD are pursuing post-secondary education now than in the past (Lindstrom, 2007; Ofiesh, et al., 2004) and determining appropriate accommodations, such as extended time for exams, is critical to student retention, academic success, and future employment opportunities. Therefore, the current study examined the theories of MPT and Differential Boost on writing tasks to provide insight into the efficacy of the accommodation of extended time for students with LD. The following research questions were posed: (1) Does extended time improve (i.e., increase) the scores obtained on written essays? (2) If there are increases in writing performance with extended time, do students without LD also benefit? (3) Is there evidence of the MPT or Differential Boost Hypothesis in the writing performance of students when comparing LD and non-LD students? (4) If writing performance does improve with extra time, then what aspects of writing (i.e., lower-order, higher-order or both) improve?

**Learning Disabilities**

For the purposes of this paper, Learning Disabilities (LD) will be defined using Government of British Columbia (BC Ministry of Education) criteria, a definition which is based
on the diagnostic criteria adopted by the Learning Disabilities Association of Canada. According
to the BC Ministry of Education (2011), the definition of a Learning Disability is as follows:

Learning Disabilities refer to a number of conditions that might affect the acquisition, organization, retention, understanding or use of verbal or nonverbal information. These disorders affect learning in individuals who otherwise demonstrate at least average abilities essential for thinking and/or reasoning. As such, learning disabilities are distinct from global intellectual disabilities.

Learning disabilities result from impairments in one or more processes related to perceiving, thinking, remembering or learning. These include, but are not limited to language processing, phonological processing, visual spatial processing, processing speed, memory, attention and executive functions (e.g., planning and decision making). Learning disabilities vary in severity and may interfere with the acquisition and use of one or more of the following: oral language (e.g., listening, speaking, understanding) reading (e.g., decoding, phonetic knowledge, word recognition, comprehension) written language (e.g., spelling and written expression) mathematics (e.g., computation, problem solving). (p. 6)

Learning disabilities impact the learning and development of students in a number of ways and to varying degrees. Of the population of students with LD, those with dyslexia comprise the largest category (Hatcher et al., 2002). These students have difficulties in processing language, primarily in the phonological aspects of language that requires the ability to analyze, produce and manipulate speech sounds of spoken words (Hatcher et al, 2002). These challenges impact students’ abilities to perform a variety of literacy based activities. All studies reviewed in this thesis involved student participants who were categorized as LD and given such classification based on meeting diagnostic criteria (i.e., DSM-IV-TR) for LD or based on the specifications of the setting from which these students were recruited.

Students with LD have difficulties with phonological aspects of language that persist into adulthood and that impact their ability in a number of ways (Stothers & Klein, 2010; Trainin & Swanson, 2005; Wilson & Lesaux, 2001). For instance, a lack of age-appropriate phonological
awareness (i.e., representation and manipulation of the sounds in oral language) can lead to difficulties with phonological decoding, word reading, reading fluency and spelling (Gregg et al., 2008; Kemp, Parrila & Kirby, 2008; Mody, 2003; Trainin & Swanson, 2005). Such deficits can significantly impact reading and written language performance (Gregg et al., 2008).

Furthermore, students with LD have been found to have significantly lower scores than their peers on measures assessing processing speed, short-term memory and WM (Jones, Obregón, Kelly & Branigan, 2008; Mody, 2003; Trainin & Swanson, 2005), suggesting that there are particular processing deficits that are common across students with LD.

The work of Hatcher and colleagues (2002) provides important insights into the profiles of students with LD, in particular, those with dyslexia. In an effort to develop a brief assessment battery for identifying students with dyslexia, these researchers administered multiple measures assessing various cognitive abilities and literacy skills to students with and without dyslexia at the post-secondary level. Hatcher and colleagues found that students’ deficits in the area of phonological awareness persisted into adulthood. Furthermore, speed of processing and short-term memory continued to be significant challenges for these students. Hatcher and colleagues suggest that a diagnosis of dyslexia can be confirmed through the use of only four measures: spelling, non-word reading, digit-span (i.e., the sequential memory for a series of numbers) and writing speed.

Building on the findings of the research team of Hatcher and colleagues, Tops, Callens, Lammertyn, Van Hees and Brysbaert (2012) aimed to replicate the research findings and determine if a reliable diagnosis was possible with a small number of tests or if a wider battery of measures was required. Tops and his research team determined that there were three tests sufficient to diagnose adults with dyslexia: word reading, spelling and phonological awareness.
Furthermore, they suggested as a result of the inclusion of literacy based measures in their shorter means to identify students with dyslexia, that there was evidence to suggest that these individuals continue to have difficulties with reading and writing into adulthood.

Thus, research supports a shared cognitive and linguistic profile among LD students, particularly students with dyslexia. However, research results have yielded inconsistencies in the recommended measures for a brief assessment for dyslexia, with some studies suggesting spelling, non-word reading, digit-span (i.e., the sequential memory for a series of numbers) and writing speed and others suggesting word reading, spelling and phonological awareness. This discrepancy could be the result of language differences as the sample of Hatcher and colleagues (2002) consisted of students whose primary language was English, while Tops and his research team (2012) assessed a Dutch population. Furthermore, Hatcher and colleagues assessed a small sample of participants from a single university, while Tops and his team had a much larger and more diverse sample. Regardless of differences of opinion on the optimal assessment battery, it can be proposed that students with LD have deficits in a number of specific areas when compared to their peers which impacts their performance in a number of academic areas. The current research investigated various cognitive and linguistic measures (e.g. spelling, word and non-word reading, digit-span, and phonological knowledge) to examine the profiles of these students compared to their typically achieving peers. These measures provide important information to compare components of the writing measures under regular and extended time.

As a result of the challenges experienced by students with LD, classroom assessment practices at post-secondary levels (e.g., examinations) may not adequately reflect students’ acquired knowledge and may instead assess construct-irrelevant variance (e.g., barriers to performance that are created by the disability) in test performances (Fuchs & Fuchs, 2001;
Lovett, 2010). For example, if a student is completing a reading comprehension task, reading speed may prevent the student from completing the test within the standard time allotted. As a result, students with LD may be unable to access the text content as quickly or easily as their non-LD peers. Therefore, to eliminate variance in scores not related to the construct being measured, accommodations are frequently put into place. In this example, extended time could be provided to the student so a slow reading speed would not impact the student’s ability to complete the task.

**Accommodations**

For the purpose of this study an accommodation will be defined as an “intentional change to the testing process designed to make the test more accessible to students with disabilities” (Sireci, Scarpati & Li, 2005, p. 460). The goal of accommodations is to allow the performance outcomes obtained by students with disabilities to be representative of the same attributes, abilities and knowledge as their peers (Gregg & Nelson, 2010; Lovett, 2010). This goal has often been referred to as “leveling the playing field,” resulting in assessment approaches that are “fair” for all students (Lovett, 2010; Zuriff, 2000). Through the implementation of accommodations, performance may be compared amongst students as the test is now presumably measuring the same construct (e.g., knowledge or learning) for all test takers, thereby reducing or eliminating construct-irrelevant variance (Lovett, 2010).

Without proper accommodations, students may be prevented from demonstrating their true abilities on a task (Fuchs & Fuchs, 2001). This issue continues to gain importance as the number of students with LD at the post-secondary level continues to grow (Lindstrom, 2007; Ofiesh, et al., 2004). Appropriate accommodations for a particular individual should be based on multiple sources of information (Lindstrom, 2007), including up-to-date disability
documentation (e.g., psychoeducational assessments) and supplementary information (e.g.,
teacher reports; Ofiesh et al., 2004).

For accommodations to be put into place, the disability must be evaluated in terms of its
“functional impact” (i.e., how it “impedes a major life activity” such as learning; Ofiesh, et al.,
2004, p. 58). Based on this evaluation, disability service providers within post-secondary settings
determine the “reasonableness” of the accommodations requested (Ofiesh, et al., 2004, p. 58).
For example, a test accommodation should not be implemented if it accommodates non-
disability related factors (e.g., text anxiety, test-taking skills) that can impact all students (Ofiesh
& Hughes, 2002). The results of the measures administered through a psychoeducational
assessment provide valuable information regarding suitable accommodations for a particular
individual.

One important processing area assessed during the psychoeducational assessment for the
LD population is speed of processing. Measures examining this construct were developed to
assess a student’s speed of performance on a task by measuring correct responses within a time
constraint (Ofiesh, 2000). It has been found that students with LD often have a slower speed of
processing compared to their peers (Hatcher et al., 2002; Ofiesh, 2000), resulting in slower rates
of performance (Ofiesh & Hughes, 2002). Poor performance on timed tasks may reflect deficits
in lower-order cognitive processing such as a failure to automatize very basic skills (Ofiesh,
2000). In exam situations this can prevent students with LD from completing the test in the
allotted time (Lesaux, Pearson & Siegel, 2006). As a result, extended time is often implemented
as an examination accommodation.

Extended time as an accommodation has been an issue of debate, and a number of
arguments have been put forward. Firstly, some exams have a critical component to them that
requires speed and efficiency (Oflesh, 2000). Doctors training in emergency medical care will need to take examinations with time constraints to ensure they are able to perform under time pressure and be successful in time-sensitive situations. In these instances an accommodation of extra time might not be appropriate as the construct that is being measured is directly related to speed and extended time could create a confound and threaten the construct validity of the results (Gregg & Nelson, 2010).

Other arguments in this debate suggest that all students would benefit from additional time, and therefore it is not an appropriate accommodation (Lovett, 2010; Zuriff, 2000). This position is difficult to defend as “benefit” has not been adequately defined. Typically, a “benefit” is suggested when test scores increase if the student is given additional time. However, in the research that will be reviewed, it is not always the case that students benefit from additional time as results vary depending on the methods and research designs utilized (Sireci et al., 2005; Zuriff, 2000). A review of research examining the impact of extended time will be presented in the subsequent section.

**Extended Time and the Maximum Potential Thesis**

Issues pertaining to the “fairness” (Sireci et al., 2005, p. 458) of extended time for students with LD has led to the investigation of the Maximum Potential Thesis (MPT; Zuriff, 2000). According to MPT, only students with LD would benefit from extended time because students without LD are already performing at their “maximum potential” under the regular time (Lovett, 2010, p. 622; Stretch & Osborne, 2005; Zuriff, 2000). For the hypothesis to be valid and the provision of an accommodation appropriate for students with LD, two findings need to be present in the research. Firstly, students with LD should show significantly improved scores when given additional time compared to their scores under the standard time condition.
Secondly, students who do not have LD should not score significantly higher on extended time conditions than their scores on the test when given standard time (Sireci et al., 2005). Both of these behaviours must be present, or the MPT does not hold and the accommodation may not be appropriate.

A number of researchers have investigated the validity of the Maximum Potential Thesis. The first of note is the work of Zuriff in 2000, who reviewed five studies to investigate the validity of the MPT for post-secondary students with LD. The analysis allowed for multiple comparisons of students with LD and their non-LD peers. The author examined performance under regular and extended time conditions (e.g., untimed) on a variety of measures (e.g., Nelson-Denny Reading Test, American College Test), and found that on all but one of the comparisons the performance of students with LD significantly improved with extended time. However, it was also found that in half of the comparisons, students without LD also obtained scores that were significantly higher when they received extended time. Therefore, Zuriff concluded that there was inconsistent support for the Maximum Potential Thesis.

