Conative Factors in the Context of Adolescent Reading Remediation

by

Sarah Elizabeth Anastasia Luckett-Gatopoulos

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Institute of Medical Science
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Abstract

The present study investigated variability in the remedial outcomes of 105 adolescents with reading disabilities who participated in PHAST PACES, a research-based reading intervention with a strong attributional retraining focus. The study focussed on the impact of three conative functions— intrinsic motivation, attributions, and effortful control—and their relationships with reading skill and reading growth. It was hypothesized that, following PHAST PACES, students would demonstrate improvement on reading outcomes, increased intrinsic motivation for reading, a shift from maladaptive to adaptive attributions, and improved effortful control. Students demonstrated significant gains on reading and effortful control measures following PHAST PACES intervention. The intrinsic motivation and attributional profiles of students did not improve. Students who performed best on reading measures at pre- and post-test made attributions of success to ability and avoided attributions of failure to ability, while reporting high perceived competence for reading, and demonstrating good effortful control.
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Chapter 1
Introduction and Literature Review

Troubling statistics describing high rates of functional illiteracy in Canada and the United States have focussed considerable interest among teachers, parents, and education reformers on reading instruction and remediation of reading problems. Data from the U.S. National Assessment of Educational Progress (NAEP; U.S. Department of Education: National Center for Education Statistics, 2007, 2009) suggest that less than one third of middle and secondary school students in the United States read proficiently for their grade level. The 2003 U.S. National Assessment of Adult Literacy (Kutner et al., 2007) revealed that many adults lack adequate literacy skills; 29% of adults in the United States possess only the basic prose literacy skills required to read and understand short, commonplace texts. A further 14% do not possess even this rudimentary level of skill (Kutner et al., 2007). A recent survey of Canadian adults (Statistics Canada, 2005; Canadian Council on Learning, 2008) revealed similarly worrisome statistics; 22% of the adults surveyed were lacking essential literacy skills and could not cope with much of the text material encountered in everyday life. A further 26% possessed only skills adequate to deal with simple materials clearly laid out and in familiar contexts (Statistics Canada, 2005; Reading the Future, 2008).

The personal and societal costs of inadequate literacy skills are very high. Canadians falling into the lowest levels of literacy are more likely than those at higher literacy levels to become and remain unemployed (Statistics Canada, 2005; Jamieson, 2006). Individuals receiving social assistance in Canada are more likely than those in the general population, or those receiving shorter-term assistance, to have inadequate literacy skills (Statistics Canada, 2005). When employed, individuals with poor literacy skills also earn less than more proficient readers. It has been reported that high school graduates in Canada earn about 50% more than those who have not completed secondary education, and that each additional year of completed education confers a wage increase of about 8% per annum (Green & Riddell, 2001; Jamieson, 2006); this economic benefit appears largely attributable to increases in literacy skill (Green & Riddell, 2001; Jamieson, 2006).

Health outcomes are also negatively affected by limited literacy skills. Canadians with limited literacy skills are less likely than others to have a health service provider (Jamieson,
2006), often do not know where to seek health care (Perrin, 1998), and frequently do not obtain medical care until a health problem has reached a crisis state (Perrin, 1998). Patients with limited literacy skills may encounter additional health problems because of failures to understand and follow medical directions, including instructions about follow-up appointments and taking medication appropriately (Perrin, 1998; Williams et al., 1995), and because of failure to express preferences and engage in informed medical decision-making (Smith, Dixon, Trevena, Nutbeam, & McCaffery, 2009).

Limited literacy also denies individuals the opportunity to choose the environments in which they work and live (Perrin, 1998; Canadian Council on Learning, 2008). Workers with limited literacy skills are frequently restricted to more dangerous jobs than those available to more proficient readers (Perrin, 1998). These jobs are often in the resource and construction industries (Statistics Canada, 2005), and safety may require reading and understanding the precautions that accompany machinery and hazardous materials (Perrin, 1998; Bouchard, 2007). Individuals with poor literacy skills experience higher than average rates of occupational injury (Perrin, 1998). They are also more likely than more proficient readers to live in poor quality housing located in impoverished and unsafe areas, with higher than average rates of pollution, crime, and traffic (Perrin, 1998). Limited literacy skills may prevent individuals from advocating for, and making, changes to their homes and workplaces to increase safety and security (Perrin, 1998).