However, there are a number of shortcomings when it comes to the studies reviewed by Zuriff (2000). Firstly, as noted by Sireci, Scarpati and Li (2005), only one of the studies reviewed was a published study, the remaining four were doctoral dissertations that were never published. In addition, these studies were conducted between 1984-1993, which could impact their relevance in terms of design and methodology, or interpretations over 20 years later. Furthermore, the studies investigated in the review were limited to multiple choice reading exams (e.g., the Nelson-Denny Reading Test) and therefore could not be generalizable to other types of tasks such as writing.
The MPT was examined more recently in the research of Sireci, Scarpati and Li (2005). In their comprehensive meta-analysis, 59 studies that examined accommodations for students with disabilities within various contexts were reviewed. Of the studies included in the meta-analysis, 14 addressed the question of extended time as a test accommodation. It should be noted, however, that the studies included in the review were not limited to students with LD. Nevertheless, of the articles examining extended time, most were specific to LD, while the remaining articles included students with various disabilities (e.g. learning disabilities, motor disabilities, and sensory disabilities) of which LD made up the largest proportion of these students.

Within the articles investigating extended time, Sireci and colleagues (2005) found that while extended time tended to improve the performance of all students, the gains were significantly greater for those with disabilities. Support for the MPT was found in about half of the studies reviewed, and in the instances where it was rejected, this rejection was generally a result of the gains experienced by those students without LD, similar to the findings of Zuriff (2000). However, generalizing from the research reviewed can be problematic due to the heterogeneity of the students who participated, the various subject matters examined and the educational levels of the students involved. Furthermore, writing was not examined in any of the research studies reviewed; therefore, more research is needed to explore how the accommodation of extended time may impact the writing performance of students with LD.

Since the reviews of Zuriff (2000) and Sireci and colleagues (2005), a number of research studies have continued to investigate the role of extended time (e.g., Lesaux, Pearson & Siegel, 2006; Lewandowski, Lovett & Rogers, 2008). For example: Lesaux and colleagues (2006) studied the reading comprehension skills of students with reading disabilities (based on scores at
the 25th percentile or lower on a word identification measure) in comparison to average and above average readers on a reading comprehension task. The Nelson-Denny Reading Test (NDRT) was administered twice under regular time (20 minutes) and an untimed condition (where students were told to work at their own pace, but were stopped at 40 minutes) across the groups. Two equivalent forms of the NDRT were counterbalanced across groups and time conditions. Scores on the reading comprehension task were compared between the time conditions and group status.

The results indicated that across the regular time condition there was a significant difference in test scores, with the normally achieving participants outperforming the students with LD. Furthermore, all of the students with LD increased their performance on the NDRT when comparing their scores between regular and extended time conditions. While the normally achieving peers showed some improvement when given extended time, the percentile scores attained for these groups were not significantly different. Therefore, although the normally achieving peers’ performance did improve to some degree, their scores were similar under the timed and untimed conditions, while the students with LD benefited significantly from additional time. These authors take their findings to suggest that extended time during examinations is an appropriate accommodation for those students with reading disabilities. In addition, the results of the study by Lesaux and colleagues (2006) do not provide support for the MPT as all students benefited from extended time, but the students with LD benefited significantly more when comparing their scores on the regular and extended time conditions.

The work of Lewadowski and colleagues (2008) provides less consistent results compared to the previous research. In their investigation of extended time, these researchers attempted to avoid ceiling effects found in the research discussed previously in the review of
Zuriff’s (2000) study. Lewadowski and colleagues (2008) administered students the Nelson-Denny Reading Test, but rather than providing the students with the standard 20 minutes suggested in the test manual, the authors gave students 13 minutes for the “regular” time condition and 50 percent more time in the extended time condition. The researchers found that students without LD performed better than students with LD when given extended time.

However, the shortcoming of this conclusion relates to the processing speed deficits discussed earlier. Students without LD were able to answer more questions, and therefore their scores increased. For students with LD, their speed of processing on such a task creates construct-irrelevant variance that accommodations are designed to eliminate. By providing students with a regular time condition which is less than suggested for one to complete the task, it creates an inappropriate end time for the test to be completed it. Furthermore, the differences between the two groups is only exacerbated when the suggested amount of time is provided as the extended time condition. The processing speed challenges of the students with LD are not accommodated with this type of extended time condition as it is the suggested time needed to complete the task. This research design impedes the students with LD from completing the task to the same level. Therefore, in their attempt to remove ceiling effects, the construct irrelevant variance of processing speed impacted the results obtained, particularly for those with LD who have been found to have difficulties in this area (Ofiesh, 2000).

The group difference is further evident in the analysis of the items attempted as there was a significant group by time interaction. Students without LD were able to attempt more items in the standard time condition, and this difference became significantly larger during the extended time condition. However, the researchers also noted that extended time did allow the students with LD to attempt a comparable amount of questions as their non-LD peers under the standard
time condition. This finding could be taken to show support for extended time as an exam accommodation wherein students with LD with extended time were able to perform at a level similar to their non-LD peers under standard time because the construct-irrelevant variance of processing speed was eliminated or reduced.

In summary, research investigating the MPT has examined extended time, particularly in the areas of reading and mathematical calculations, and found that students without LD often also benefit from extended time, but not to the same extent as their LD peers (Sireci et al., 2005; Zuriff, 2000). This finding is inconsistent with the MPT, as students without LD are considered to already be performing at their “maximum potential” (Stretch & Osborne, 2005; Zuriff, 2000). Therefore, it is unclear how to determine the appropriateness of providing accommodations for students with LD when everyone might benefit. Students who are given additional time for exams, should be so provided based on multiple sources of data including information from their individual psychoeducational assessments (Lindstrom, 2007; Lovett, 2011; Ofiesh et al., 2004). Students are typically provided with time and a half or double time (Lovett, 2011; Ofiesh, & Hughes, 2002), with some research suggesting that time and a quarter, might be sufficient for students with disabilities (Lovett, 2011, Cahalan-Laitusis, King, Cline, & Bridgeman, 2006). Therefore, more research in this area is needed to examine extended time as an accommodation for students.

The interaction between extended time and group membership (students with disabilities and those without) needs to be examined further. This interaction is described in the Differential Boost Hypothesis (Fuchs & Fuchs, 2001; Lovett, 2010) which suggests that appropriate accommodations will lead to greater improvement in scores for students with disabilities than for their non-disabled peers. Differential boost is supported in the research reviewed, but the amount
of “boost” needs to be qualified. For example, how much of an improvement in test scores needs to be exhibited by those with LD, compared to their non-LD peers for one to be able to suggest that students with LD are “benefiting” significantly more. This qualification will provide important information to psychologists who recommend extended time for students as an accommodation and those campus disability resource centre facilitators who implement these recommendations to determine if the accommodation of extended time is appropriate (Sireci et al., 2005). Therefore, future research is needed to investigate the role of Differential Boost in determining appropriate accommodations for students with LD.

A question that still needs to be asked is how a “benefit” from extended time within the context of writing can be operationally defined. For reading comprehension and mathematical problem solving, benefit can be inferred by the number of items correctly answered within the designated time. The term “benefit” creates challenges when it comes to the writing process as there are more elements involved than simply assessing right or wrong responses. In the context of writing, more productivity does not imply better quality. Furthermore, would more productivity (i.e. more words on the page) be sufficient to suggest a “benefit” from extended time? Therefore, determining the “benefits” of additional time in the context of written composition may be challenging. As a result, a review of the model of writing that will provide the framework for the examination of writing within the context of extended time will be undertaken before investigating the literature on LD and writing. Following this discussion, the role of extended time within the context of writing for these students will be investigated to provide perspective for the current study.
Model of Writing

The Functional Writing System is a framework for conceptualizing the component processes involved in writing wherein writing can be perceived as a triangle with transcription (e.g., handwriting, spelling) and executive functions (e.g., planning, reviewing, revising) at the two base points supporting the writing process, and text generation (e.g., words, sentences) at its apex (Berninger & Amtmann, 2003). Working memory operates at the center, activating both long-term and short-term memory during composition and review (Berninger & Amtmann, 2003; McCutchen, 1996). Transcription provides a foundation for developing writers (e.g., early elementary) as students learn how to form and spell words necessary for text generation. As development continues, the executive functions of planning, reviewing and revising assume a more dominant role in the writing process. The elements of planning, reviewing and revising develop with support from teachers and parents, and over time these components become more self-regulated and less dependent on support (Berninger & Amtmann, 2003). Based on this structure, writing can also be conceptualized as lower-order skills (e.g., spelling, handwriting, punctuation) that are involved in transcription, and higher-order skills (e.g., planning, organization, revising), that are associated with executive functioning processes.

Berninger and Amtmann’s model is influenced by the work of Flower and Hayes (1981). Their Cognitive Theory of Writing conceptualizes the writing process as a series of recursive stages that involve planning, translating and reviewing. In later revisions to their influential model, translation encompasses the processes of text generation and transcription while reviewing is discussed as revising (Hayes, 2006). In text generation, writers translate their ideas into language (i.e., words and sentences). During transcription, the writers rely on their handwriting and spelling skills to translate language into a written text. Their work recognizes
writing as a cognitively complex task that requires the coordination of many components at the same time. The *Functional Writing System* builds on this earlier work by proposing a WM framework where transcription and executive functions support the writing process and text generation.

Within the *Functional Writing System* framework, WM is described as a capacity-limited resource (McCutchen, 1996). Therefore, to allow greater involvement of executive functions in the writing process, lower-order writing skills must become automatized to free up resources available for the higher-order skills. Automatization is considered to be present when the writer has developed sufficient fluency or efficient execution of lower-order processes involved in transcription skills (Peverly, 2006), allowing other, potentially higher-order components, to draw on more resources and thereby increasing their role in text generation.

The writing system must develop balance between the demands of the various components involved in writing so that all the processes are coordinated efficiently (Torrance & Galbraith, 2006). Without this balance, multiple processes must compete for valuable resources interfering with various writing components’ outputs (Torrance & Galbraith, 2006). Therefore, composing written text can be described as a cognitively demanding task that requires the integration of multiple processing demands including various lower- and higher-order skills (Harrison, 2009; McCutchen, 2000). The already cognitively-demanding task of writing can pose challenges for some writers, particularly those with LD, when limited resources are utilized where automaticity should have occurred (e.g., transcription). Therefore, lack of automaticity can have a detrimental impact on students’ writing. The *Functional Writing System* provides a guiding framework for many studies that have investigated the role of handwriting fluency and
automacy in transcription skills. The studies below focus on the specific case of university-level writing.

**University Writing**

Assessment of learning at the post-secondary level can rely heavily on a student’s writing skills (Connelly et al., 2006). A number of studies have examined the factors involved in writing at the post-secondary level and handwriting has been of particular interest. Connelly and colleagues (2005) studied whether slow handwriting influenced essay writing performance under non-pressurized (practice essay during tutorial) and pressurized (essay question as part of an examination) conditions. Handwriting speed was assessed based on the measure produced by Berninger, Mizokawa and Bragg (1991). In this task, students were told to write the letters of the alphabet in order and in lowercase as quickly and accurately as they could in one minute. Connelly and his team (2005) found that handwriting fluency was not associated with performance on the non-pressurized class essay. However, when it came to the pressurised condition, handwriting fluency accounted for a significant amount of the variance associated with writing quality as measured by the participants’ overall marks on the exam essays.

Connelly and colleagues (2005) interpreted their findings to suggest that lower-order processes can constrain the higher-order skills necessary for writing tasks, and this is influenced by the demands of the task, consistent with the *Functional Writing System*. Interestingly, Connelly and colleagues reported that it was not the introduction that correlated with handwriting fluency, but rather more the body of the text and in particular the conclusions that were written. It would seem that the time involved to write the essay influenced the writing produced. Slower writers seemed to run out of time to produce proper body- and conclusion- sections but had sufficient time to produce introductions. Furthermore, a number of students did
not have time to write a conclusion, putting the overall quality of their written product at a clear disadvantage. Therefore, handwriting fluency not only impacts the quantity of writing produced, but also the quality.

These findings are supported by research by Olive and Kellogg (2002) who studied adults’ writing using their typical handwriting (an automatized process) and an unpracticed uppercase script (non-automatized process). Olive and Kellogg suggest that adults with slow handwriting, as exhibited through the unpracticed script, may be limited in their ability to perform higher-order processes involved in writing because of the strain that is placed on WM by the non-automatized skills involved in transcription (i.e., lower-order skills).

These findings are also consistent with Peverly (2006) who suggested that the greater the transcription speed of written production (and by association, automaticity), the less strain will be placed on WM. Therefore, writers will be able to use the limited resource capacity of WM for higher-order processing. Peverly’s descriptive review of the literature indicated that handwriting processes compete for WM resources in writers, and that individual differences in handwriting speed are related to the length and quality of essays produced. Moreover, Peverly suggested that individual differences in writing fluency can differentiate adults who have difficulties with writing from typically-achieving peers.

This research is consistent with the Functional Writing System in that a limited amount of cognitive resources are available in the writing process, and an increase in demands in one area will result in fewer cognitive resources available for other areas. As a result, if a student has not automatized the lower order transcription skills necessary to write the essay, constraints are placed on the higher order skills which can impact the quality of the writing being produced. The
effects of such constraints can be further impacted by the additional cognitive load associated with examination writing.

This review has highlighted the theoretical importance of automatized lower-order transcription skills in the production of quality writing. It has also emphasized the empirical support for a capacity-limited WM system in which writing processes must coordinate (Berninger & Amtmann, 2003; McCutchen, 2000). Post-secondary students with LD frequently have documented difficulties with writing tasks due to WM and processing deficits (Lindstrom, 2007). At the same time, writing is a necessary skill, as students are required to write for most of their coursework and assessment tasks. A review of post-secondary writing research in the context of LD provides a further background for the current study.

Learning Disabilities and Writing

Among the population of students with LD, it is suggested that a majority experience written language difficulties involving mechanical (i.e., lower order skills) and compositional characteristics (i.e., higher order skills; Berninger, 1999; Harrison, 2009; Lindstrom, 2007). One explanation for these difficulties may be that processing speed deficits, characteristic of students with LD, may be related to a failure to automatize very basic skills (Ofiesh, 2000). This lack of automatization could be further impacted by the limited capacity of WM (McCutchen, 1996). These writing difficulties can become exacerbated in higher levels of education where there are more curriculum demands and teacher expectations that can compound challenges with writing (Li & Hamel 2003; Lindstrom, 2007).

A number of studies have examined the writing skills of post-secondary students with LD (see Li & Hamel, 2003). In a synthesis of the literature, Li and Hamel (2003) investigated the characteristics and error patterns in the writing of post-secondary students with LD and writing
difficulties. Only seven articles were included in their examination on this topic. Therefore, a rich body of empirical research is lacking in this area. Nevertheless, Li and Hamel (2003) highlighted two categories of errors: mechanical (e.g., spelling, punctuation) and content (e.g., planning, organization). These two categories were consistent with the Functional Writing System which groups writing into lower- and higher-order skills (Berninger & Amtmann, 2003). Of particular concern are the lower-order skills as they are suggested in this framework to limit the resources available to higher-order processing.

**Lower-Order Skills Involved in Writing**

**Spelling difficulties.** Spelling can be challenging for many students with LD, particularly those with dyslexia as they have difficulty mapping the speech sounds to the corresponding letter sequence (Hatcher et al., 2002). Difficulties with sound-letter connections hinder children’s development and storage of lexical knowledge (Ehri, 2000). These difficulties with phonological processing and letter sound connections typically persist into adulthood and can result in slow speed for reading, poor spelling and challenges with written expression (Hatcher et al., 2002; Connelly, et al., 2006).

The literature reviewed by Li and Hamel (2003) found that writers with LD made significantly more spelling, punctuation and capitalization errors than their non-LD peers. This finding appears consistent across a number of research studies that have since been conducted (Connelly, et al., 2006; Harrison & Beres, 2007; Harrison, 2009). When examining spelling within these studies, differences emerge when comparing spelling within the context of composition and in isolation. Harrison and Beres (2007) found that students with writing difficulties produced more spelling errors in their essays compared to their peers, but spelling differences compared to controls were not noted in their dictated spelling measure (Harrison,
This was also found in the research by Connell and colleagues (2006). Furthermore, Connelly and his team (2006) found that students with dyslexia also produced more spelling errors during the essay task than peers in a spelling-skilled matched group based on a dictated spelling measure, the Wide Range Achievement Test–3rd Edition (WRAT-3; Wilkinson, 1993).

These findings could be the result of the capacity-limited nature of WM within the context of writing (McCutchen, 2000), which may not be evident when producing words in isolation from dictation, but becomes apparent when the cognitive demands of the task are greater (e.g., essay composition) and more processes are vying for the limited resources available. Students with LD are known to have challenges with WM and, within a capacity-limited system, it may reduce their ability to cope with the same level of demands when engaged in a writing task compared to other students without memory challenges (Connelly et al., 2006).

According to the Functional Writing System, spelling is a lower-order (i.e., transcription) skill that competes for cognitive resources, especially when it has not become automatized (Berninger & Amtmann, 2003; McCutchen, 1996), leaving fewer resources available for other processes, which can result in less text produced, more spelling errors and reduced lexical diversity (Harrison, 2009).

**Handwriting fluency.** Considerable research has examined handwriting fluency and its connection to writing. Hatcher and colleagues (2002) conducted a cognitive assessment of students with dyslexia and found that these students wrote more slowly than control participants. This finding was supported by the work of Connelly and colleagues (2006), who found that students with dyslexia wrote less than their chronologically-age matched peers. Furthermore, Connelly and his research team (2005) determined that handwriting fluency accounted for a significant proportion of the variance in essay quality. Adults with slow handwriting may not be
able to execute higher order processes because of the resources utilized by this non-automatized process (Peverly, 2006). These competing demands can impact the quantity and quality of the writing being produced. Therefore, working memory constraints can result in a reduction in the student with LD’s abilities to cope with the demands involved in writing compared to his/her peers (Connelly et al., 2006).

**Higher-Order Skills involved in Writing**

Research has examined the role of transcription skills such as writing speed and spelling, to overall writing quality, but few have investigated the higher-order components (e.g., organization, theme development). Connelly and colleagues (2006) provided insights into the writing skills of students with dyslexia. These researchers examined group differences between students with dyslexia, chronologically age-matched and spelling-skill matched peers on cognitive and linguistic measures (e.g., working memory, spelling) and a writing task. The researchers scored the essays produced by their participants based on the *Functional Writing System* framework, examining lower-order and higher-order skills separately. They found that students with LD produced more spelling errors in their written composition and wrote more slowly which, according to the *Functional Writing System*, would put constraints on the resources available for higher-order skills. However, the researchers also found that the higher-order writing skills did not differ from those of the age-matched group.

This finding contradicts the impact transcription deficits are suggested to have on writing quality according to the model examined. This could have been the result of how higher-order skills were being assessed, as the researchers used holistic scores with a maximum of 6 that were calculated to provide the score for the overall quality of the essays produced. This holistic score was then broken down into the 6 areas assessed (e.g. ideas and development; organization,
vocabulary, sentence structure) with a total of 4 for each area examined separately. As a result, there was a limit in range possible for each area, which could have resulted in the researchers not being able to find a significant difference.

Nonetheless, the researchers support the claim that the overall essay quality of students with dyslexia is poorer than their age-matched peers. This conclusion was based on the students’ spelling and handwriting fluency abilities (i.e., lower-order skills) that impact their essay scores. Moreover, the number of words produced in the essay component was significant between the groups as students with dyslexia produced shorter essays than their peers. Overall, the findings suggest that students with dyslexia are producing essays of lesser quality and quantity than their peers.

Connelly and colleagues (2006) also found significant differences in the cognitive measures administered to the participants in their study. In particular, differences in memory were found as students with dyslexia performed lower on a verbal working memory measure (listening span task) compared to both their age- and spelling-matched peers. Such working memory constraints can reduce the ability to cope with the demands of the writing process, which are further impacted by difficulties with lower-order skills. It is interesting, however, that higher order aspects of writing were not found to be impacted. More research is needed to investigate the relationship between these processes.

Gregg, Coleman, Davis and Chalk (2007) examined the contribution of various writing components (e.g., spelling, vocabulary) to scores obtained by students with and without dyslexia on essays and found that vocabulary complexity, word count, spelling and handwriting all accounted for significantly more variance in the essay quality of students with dyslexia compared to their peers. However, these researchers did not frame their study with the
Functional Writing System and, therefore, determining the role of lower-order and higher-order skills involved in the writing process is not discussed. Nevertheless, spelling and handwriting were found to account for more variance in the scores of students with dyslexia, which is consistent with previous research (e.g., Connelly et al., 2006) suggesting deficits in lower-order skills. Furthermore, it could be taken to suggest that higher-order skills are also impacted because vocabulary use was also found to be significantly different as students without LD performed notably higher.

Gregg and colleagues (2007) also found that there was a significant difference between the group with dyslexia and the control group on their ability to finish the essay in the allotted time, with the control group more likely to finish. This highlights the processing speed deficits and challenges due to inefficiencies in working memory discussed earlier, and may provide evidence for the accommodation of additional time for those students with dyslexia. Whether the differences between the groups would remain if the students with dyslexia were able to complete the task to the same level as their peers is unknown and requires more research.

The work of Harrison and Beres (2007) compared the writing of students with a history of literacy-based LD and current writing difficulties to those without and provided further insights into the writing of students based on the Functional Writing System. These researchers examined the writing quality of students with and without writing difficulties and the strategies that these students used for writing composition. Through the analysis of the writing produced, it was determined that students with writing difficulties have challenges with both transcription (e.g., spelling, punctuation) and composition (e.g., organization, theme development, vocabulary). The students with LD also produced shorter essays of lesser quality than their peers without writing difficulties. These findings could be the result of the complexities involved in
writing, as during this process multiple skills are being executed simultaneously within a limited WM framework (McCutchen, 2000). Of note in their findings, the measure of WM approached significance \( p = .06 \), as students with writing difficulties achieved lower scores than their peers on this measure, highlighting the importance of WM within this system. This finding may have reached significance had the sample size been larger \( n = 20 \). The difference between groups on the measure of WM is consistent with the findings of Connelly and colleagues (2006) and suggests the importance of WM for writing.

In addition to deficits in lower-order skills, Harrison and Beres (2007) also found important implications for higher-order skills in these students’ writing. The students with LD in this study produced essays that were less organized, had limited theme development and less sophisticated vocabulary compared to students without writing difficulties. Interestingly, vocabulary in isolation (as measured through the vocabulary subtest of the Wechsler Adult Intelligence Scale – 3rd Edition; WAIS-III, Wechsler, 1997) was not significantly different between the groups; however, within the context of written composition, vocabulary scores were significantly lower for students with LD. Harrison and Beres suggested that vocabulary scores were lower likely because students with LD were relying on less sophisticated word choices that they were able to spell, rather than attempting more complicated words. Therefore, difficulties in core lower- and higher-order component processes may become apparent when the cognitive demands of the task are greater and more processes require the limited resources available. The findings of Harrison and Beres (2007) suggest that LD students have difficulties with both lower-order and higher-order skills which is consistent with the Functional Writing System.

In addition, Harrison and Beres (2007) obtained strategy reports to further investigate the writing characteristics of their participants. The researchers asked participants: “Tell me what
you did to write this essay,” and created categories based on the themes that emerged in the students’ responses. These categories matched lower-order skills (e.g., spelling, handwriting, punctuation) and higher-order skills (e.g., planning, organizing, revision) and were compared between students’ responses. The researchers concluded that students with LD were aware of their difficulties with lower-order skills and placed an over-emphasis on these skills when writing compared to their peers (Harrison & Beres, 2007). This over-emphasis on lower-order aspects was described as possibly reflecting the students’ awareness of their difficulties with transcription skills and its impact on the overall quality of the written composition produced. Therefore, as students focus more cognitive resources on the lower-order skills, there are fewer resources available elsewhere which can impact the higher-order aspects of writing and the overall quality of the written product. Furthermore, students without writing difficulties reported utilizing significantly more higher-order strategies in their approach to writing the essay. This finding is also consistent with the view that as lower-order skills become automatized, more cognitive resources are available for higher-order compositional skills (McCutchen, 2000).

In summary, research has shown that students with LD have challenges with lower-order writing skills (Connelly, et al., 2006, Harrison & Beres, 2007, Gregg et al., 2007). However, the difficulties that these students have with higher-order writing skills are unclear. The findings of Connelly and colleagues (2006) suggest that there are no significant differences in the higher-order skills of students with and without LD, while the results from Harrison and Beres (2007) suggest that students with LD have difficulties with lower- and higher-order skills. More research is needed.

The time allotted for the various writing tasks examined also provides important insights into the discrepancies in their findings. Timed writing tasks were used in both studies. Students
in the Harrison and Beres (2007) study received 15 minutes (as per WIAT-II administration) while students in the Connelly and colleagues (2006) study wrote for 30 minutes. Therefore, difficulties in higher-order skills found in the Harrison and Beres (2007) study may be the result of time. Furthermore, Gregg and colleagues (2007) found significant differences between the groups in their ability to complete the writing task within the time provided, and therefore not being able to complete the task could have influenced their scores obtained. However, a comparison of time as a variable was not examined in the research. An investigation of time within the context of writing could provide valuable information about students with LD and their writing characteristics. Furthermore, it could provide important knowledge to the area of appropriate examination accommodations, in particular, extended time.

**Extended Time and Writing for Students with LD**

Limited research has examined the effect of extended time on students’ academic performance despite the fact that this accommodation is one of the most commonly requested by post-secondary students with LD (Lovett, 2010; Ofiesh, Hughes, & Scott, 2004; Zuriff, 2000). Research has investigated the role of extended time, but this has been primarily focused on studies examining reading comprehension and mathematical knowledge (e.g., Lesaux et al., 2006; Lewandowski et al., 2008; Sireci, Scarpati, & Li, 2005) with research in the area of writing extremely limited. This lack of research on writing is surprising as students with LD report writing as an area of great academic concern (Hatcher, Snowling, & Griffiths, 2002) and research has found that students with LD experience challenges with writing even when they have developed resources to compensate for their reading difficulties (Li & Hamel, 2003). Specifically, writing can be challenging for students with LD in a number of ways ranging from mechanics (e.g., spelling, punctuation) and writing fluency, to composition (e.g., organization,
theme development). Furthermore, the impact on higher-order skills based on deficits or lack of fluency in lower-order components is unclear, with some research suggesting that higher-order skills are intact despite constraints of the lower-order skills (Connelly et al., 2006), while others find difficulties in both areas (Harrison & Beres, 2007).

The Current Study

The current study aimed to fill a gap in the literature by examining the writing of students with LD (across both lower- and higher-order skills) under different time conditions. Previous research has demonstrated that students with LD have a number of writing difficulties in both transcription and composition skills (for a review see Li & Hamel, 2003). However, gaining understanding about the extent to which additional time can offset these challenges will provide valuable insights into appropriate exam accommodations for this population. It is also anticipated that this research will have practical implications and inform the recommendations for accommodations (in relation to writing) as suggested by psychologists who conduct the assessments for students with LD pursuing a post-secondary education.

The Maximum Potential Thesis and Differential Boost perspectives were explored to examine their validity in relation to the effects of extended time in the context of writing. While there has been limited support in the research focused on reading comprehension and mathematical knowledge for the MPT, Differential Boost is frequently found, as all students benefit from additional time, but the students with LD tend to benefit more (e.g., Sireci et al., 2005). However, writing has not been investigated to date and therefore drawing conclusions about the role of MPT and Differential Boost for writing is not appropriate at this time. In the current study, the differences in the scores obtained by the students with LD as well as their peers, under regular and extended time, were examined to assess these claims.
In addition, the current research investigated various cognitive and linguistic measures to examine the profiles of students with LD. Measures assessing cognition (letter and digit naming speed, verbal memory span and WM), oral language (phonological processing and expressive vocabulary), reading (word reading and decoding) and writing (spelling and handwriting fluency) were administered to examine the relations among these basic literacy and cognitive processing variables and individual differences in writing.

Another key aspect of the current study was to qualify how we define ‘better’ performance when given additional time. In the case of reading comprehension and mathematical knowledge, more questions correctly answered represent better performance with extended time. In the case of writing “better,” it is less objective and therefore the idea of benefiting from extended time needs to be qualified. For the purpose of this study, numerous indices of students’ writing performance were used in order to examine the differences between standard time and extended time and to determine if “benefit” is the appropriate term. For instance, essay word counts allowed the researchers to identify whether students were writing more when given extra time. However, writing more might not imply that the students were writing essays of “better” quality. Therefore, students’ writing was also evaluated across lower-order and higher-order aspects consistent with the Functional Writing System (Berninger, 1999; Berninger & Amtmann, 2003). In the literature reviewed, students with LD appear to have writing difficulties in both transcription and composition skills and therefore examining these skills separately and together provides valuable insights into the writing of students with LD. Furthermore, by examining the lower- and higher-order skills of the students’ writing, the current study adds insight into the influence that lower-order skills (i.e., transcription) have on higher-order skills (i.e., organization) in adults’ writing.
Therefore, the following questions were investigated in the current study: (1) Does extended time improve (i.e., increase) the scores obtained on written essays? (2) If there are increases in writing performance with extended time, do students without LD also benefit? (3) Is there evidence of the MPT or Differential Boost Hypothesis in the writing performance of students when comparing LD and non-LD students? (4) If writing performance does improve with extra time, then what aspects (i.e., lower-order, higher-order or both) of writing improve?
Method

Participants

University students diagnosed with a Learning Disability were recruited through the Resource Centre for Students with Disabilities (RCSD) at the University of Victoria. Flyers were posted in the RCSD and an email was sent to students to notify them of the study taking place. To obtain a control group, flyers were created and posted around campus. The control group members were also recruited from the University of Victoria’s research participant pool in the Psychology Department. Therefore, students recruited comprised two groups; students with LD and students without LD (non-LD). Membership in the LD category occurred if the student met university criteria (see website at: http://rcsd.uvic.ca/assessment.html) for LD which is based on diagnostic criteria outlined in the DSM-IV-TR.

Confirmation of diagnosis was obtained through a student self report questionnaire as it has been found to be an effective and ecologically valid way for determining adults’ literacy-based learning difficulties in research (McGonnell, Parilla & Deacon, 2007). The students with LD were also receiving services from the RCSD when the study was taking place. Participants in the LD group were given a gift card for their participation in the study as an honorarium. Students in the control group were also given a gift card for their participation, unless they participated through the research participation system. In that case, students were given course credit based on their participation. Participants were excluded if they had a primary language other than English, had a co-morbid diagnosis (such as Attention Deficit Hyperactivity Disorder (ADHD) or a mental health condition) or had suffered from a traumatic brain injury that would impact their ability to perform the tasks required. Overall 38 students that were recruited for the
project were included in data analysis, of which 19 comprised the LD group and 19 students comprised the control group.

The group of students with LD consisted of eight females and 11 males with an average age of 24.22 years old (and a standard deviation of 5.95 years). On average, these students had been diagnosed with their LD for 10.78 years (ranging from 5 to 16 years). Furthermore, many of these students reported use of additional accommodations when completing written exams (e.g. use of computer, assistive technology). The students without LD consisted of 14 females and five males with an average age of 21.99 years old (and a standard deviation of 2.54 years). Students recruited for the study had backgrounds in a range of faculties including science, arts and education.

The current study involved a mixed between and within subjects design. Students with and without LD were compared separately to assess improvements in essay writing performance between regular and extended time. Furthermore, the students were compared across the time conditions to determine the performance of students with LD compared to their non-LD peers on the regular time and the extended time essay writing. These analyses provided rich information as to the performance of these groups of students across time conditions.

The current design built on the limitations of previous studies. For instance, the work reviewed by Zuriff (2000; see Runyan, 1991a, 1991b in Zuriff, 2000) included research that did not separate timed and untimed conditions. The participants in those studies were instructed to work for 20 minutes which became their regular time score, and then were instructed to continue working until they completed the task. The score once they completed the task became their untimed condition score. This research design limited the interpretation of the results as many of the students without LD completed the task under the regular time provided, creating an artificial
ceiling, as previously discussed. While the students without LD did not improve their performance with unlimited time, the students with LD did improve, which could be taken to suggest support for the MPT. However, the design of these studies limits the conclusions one can make and the current study provided two separate conditions to investigate regular time and extended time.

Previous research has also utilized an untimed condition which is not characteristic of the examination conditions students are presented with. Students with LD are typically provided with time and a half or double the time of the regular class to complete their examinations (Ofiesh & Hughes, 2002; Stretch & Osborne, 2005). Providing the students with unlimited time reduces the ecological validity of the task and therefore caution should be used when interpreting the results (Zuriff, 2000). Students should have a proper end to the task provided so that they are able to pace their performance. While the current study did not provide a simulated test scenario, it did attempt to provide information around extended time accommodations by providing double time as the extended time condition as research of Ofiesh and Hughes (2002) determined that when students with LD were given unlimited time, they used approximately double the regular time.

Therefore, the design of the current study was developed similar to that of Lesaux and colleagues (2006) wherein students would complete two alternative forms of the same measure under regular and extended time conditions. This analysis allowed for comparisons within the groups separately to determine improvement in performance as a result of the time provided as well as between the two groups across the time conditions. The order of time conditions were also counterbalanced across participants.
General Language and Literacy Measures

Research indicates that adults with LD continue to experience cognitive and linguistic processing deficits in certain key areas (e.g., working memory). Additionally, writing ability is also closely connected to many of these processes (see Berninger & Amtmann, 2003; McCutchen, 2000). Therefore, several cognitive, linguistic, reading and writing measures were administered to examine the performance of LD and non-LD students. The selected measures provided valuable information about the cognitive and linguistic profiles of these students.

Cognitive Measures.

Rapid Automatized Naming. The RAN-Digits and RAN-Letters subtests from the Comprehensive Test of Phonological Processing were used to assess processing speed through measuring rapid naming. (CTOPP; Wagner, Torgesen, & Raschotte, 1999). The RAN-Digits requires participants to quickly and accurately name digits 0-9 that are randomly displayed in a 4 by 9 grid. The measure was administered and scored according to the standardized procedures outlined in the manual. Two trials of the random display were administered and the completion times for each of the trials were combined to create the participant’s raw score. Scaled scores \( (M = 10, SD = 3) \) based on the CTOPP normative sample were also recorded for analysis. The RAN-Letters consisted of the same procedure as the RAN-Digits but participants were required to name the letters a, c, k, t, n and s instead of numbers on the 4 by 9 display. The examiner’s manual outlines test-retest reliability for those 18 years and older for the rapid digit naming and rapid letter naming at .90 and .86 respectively.

Verbal Short-term and Verbal Working Memory. The Digit-Span Forward and the Digit Span Backward tasks from the Wechsler Adult Intelligence Scale 3rd Edition (WAIS-III; Wechsler, 1997) were administered to assess verbal short-term and verbal working memory,
respectively. Digit Span Forward required the student to repeat increasingly longer number sequences verbatim and is considered a measure of verbal short-term memory rather than working memory (Oberauer, SüB, Schulze, Wilhelm, & Wittmann, 2000) as it does not require the individual to perform a transformation to the information, a process associated with WM. Digit Span Backward required the student to repeat increasingly longer sequences of digits in reverse order and is considered a measure of verbal working memory as it requires the reordering of the digits which involves the individual simultaneously storing and transforming the digits presented, which are considered to be functions involved with working memory (Oberauer et al., 2000). Administration guidelines were followed according to standardization procedures outlined in the WAIS-III manual for starting and stopping points and scoring rules. Raw scores were recorded separately for each task. The technical manual outlines test-retest reliability for the digit span subtest at 0.83 for the age group 16 to 29.

**Linguistic Measures.**

**Phonological Processing.** The Elision subtest of the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999) was administered to assess phonological awareness. This measure assesses the ability to remove phonological segments from words orally and generate another word (e.g., “say ‘blend’ without saying /l”). The test was administered according to the procedures and scoring procedures outlined in the manual. Raw scores and standard scaled scores ($M = 10, SD = 3$) were recorded. The examiner’s manual outlines test-retest reliability of .77 for those 18 years and older for the Elision task.

**Expressive Vocabulary.** The vocabulary subtest of the Wechsler Adult Intelligence Scale-3rd Edition (WAIS-III, Wechsler, 1997) was administered to assess expressive vocabulary. Students were shown the words one at a time and asked to define the word orally (e.g., “What
does settlement mean?”). Administration guidelines presented in the WAIS-III manual for starting and stopping the presentation of words and instructions for scoring were followed. Raw scores and standard scaled scores ($M = 10, SD = 3$) were recorded. The technical manual outlines test-retest reliability for the vocabulary subtest at 0.89 for the age group 16 to 29.

**Reading Measures.**

**Word Reading and Decoding Fluency.** The Test of Word Reading Efficiency (TOWRE; Torgesen, Wagner, & Rashotte, 1999) was used to assess word reading and decoding fluency of the participants. The TOWRE word reading task consists of a list of words that students read out loud as quickly and accurately as possible in 45 seconds. The TOWRE non-word reading task consists of a list of pseudoword (pronounceable non-words) that students read out loud as quickly and accurately as possible in 45 seconds. The tasks were administered according to the procedures and scoring protocols outlined in the manual. Raw scores and standard scores ($M = 100, SD = 15$) were recorded. The Examiner manual outlines test-retest reliability for the TOWRE sight-word reading (i.e. word reading) at 0.84 for those between the ages of 10 and 18, and a reliability rating of .82 for those who are 19. Reliability for the TOWRE phonemic decoding efficiency (non-word reading) is listed at 0.89 for those between the ages of 10 and 18, and .91 for those who are 19 years old.

**Writing Measures.**

**Spelling.** The Wide Range Achievement Test- Third Edition (WRAT-3; Wilkinson, 1993) was used to assess spelling skills of the participants. This task is a spelling dictation task, administered and scored according to the procedures outlined in the manual. Raw scores were calculated based on the number of words spelled correctly and converted to standard scores ($M =$
Raw scores and standard scores were recorded. The administration manual outlines the test-retest reliability of the measure of 0.93 for the version that was administered.

**Writing Fluency.** Handwriting fluency was assessed using a measure developed by Berninger, Mizokawa and Bragg (1991). This task involves the participant writing the letters of the alphabet in order, in lowercase letters, as quickly as they can in one minute. In this time if they finish writing the alphabet, they must begin the alphabet again and continue writing letters until they are told to stop. Letters are counted towards the participant’s score if the letters are in the correct order and legible. Letters are counted as legible if in the examiner’s opinion the letter is recognisable on the page without cues from the surrounding letters. This task has been used in a number of studies examining handwriting fluency (see Berninger, 1999). Raw scores were recorded based on the number of letters produced.

**Essay Composition.** Students completed two handwritten essays. The essay composition subtests from the Wechsler Individual Achievement Test-2nd Edition (WIAT-II; The Psychological Corporation; 2002) was used as the writing measure. By utilizing the two prompts (A and B) in the WIAT-II, it was possible to counterbalance across participants which prompt participants received under which time condition (15 or 30 minutes) and in which order (first or second). The WIAT-II essay composition was also selected as essays are evaluated across lower-order and higher-order aspects, consistent with the *Functional Writing System*. In addition, to eliminate potential practice effects that may have been present if students had recently been assessed using the WIAT-III, the older version was selected. The WIAT-II essay composition task is considered to be ecologically valid in that students are required to write a persuasive essay, similar to the academic writing demands of post-secondary students (Harrison & Beres, 2007). The WIAT-II manual reports strong reliability and validity estimates based on the inter-
rater (r=.87) and test-re-test (r=.77) reliability. The task was administered according to the standardized procedures outlined in the manual, with the exception of the time allotted to complete the task in the extended time condition.

**Scoring.** Essays were transcribed via a word processor maintaining errors in spelling and punctuation to eliminate any potential bias in essay quality associated with poor handwriting (Graham & Weintraub, 1996). Each essay was scored by two independent raters who were trained in administration and scoring procedures associated with the WIAT-II. The raters were not involved in the data collection. Raters were blind to the essay writer’s group membership (LD vs. non-LD) and time provided (15 vs. 30 minutes). Inter-rater reliability for overall WIAT-II Essay Composition scores was good (r =.77).

Essays were scored according to WIAT-II criteria across lower-order (e.g., mechanics) and higher-order skills (e.g., organization) consistent with the components of the *Functional Writing System* outlined previously (see Berninger & Amtmann, 2003). The four categories outlined in the WIAT-II scoring were evaluated: mechanics, organization, theme development and vocabulary. Mechanics (max score 9) included spelling and punctuation (e.g. capitalization, comma use) errors. Organization (max score 17) assessed elements such as sentence structure, sequencing of ideas and use of linking expressions. Theme development (max score 8) examined the reasons given for students’ positions and support for their arguments on the question posed. The information that was provided for their argument was assessed not based on the quality or the validity but rather how they supported their position. For example, was the information included in the argument on topic, did the student provide any counter arguments to the one being made, and was the student simply answering the question proposed. Vocabulary (max score 7) was evaluated by determining if the words the student used were specific and varied and
if the expressions and language used caught the reader’s interest (for a complete review of
scoring procedures for the WIAT-II essay composition see Scoring Manual; The Psychological
Corporation; 2002).

Inter-rater agreement was established across each of the components of the WIAT-II
Essay Composition. Inter-rater agreement was highest for mechanics ($r = .87$) and lowest for
vocabulary ($r = .39$). Lower agreement in the area of vocabulary could be attributed to the
subjectivity involved in determining what should be considered varied or specific vocabulary, as
well as when an expression captured the reader’s interest. Discrepancies between the raters were
resolved through discussion such that by the end there was 100 percent inter-rater agreement.
The number of words written in the essays was also recorded.

**Procedure**

Students completed all of the tasks, individually in one 90 minute session in a research lab
on campus. The author completed all of the data collection. At the time of administration,
students were also administered a background questionnaire to obtain information about their
academic programs, diagnoses and access to accommodations.
Results

The following section describes the results from the analyses completed to address the research questions: (1) Does extended time improve (i.e., increase) the scores obtained on written essays? (2) If there are increases in writing performance with extended time, do students without LD also benefit? (3) Is there evidence of the MPT or Differential Boost Hypothesis in the writing performance of students when comparing LD and non-LD students? (4) If writing performance does improve with extra time, then what aspects (i.e., lower-order, higher-order or both) of writing improve?

Before commencing with the analyses, an initial evaluation of assumptions was performed on the outcome variables (the essay composition scores, as well as the cognitive, linguistic, reading and writing measures). The data was examined for the assumption of normal distribution, heterogeneity of variance, and outliers. Based on the descriptive statistics and a visual inspection of the histogram for each dependent variable separately (for the LD and non-LD groups), the assumption of a normal distribution was met. Heterogeneity of variance was examined by comparing the students with LD to the non-LD students on the degree of variance in their scores on these measures. The assumption of homogeneity of variance was confirmed for all of the variables except for spelling (as assessed by the WRAT-3), phonological awareness (assessed with the CTOPP Elision) and working memory (assessed with the WAIS-III Digits Span Backwards) as the students with LD had significantly more variance in their scores than did students in the non-LD group. This finding is not considered to be problematic for a number of reasons.
Students with LD are comprised of a large composite of students who can have challenges in various areas, creating the possibility that there might be more variance between them than students from a non-LD population. For example, the largest population of students with LD are suggested to have dyslexia which is characterized as having difficulty with phonological aspects of language such as analyzing, producing and manipulating speech sounds of spoken words (Hatcher et al., 2002). Therefore, higher variance in Elision scores versus students without LD may be the result of variability within the group of LD students themselves. Furthermore, ANOVA is a robust procedure that is considered to be resilient to violations of homogeneity of variance (Howell, 2008; Tabachnick & Fidell, 2013). Therefore, the violation of the assumption of homogeneity is not considered to be problematic. Through examination of the data, it was also determined that there were no outliers present in the data (i.e., no participants who scored 3 or more standard deviations above or below the mean based on their group membership). Furthermore, no participants were missing data (n = 38) on any of the variables examined.

The analysis will begin with the task performance differences between LD and non-LD students on the cognitive, linguistic, reading, and writing measures. The aim of these analyses was to examine if the cognitive-linguistic profiles of the students with LD in the present study were consistent with the profiles described in previous research (e.g., Hatcher et al., 2002; Tops et al., 2012). Additionally, if students with LD do benefit from extended time, examining the profiles of performance of the two groups of students in the current study across these measures may provide important clinical insight into why extended time may be beneficial.

Then, a 2 (LD, non-LD) X 2 (15, 30 minutes) repeated measures ANOVA was conducted to examine whether there were differences between groups on the WIAT-II Essay Composition
with regular versus extended time. These analyses tested the Differential Boost Hypothesis and the MPT directly by determining whether writing performance of all participants improved with extended time, but those students with LD benefited significantly more (Differential Boost Hypothesis), or whether only those students with LD benefitted because students without LD were already performing at their maximum potential (Maximum Potential Thesis). Follow-up analyses were then conducted to examine significant main effects. These analyses examined the performance of participants based on group membership (looking at LD and non-LD students independently) and time provided (when provided with either 15 or 30 minutes separately).

The scores obtained on the essay compositions were also broken down into lower- (i.e., mechanics) and higher-order (i.e., organization) skills, consistent with the functional writing system (Berninger & Amtmann, 2003) to examine score differences in more detail, creating four additional dependent variables per WIAT-II Essay Composition score. Each WIAT-II Essay Composition score was deconstructed into the following four areas: (1) mechanics (2) theme development (3) organization and (4) vocabulary. These analyses were conducted to examine whether writing performance improves with extra time, and if so, then what aspects (i.e., lower-order, higher-order or both) of writing improve? These research questions provide important information to determine whether the results support either the Maximum Potential Thesis or Differential Boost Hypotheses.

A second, a 2 (LD, non-LD) X 2 (15, 30 minutes) repeated measures ANOVA was conducted to examine whether there were differences between groups on word count of the WIAT-II Essay Compositions with regular versus extended time. These analyses also tested the MPT and the Differential Boost Hypothesis directly by determining whether writing performance (as measured by the quantity of words produced) of participants improved with
extended time. Did only students with LD benefit from extended time because students without LD were already performing at their maximum potential (Maximum Potential Thesis), or did all students benefit from extended time, but those students with LD benefited significantly more (Differential Boost Hypothesis)? Follow-up analyses were then conducted to examine significant main effects. These analyses examined the performance of participants based on group membership (looking at LD and non-LD students independently) and time provided (when provided with either 15 or 30 minutes separately).

**Differences Between Groups on Cognitive, Linguistic, Reading and Writing Measures**

Table 1 summarizes the descriptive statistics across the cognitive (RAN with digits and letters, verbal short-term and verbal working memory), and linguistic (phonological processing and vocabulary) measures. Analyses were run using one-way ANOVAs for each measure with a bonferroni correction based on the number comparisons, resulting in a necessary $p \leq 0.008$ for significance.

**Cognitive and Linguistic Measures.** As shown on Table 1, group differences on the cognitive measures revealed that the students with LD not only performed lower than their peers on measures of rapid letter naming $F(1, 36) = 7.82, p = .008$, but also obtained scores that were generally below average (i.e., 7.21), while their peers scored within the average range (i.e., 9.73). The students with LD also achieved scores that were lower than their peers on a measure of working memory $F(1, 36) = 13.17, p < .008$.

For the linguistic measures, only the phonological processing task was significantly different $F(1, 36) = 9.78, p < .008$ with the LD group achieving significantly lower scores than the non-LD group. There were no differences between LD and non-LD students in their expressive vocabulary.
Table 1: Descriptive Statistics Across Cognitive and Linguistic Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>LD ( (n = 19) )</th>
<th>Non-LD ( (n = 19) )</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAN – Digits</td>
<td>8.31 ( M ) 3.23 ( SD )</td>
<td>10.63 ( M ) 2.31 ( SD )</td>
<td>6.44</td>
<td>.016</td>
</tr>
<tr>
<td>RAN – Letters</td>
<td>7.21 ( M ) 2.57 ( SD )</td>
<td>9.73 ( M ) 2.97 ( SD )</td>
<td>7.82*</td>
<td>.008</td>
</tr>
<tr>
<td>Digit Span Forwards</td>
<td>10.57 ( M ) 2.11 ( SD )</td>
<td>11.00 ( M ) 2.35 ( SD )</td>
<td>.366</td>
<td>.566</td>
</tr>
<tr>
<td>Digit Span Backwards</td>
<td>6.42 ( M ) 1.30 ( SD )</td>
<td>8.47 ( M ) 2.09 ( SD )</td>
<td>13.17*</td>
<td>.001</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>12.15 ( M ) 1.89 ( SD )</td>
<td>11.68 ( M ) 1.60 ( SD )</td>
<td>.694</td>
<td>.410</td>
</tr>
<tr>
<td>CTOPP – Elision</td>
<td>8.68 ( M ) 2.51 ( SD )</td>
<td>10.63 ( M ) 1.01 ( SD )</td>
<td>9.78*</td>
<td>.003</td>
</tr>
</tbody>
</table>

*Note:* Scores are based on standard scores and scaled scores except for Digit Span Forwards and Backwards which is shown as Raw Score due to lack of standardization of these measures. CTOPP = Comprehensive Test of Phonological Processing. \*\( p < .008 \).

**Reading and Writing Measures.** Table 2 summarizes the descriptive statistics across the reading (word reading and decoding fluency) and writing measures (spelling and handwriting fluency). Analyses were run using one-way ANOVAs for each measure with a bonferroni correction based on the number comparisons, resulting in a necessary \( p \leq 0.013 \) for significance. Students with LD were slower and less accurate in reading non-words than were their peers \( F(1, 36) = 26.45, p < .01 \). The students with LD also scored below average (i.e. 88.78) on the decoding fluency task, while the non-LD students scored within the average range (i.e. 105.52).

For the writing measures, the students with LD spelled more words incorrectly from a dictated list that increased in difficulty than their peers \( F(1, 36) = 50.86, p < .01 \). Students with LD also wrote fewer letters within a time constraint \( F(1, 36) = 13.24, p < .01 \), when compared to their peers in the control group.
Table 2: *Descriptive Statistics Across Reading and Writing Measures*

<table>
<thead>
<tr>
<th>Measure</th>
<th>LD</th>
<th>SD</th>
<th>Non-LD</th>
<th>SD</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOWRE – Word Reading</td>
<td>91.57</td>
<td>11.23</td>
<td>99.89</td>
<td>10.94</td>
<td>5.33</td>
<td>.027</td>
</tr>
<tr>
<td>TOWRE – Decoding Fluency</td>
<td>88.78</td>
<td>8.81</td>
<td>105.52</td>
<td>10.42</td>
<td>28.58*</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>WRAT-3 – Spelling</td>
<td>94.10</td>
<td>9.80</td>
<td>111.42</td>
<td>3.97</td>
<td>50.85*</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Handwriting Fluency</td>
<td>86.63</td>
<td>18.81</td>
<td>108.52</td>
<td>18.26</td>
<td>13.24*</td>
<td>.001</td>
</tr>
</tbody>
</table>

*Note.* Scores are based on standard scores and scaled scores except for Handwriting Fluency and Digit Span Forwards and Backwards which is shown as Raw Score due to lack of standardization of these measures. TOWRE = *Test of Word Reading Efficiency;* WRAT-3 = *Wide Range Achievement Test-3rd Edition.* *p < .013.

In summary, the profiles of students with LD across these measures are significantly different from their non-LD peers. As expected, students in the LD group obtained lower scores across measures in areas of cognition, linguistics, reading and writing. These findings highlight the profile differences found between students with LD and non-LD students as being consistent with the extant research on the processing and skills deficits experienced by post-secondary students with LD, and indicate that the present sample of students with LD were relatively homogeneous in their cognitive, linguistic, and literacy profiles.

**Group Differences in Writing Performance on Essay Composition Across Time**

The results of a 2 (LD, non-LD) X 2 (time: 15, 30 minutes) repeated measures ANOVA utilizing overall WIAT-II Essay Composition scores (which comprised mechanics, organization, theme development and vocabulary) as the dependent variable, indicated a non-significant main effect of time (i.e. performance was not impacted by time provided to complete the essay), and the interaction between time and group membership was not significant. However, the main
effect of group membership was significant $F(1, 36) = 13.01, p < .01$ as the students with LD performed lower than their peers on the essay composition measure irrespective of time provided to complete the task. Follow-up analyses were conducted to further examine these main effects.

**Additional Analyses Examining Group Differences.** First, analyses examined the overall essay composition scores by time provided (15 and 30 minutes) separately to determine group differences. Second, the specific areas (e.g., theme development and vocabulary) that make up the essay composition score were assessed separately to determine if these scores resulted in significant differences between the LD and non-LD groups individually. The scores obtained on these variables are presented in Table 3 for the essay composition when given 15 minutes and Table 4 for the essay composition when given 30 minutes for each group.

**Table 3: Group Differences on Essay Composition – 15 Minutes**

<table>
<thead>
<tr>
<th>Measure</th>
<th>LD</th>
<th>Non-LD</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$M$</td>
<td>$SD$</td>
<td>$M$</td>
<td>$SD$</td>
</tr>
<tr>
<td>Overall Score</td>
<td>21.05</td>
<td>4.84</td>
<td>25.89</td>
<td>4.62</td>
</tr>
<tr>
<td>Mechanics</td>
<td>3.15</td>
<td>2.40</td>
<td>5.57</td>
<td>1.77</td>
</tr>
<tr>
<td>Organization</td>
<td>10.10</td>
<td>2.25</td>
<td>11.7</td>
<td>2.83</td>
</tr>
<tr>
<td>Theme Development</td>
<td>4.94</td>
<td>1.31</td>
<td>5.26</td>
<td>1.36</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>2.84</td>
<td>1.21</td>
<td>3.26</td>
<td>1.44</td>
</tr>
</tbody>
</table>


**15 Minute Essay.** The students with LD were outperformed by the non-LD students on essay composition scores $F(1, 36) = 9.91, p < .01$. These scores were broken down into their sub-skill categories (e.g. mechanics and organization) to determine if the differences in scores were significant for a specific area of the essay composition score. These additional analyses were run
using one-way ANOVAs for each sub-skill category with a bonferroni correction based on the number comparisons, resulting in a necessary $p \leq 0.01$ for significance. This analysis indicated that the students with LD scored significantly lower in the area of mechanics than the non-LD students, making more spelling and punctuation errors in their writing $F(1, 36) = 12.43, p < .01$. There were no other significant differences between groups across the other writing areas.

Table 4: Group Differences on Essay Composition – 30 Minutes

<table>
<thead>
<tr>
<th>Measure</th>
<th>LD</th>
<th>Non-LD</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Score</td>
<td>20.89</td>
<td>25.84</td>
<td>10.28</td>
<td>.003</td>
</tr>
<tr>
<td>Mechanics</td>
<td>2.42</td>
<td>4.84</td>
<td>9.86</td>
<td>.003</td>
</tr>
<tr>
<td>Organization</td>
<td>9.94</td>
<td>12.21</td>
<td>10.42</td>
<td>.003</td>
</tr>
<tr>
<td>Theme Development</td>
<td>5.73</td>
<td>5.21</td>
<td>1.61</td>
<td>.213</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>2.78</td>
<td>3.57</td>
<td>2.48</td>
<td>.124</td>
</tr>
</tbody>
</table>


**30 Minute Essay.** Parallel analyses were conducted for the 30 minute essay composition. Similar to the 15 minute essay, the students with LD achieved lower scores than their non-LD peers on the essay composition score $F(1, 36) = 10.28, p < .01$. These scores were broken down into the specific areas (e.g. mechanics and organization) to determine if differences on essay composition scores were the result of differences in scores obtained on one or more of these domains. These additional analyses were run using one-way ANOVAs for each sub-skill category with a bonferroni correction based on the number comparisons, resulting in a necessary $p < .01$ for significance.
The analysis indicated that the group of students with LD scored significantly lower in the area of mechanics than their peers, making more spelling and punctuation errors in their writing $F(1, 36) = 9.86, p < .01$. Unlike the 15 minute writing sample, scores within the area of organization for the 30 minute essay were significantly different $F(1, 36) = 10.42, p < .01$ as the students with LD wrote essays that were less organized than their peers when provided with an extra 15 minutes of writing time. The measures of theme development and vocabulary were not significantly different between the two groups.

In summary, it appears that regardless of time provided, students with LD are producing more spelling and punctuation errors compared to their peers. There are also group differences when examining organization, where students with LD seem to be producing less organized essays than non-LD students, when students are provided with more time, which is inconsistent with both the MPT and the Differential Boost Hypothesis.

**Group Differences in Writing Performance as Assessed by Word Count Across Time**

The results of a 2 (group membership: LD, non-LD) X 2 (time: 15, 30 minutes) repeated measures ANOVA utilizing WIAT-II word count as the dependent variable, indicated a main effect of time (i.e. the number of words written was impacted by the amount of time provided to complete the essay), $F(1, 36) = 18.80, p < .01$, and a main effect of group membership (i.e. the number of words written varied based on group membership), $F(1, 36) = 421.51, p < .001$. However, the interaction between time and group membership was not significant. Follow-up analyses were conducted to further examine these main effects.

**Additional Analyses Examining Group Differences.** To examine the main effect of group membership, additional analyses were run using one-way ANOVAs for each time condition (15 and 30 minutes) with a bonferroni correction based on the number of comparisons,
resulting in a necessary \( p \leq .025 \) for significance. The results from the analyses are presented in Table 5. The word counts of the WIAT-II Essay Composition for 15 minutes were significantly different as the students with LD wrote fewer words than the non-LD students \( F(1, 36) = 8.89, \ p < .01 \). However, the word count of the WIAT-II Essay Composition for 30 minutes was not significant as the students with LD wrote a comparable amount of words compared to the non-LD students \( p > 0.05 \). Therefore, when students are provided with 15 minutes (i.e. standard time), those with LD wrote less than their peers. However, when all students were given additional time (i.e. 30 minutes), this difference vanished as students with LD were able to write a comparable number of words.

Table 5: Group Differences on Word Count

<table>
<thead>
<tr>
<th>Measure</th>
<th>LD</th>
<th>Non-LD</th>
<th>( F )</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word Count for 15 Essay</td>
<td>159.10 53.78</td>
<td>207.78 46.57</td>
<td>8.89*</td>
<td>.005</td>
</tr>
<tr>
<td>Word Count for 30 Essay</td>
<td>240.78 97.70</td>
<td>243.89 93.53</td>
<td>.010</td>
<td>.921</td>
</tr>
</tbody>
</table>

*Note. Scores based on WIAT-II Essay Composition Scores. WIAT-II = Wechsler Individual Achievement Test Second Edition. *\( p < .025 \)

Differences in word count between the groups at 15 minutes but not at 30 could show some support for the theories as there are differences in the amount of words produced as a function of time provided. Further analysis looking at differences across time will be examined in the subsequent section to provide more information as to the performance of students and potentially uncover support for the Differential Boost Hypothesis or the MPT.

**Additional Analyses Examining Differences over Time.** To examine the main effect of time by group on word count, additional analyses were run using repeated measures t-tests for each group with a bonferroni correction based on the number of comparisons, resulting in a
necessary $p \leq .025$ for significance. It was determined that students with LD wrote more words when given 30 minutes as compared to 15 minutes $t(1,18) = -3.68, p = .002$. Students with LD wrote on average 81.68 more words when given extra time. However, it was also determined that non-LD students did not write significantly more words when given 30 minutes as compared to 15 minutes $t(1,18) = -2.30, p = .033$. Students wrote on average 36.11 additional words when given extra time. Therefore, students with LD wrote more than twice as many more words when given additional time, compared to their peers. This finding could show support for the Differential Boost Hypothesis, as all students were writing more words when provided with additional time, but those with LD were writing significantly more words. Differences in performance will be discussed more fully in the following section.
Discussion

The purpose of the present study was to examine the impact of extended time on essay composition for students with LD and to compare that performance with non-LD students. The results of the analyses performed in the previous section will be discussed to determine if the findings are consistent with the Differential Boost Hypothesis or the Maximum Potential Thesis.

Students with LD Compared to their Peers

The students with LD in the current sample were relatively homogeneous in their cognitive, linguistic, and literacy profiles and demonstrated significant differences on key processes and skills compared to the non-LD group. The students within the LD group scored significantly lower than their non-LD peers in the areas of spelling, phonological decoding, decoding fluency, rapid naming, working memory and handwriting fluency. Therefore, it appears that the participants with LD and control group differed significantly and in expected ways on the linguistic and cognitive measures. Therefore, the current sample of students that comprised the LD group shows cognitive characteristics consistent with previous studies of LD when comparing non-LD students, suggesting a representative sample.

However, while the scores of students with LD were significantly lower than their peers without LD, in a number of instances their scores were within the average range when compared to the standard and scaled scores for the larger population (based on the specific test’s normative sample). For example, the mean standard score for students with LD on the WRAT-3 spelling task was 94.10, which is within the average range. However, the standard deviation of those scores was 9.80, suggesting that many would have been below average. Therefore, the range in scores could be the result of LD impacting the learning and development of students in a number
of ways and to varying degrees, which could have been masked when averaging scores across students with different learning profiles. Future research could limit the group of students with LD to those who have challenges in a specific area (e.g. writing or mathematics) which could impact the scores obtained on the measures utilized in the present study and the average achieved by the group of LD students.

Furthermore, when comparing students’ scores on the WIAT-II mechanics, those with LD made significantly more spelling, punctuation and capitalization errors than their non-LD peers. This finding appears consistent across a number of research studies that have been conducted (e.g. Connelly, et al., 2006; Harrison & Beres, 2007; Harrison, 2009). In addition, these studies found differences when comparing spelling within the context of composition and in isolation, which is consistent with the present study. For example, Connelly and his team (2006) found that students with dyslexia produced more spelling errors during the essay task than their peers in a spelling-skilled matched group based on the WRAT-3 spelling measure. Therefore, even though spelling in isolation may not have been found to be significantly below average for the current sample of students with LD based on the WRAT-3, due to the capacity-limited nature of WM within the context of writing (McCutchen, 2000), the cognitive demands of the task are greater when writing an essay, and therefore more processes are vying for the limited resources available, resulting in these students with LD making significantly more spelling errors in writing when compared to their non-LD peers.

In addition, while the current sample of students with LD were collectively performing within the average on some of the measures important for determining a diagnosis of LD (e.g. spelling and word reading), their skills in other areas were collectively below average (e.g. decoding fluency and rapid letter naming). These areas are important skills for students to
develop automaticity in. For example, difficulties with phonological aspects of language (i.e. the ability to analyze, produce and manipulate speech sounds of spoken words; Hatcher et al., 2002) can impact students’ abilities to perform a variety of literacy based activities (Stothers & Klein, 2010; Trainin & Swanson, 2005; Wilson & Lesaux, 2001). Such deficits can significantly impact reading and written language performance (Gregg et al., 2008) which are important skills required for academic success at post-secondary.

Furthermore, the students within the LD group were recruited from the Resource Centre for Students with a Disability (RCSD), where they would have been required to provide appropriate documentation of an LD diagnosis to receive academic supports on campus. Therefore, the measures used to examine the cognitive, linguistic, reading and writing profiles of these students within the current study, may not have been sufficient to fully extrapolate their challenges in these areas adequately for confirming a diagnosis of LD. Confirmation of an LD diagnosis was beyond the scope of this study. Future research in the area of extended time, could obtain copies of students’ psychoeducational assessments for review prior to inclusion of students within the LD group.

Therefore, while the current sample of students with LD did perform significantly lower in the areas of spelling, non-word reading, digit-span and writing speed, compared to those in the non-LD group, they were performing within the average range, which could be the result of a number of factors as outlined above. Consequently, the current study cannot make claims to support or conflict the findings of Hatcher and colleagues (2002) who suggested that a diagnosis of dyslexia can be confirmed through the use of only those four measures, or the findings of Tops and his research team (2012) who also suggested a shorter assessment of dyslexia with measures assessing word reading, spelling and phonological awareness. More research is needed
in this area before conclusions can be drawn on the potential for a shorter assessment of dyslexia specifically or LD more generally.

**Does Extended Time Improve Performance on WIAT-II Essay Composition Scores?**

Based on the writing scores obtained by the students with LD and their peers, there does not appear to be a benefit to performance when students are provided with additional time when completing the WIAT-II Essay Composition task. Scores on the 15 minute essay were comparable to those attained on the 30 minute essay based on overall scores on the WIAT-II Essay Composition. Therefore, the results of the present study do not provide evidence for the Differential Boost Hypothesis (i.e., all students benefit when given extended time to some degree, but there is a differential boost in their scores as the students with LD improve significantly more) or the Maximum Potential Thesis (i.e., only students with LD will improve when given extended time because students without LD are already performing at their “maximum potential”) when evaluating overall writing quality. Students, regardless of their group membership, did not perform better on the WIAT-II Essay Composition when given extended time.

The lack of differences in overall scores for participants’ WIAT-II Essay Compositions when given extended time is inconsistent with previous research investigating the accommodation of extra time (e.g., Lewandowski et al., 2008; Sireci et al., 2005), which did show an improvement in scores when additional time was provided. However, previous research has been largely limited to the areas of reading comprehension and mathematics and differences in performance (as measured by number of correct answers) when giving students extended time. Writing is a complex and multifaceted cognitive and linguistic task (Berninger & Amtmann, 2003) and therefore, improvements with extended time may be more difficult to demonstrate.
Answering a greater number of math or reading comprehension questions correctly within a particular time frame is much easier to assess than essay quality.

**Does Extended Time Improve Performance on Word Count?**

When it came to essay quantity (i.e., word count), there does appear to be some support for the Differential Boost Hypothesis, as all students did write more when given additional time, however, the students with LD wrote significantly more. When given extended time, students with LD wrote more than twice as many additional words than their peers which resulted in a significant difference in the number of words for those with LD when comparing essays written with 15 minutes compared to 30 minutes, but this comparison was not significant for their non-LD peers. Therefore, while students with LD are not writing essays that would produce higher scores within the overall WIAT-II Essay Composition scoring criteria, they are writing more when given additional time.

**What is Considered Doing “Better”?**

A question that remains is what is considered to be doing “better” when it comes to writing and how should one determine “benefiting” from extended time? Based on the WIAT-II scoring, the students overall did not write better qualitatively, however, they did produce more words, with the students in the LD group writing significantly more words (which could be considered a quantitative measure of performance). Based on the structure of examinations at the post-secondary level, it might not be important to write a more organized essay (e.g. use of topic sentences, containing linking words), or use a richer vocabulary (e.g. are the words used specific as well as varied), but rather get more information on the page. For example, some courses allow for point form responses when completing long- or short-answer sections. If the goal of the exam is to write more points on a topic, rather than awarding points for producing an essay that is well
structured with rich vocabulary, then being able to write more words when given extended time might be more important than writing an essay of better organizational quality. Future research should look at the features of the written components of exams across disciplines to determine what can be considered performing better when it comes to written exams.

In addition, in research studies examining extended time within the context of reading and mathematics, better performance was defined as more questions answered correctly (e.g., Lesaux et al., 2006; Lewandowski, et al., 2008; Sireci et al., 2005). Therefore, students were determined to have “benefited” when given extended time because they were able to answer more questions correctly. These questions were not necessarily harder, or answered in a “better” format. Therefore, when it comes to writing, could writing more words on the page when given extended time be considered equal to the idea of “benefiting” from extended time when one is able to answer more questions correctly? The concept of benefiting from extended time is complex, and researchers and practitioners will need to define “benefit” in relation to the discipline specific knowledge and skills assessed in post-secondary settings.

**Differences in Writing between Students with LD and their Peers**

The current research did not find differences in performance when students were given regular versus extended time to complete essay compositions, yet there were differences found when it came to the writing of students with LD and their non-LD peers. Students with LD had difficulties across lower- and higher-order skills consistent with previous research (Connelly et al., 2006; Harrison & Beres, 2007). In particular, students with LD wrote essays with more spelling and punctuation errors and their essays were less organized. It could be suggested, based on the *Functional Writing System* framework, that there is a lack of automatization in lower-order aspects of writing (as assessed by spelling and punctuation), which impacts the WM.
resources available to perform the higher-order aspects (as assessed by organization, theme development and vocabulary; Berninger & Amtmann, 2003; McCutchen, 1996). Furthermore, the students in the current LD group were found to have significantly lower scores on WM than the non-LD students. Therefore, challenges with lower-order skills, combined with already encumbered WM resources, may result in an even greater strain on WM by these non-automatized skills involved in transcription, which could significantly impact written performance (McCutchen, 1996; Olive & Kellogg, 2002). Post-secondary students with LD frequently have documented difficulties with written composition tasks, and the current findings support this conclusion (Harrison, 2009; Lindstrom, 2007).

**Lower-Order Skills.** The literature that has been reviewed showed that students with LD make significantly more spelling and punctuation errors than their peers and the current study’s findings are consistent with this previous research (Connelly et al., 2006, Harrison, 2009; Li & Hamel, 2003). If cognitive resources of WM are being taxed by these lower-order skills, it can result in less text being produced and more spelling errors (Harrison, 2009). The findings of the present study indicate that under regular time, less text and more spelling errors are being produced by students with LD compared to their peers. However, when given extended time, these students are able to produce the same amount of text as their peers while still making more spelling and mechanical errors. In addition, the students with LD in the present study were shown to have lower handwriting fluency scores, and according to the research of Connelly and his team (2005), handwriting fluency accounted for a significant proportion of the variance in essay quality. Therefore, the lower handwriting fluency scores of the current LD group could be considered a contributing factor in their overall essay scores.
Higher-Order Skills. The research on the impact of higher-order skills on the writing of students with LD has been mixed as outlined previously. The research of Connelly and colleagues found that students with LD did not differ in their higher-order writing skills from their age-matched peers. However, Harrison and Beres (2007) found that students with LD had difficulty with both lower- and higher-order skills involved in writing. The current findings have replicated Harrison and Beres (2007) results, as students with LD were outperformed by their peers on indices of mechanics (a lower-order skill) and organization (a higher-order skill).

Limitations

While the current study does provide important information on the role of extended time within the context of writing, some limitations should be noted. First of all, participants were not provided with an exam setting in which they were to write their essay compositions. The possibility of additional cognitive load and heightened anxiety associated with exam writing was therefore not assessed by this study. Future research might examine the performance of students based on their performance during an examination. Having a simulated testing environment may allow for the pressure of examination settings as well as the motivation to do well impact their performance, as it would during an examination setting (Lewandowski et al., 2008). In addition, there was no measure of physiological functioning during their completion of the written composition and therefore contributing factors to exam writing such as anxiety and stress were not assessed. These factors are important to consider when looking at students’ performances on examinations. Previous research has noted that frustration, stress and test anxiety can all be experienced by students with high-incidence disabilities, including LD, and therefore should be assessed when measuring performance (Lovett, 2010). Future research that examines
physiological functioning when given regular and extended time could provide valuable information as to the performance of these students.

Another potential limitation of the current study was the sample size which was smaller than others conducting similar research (see Lewandowski et al., 2008; Lesaux et al., 2006) which may have impacted the results. Based on a power analysis, when utilizing two groups measured at two instances, one would need a total sample size of 54 participants to potentially reach significance (Faul, Erdfelder, Lang & Buchner, 2007). The current study was limited by the number of students with LD that came forward to participate in the study. Therefore while the current study did not find a significant difference across time for the WIAT-II Essay Composition scores, there may still be differences present, which potentially could have been found with a larger sample size. Future research with a larger sample size could provide more information as to whether the Differential Boost Hypothesis or MPT are present when looking at writing across time.

In addition, while the students who were recruited for the LD group were obtained through the Resource Centre for Students with a Disability, their psychoeducational assessments were not obtained. Therefore, confirmation of diagnosis of LD for those within the LD group was obtained through a student self report questionnaire and not specific documentation. Nevertheless, this method has been found to be an effective and ecologically valid way for determining adults’ literacy-based learning difficulties in research (McGonnell, Parilla & Deacon, 2007). The issues around proper classification of post-secondary students with LD is part of a larger concern outside the scope of this study (see Sparks & Lovett, 2009 for a review of the literature). The work of Sparks and Lovett (2009) determined that a wide range of criteria have been used to identify students with LD, and that various standards are used at university
disability offices. This lack of consistency is problematic and future research is needed to ensure correct classification of students with LD in order to determine correct group membership (LD vs. non-LD) which can significantly impact researchers’ abilities to find significant differences across time and groups.

Furthermore, the students with LD were not limited to those with writing difficulties. Therefore, the lack of significant results in the study examining improvements in performance when it came to the writing quality of the students may be as a result of the variability within the LD group. Had the LD group been limited those with LD specific to writing, the results may have been different. Future research could examine specific areas of LD and their performance when provided with additional time across exam formats (e.g. writing and reading) and how improvements in performance vary across time provided and formats of the exams.

Future Research

Future research examining extended time in the context of writing should consider response formats. Would there be the same results if one single essay was produced compared to multiple short answer responses? Would students with learning disabilities perform differently due to potential challenges of task switching between topics? One of the components for a diagnosis of LD is difficulty with executive functioning (including but not limited to task switching; Ministry of Education, Province of British Columbia, 2011). If the student was required to write multiple responses would that then impede performance when given a standard amount of time, more so than one single response? Future research could examine giving students multiple short-answer written responses and compare their performances when given regular and extended time. One essay might not be consistent with the structure of examination settings across faculties.
Furthermore, the WIAT-II Essay Composition requires the students to respond to a probe for which the student has not studied. Does the added complexity of needing to study impact the ability to perform a written response on an exam? While the individual would still need to retrieve information from memory to complete both tasks, in the prompt format the student is drawing on information they already have or can reason about, whereas in an exam setting the student must access information from memory they have had to recently learn. Future research might examine the type of written responses given by students when examining the impact of extended time for students with LD. Providing them with a more environmentally congruent setting and circumstances to complete essay compositions, might impact their performance and thus provide different results.

Another factor to take into account when looking at the benefits of extended time and testing accommodations is to consider that while extended time is the most common accommodation requested by students with LD at post-secondary, it is not the only accommodation (Lovett, 2010; Ofiesh et al., 2004). Many students receive additional accommodations when completing examinations such as the use of assistive technology or a separate setting for tests (Cawthon & Cole, 2010). Therefore, students with LD might require the provision of all of their accommodations to truly perform at their maximum potential. Other accommodations may impact the performance of students within a testing situation in conjunction with extended time. Future research might examine multiple accommodations and their relations to student performance.

Additionally, future research could examine extended time across contexts (e.g. writing and reading). Previous research has been limited to one domain and it would provide important information about students’ performance when given extended time to see how they perform
when required to combine skills (reading and writing). Furthermore, comparing performance when given extended time in the context of writing versus reading may provide additional information about when extended time is warranted as an exam accommodation. For example, Ofiesh and Hughes (2002) noted that time required for a test can change as a result of the testing format and the type of response that is required by the individual. An essay response and a multiple choice test may require different amounts of time depending on the individual’s learning profile.

Conclusion

This study contributes to the literature on the performance of students with LD compared to their peers when provided with additional time. It focuses on writing performance within the context of extended time which is a largely understudied area, as most of the previous research has examined reading comprehension and mathematics. The results of the current study suggest that writing achievement and doing “better” when given additional time is dependent on how improvements in performance are defined and measured. When evaluating the quality of scores based on the WIAT-II Essay Composition criteria, there was no difference in scores obtained between LD and non-LD students when extended time was provided.

However, quantitatively, twice as many more words were written by students with LD when provided with extended time compared to their non-LD peers. This finding suggests that students with LD might be benefiting from extended time as they are able to write more on the page when given extended time, and this might be sufficient to demonstrate improved performance, depending on how the grading of a written exam is determined. The present study is one of the first studies investigating writing within the context of extended time and therefore more research in this area is needed before definite conclusions can be drawn as to the impact
extended time can have on the writing performance of students with LD. The limited research on writing performance is surprising given the challenges that students with LD face when it comes to writing (Li & Hamel, 2003) and the prevalence of extended time as an accommodation in post-secondary settings.
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