1 Reading Disabilities: Definition and Core Deficits, Prevalence, and Developmental Course

Literacy learning problems are typically first evident in childhood. When difficulties with acquiring accurate and fluent word recognition and decoding skills occur, and they are unexpected given the child’s general cognitive abilities and access to effective instruction, dyslexia, or developmental reading disability (RD) may be the cause (Shaywitz, Morris, & Shaywitz, 2008; Lovett et al., 1994). Estimates place the prevalence of learning disabilities at about 8-15% of otherwise normally developing children (Lyon, 1996; Altarac & Saroha, 2007). Reading disabilities are believed to be the most common, accounting for perhaps 80% of all learning disabilities (Lerner, 1989).
Research investigating the developmental processes underlying RD has focussed on a core deficit in phonological awareness—the ability to recognize, identify, and manipulate elements of the sound structure of spoken words (Wagner et al., 1997; Shaywitz, Morris, & Shaywitz, 2008). Phonological awareness is robustly predictive of reading ability (Shaywitz, Morris, & Shaywitz, 2008; Wagner et al., 1997; Scarborough, 1998). Most children who are delayed in reading skill acquisition have difficulty with tasks requiring phonological awareness and phonological processing skills (Bradley & Bryant, 1983; Stanovich & Siegel, 1994; Wagner & Torgesen, 1987), including categorising sounds (Bradley & Bryant, 1983; Wolf & Bowers, 1999). These difficulties do not appear to be due to a developmental lag (Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996). Illiterate adults who have not been exposed to reading instruction are not able to perform tasks requiring phonemic awareness (Morais, Cary, Alegria, & Bertelson, 1979), arguing for reciprocity between reading development and phonological processing skills. Phonemic insensitivity and other phonologically-based problems are widely accepted as the basis for a majority of reading disabilities (Wolf & Bowers, 1999), and current intervention research has focussed on remediating deficits in phonological awareness (e.g., Lovett, Lacerenza, Borden, Frijters, et al., 2000; Hatcher et al., 2006; Torgesen et al., 1997; Foorman et al., 1997).

Research attention has turned to other characteristics common to RD individuals, particularly deficits in naming speed (Wolf & Bowers, 1999). Rapid automatized naming describes the ability to rapidly name sequences of items presented in a visual array (Wolf & Bowers, 1999). Studies have found that naming speed is correlated concurrently and longitudinally with early reading skills when phonological awareness, verbal IQ, and earlier reading skills are controlled (Compton, 2003; Lervag & Hulme, 2009). In normal adult samples, naming speed is predictive of individual differences in reading rate and text comprehension (Arnell, Joanisse, Klein, Busseri, & Tannock, 2009). The “double deficit” model of reading disabilities posits the independent contributions of phonological awareness and naming speed (Wolf & Bowers, 1999; Vaessen & Blomert, 2010; Vaessen, Gerretsen, & Blomert, 2009; King, Giess, & Lombardino, 2007). Much evidence suggests, however, that these processes and associated deficits are interrelated (e.g., Schatschneider, Carlson, Francis, Foorman, & Fletcher, 2002; Wagner et al., 1997; Vaessen, Gerretsen, & Blomert, 2009).
A third core characteristic shared among many individuals with RD is a deficit in cognitive strategy use—particularly in the implementation and monitoring of reading strategies (Chan, Cole, & Barfett, 1987; Snow & Lohman, 1984). Proficient readers know a variety of effective reading strategies, and are able to select, and apply them appropriately (Pressley, Goodchild, Fleet, Zajchowski, & Evans, 1989), but struggling readers are frequently limited by ineffective or inconsistent strategies, and monitor their implementation poorly (Pressley, Goodchild, Fleet, Zajchowski, & Evans, 1989). Substantial evidence suggests that struggling readers benefit from intervention that includes explicit teaching of reading strategies (Chan, Cole, & Barfett, 1987; McGee & Johnson, 2003; Forness, Kavale, Blum, & Lloyd, 1997; Lovett et al., 1994; Lovett et al., 1996; Pressley, Johnson, Symons, Goldrick, & Kurita, 1989). Effective strategy instruction requires training in metacognition (Malone & Mastropieri, 1991; Mason, 2004; Pressley, Johnson, Symons, Goldrick, & Kurita, 1989) and practise in context (Pressley, Johnson, Symons, Goldrick, & Kurita, 1989).

Children and adolescents who demonstrate the core deficits of RD typically do not outgrow these problems (Scarborough, 1984; Shaywitz et al., 1999). These deficits do not reflect a lag in development (Francis et al., 1996; Jacobson, 1999). Deficits persist into adulthood even in cases of good literacy outcomes (Bruck, 1992; Wilson & Lesaux, 2001). The gap between the reading skills of typically developing children and reading-disabled children often widens over time (Jacobson, 1999; Juel, 1988; Cunningham & Stanovich, 1997), especially if no or ineffective intervention is provided (Juel, 1988), leading to low literacy achievement statistics for students in higher grades (US Department of Education: National Center for Education Statistics, 2007, 2009).

2 Reading Remediation: Essential Components

Reading disabilities are amenable to remediation that is explicit, well-structured, and intensive (Lovett, Ransby, Hardwick, Johns, & Donaldson, 1989, Lovett et al., 1994, Lovett, Lacerenza, Borden, Frijters, et al., 2000). Good progress has been made in identifying the essential components of intervention for elementary and middle school children with RD, and of early intervention for young children at risk for RD.

Converging evidence from several studies has shown that intensive intervention including phonological skills training has a positive effect on reading skill acquisition for at-risk and
disabled populations (Shaywitz, Morris, & Shaywitz, 2008; Elbro & Petersen, 2004; Ball & Blachman, 1991; Hatcher et al., 2006). Torgesen, Rose, Lindamood, Conway, and Garvan (1999), for example, investigated the relative effectiveness of three instructional approaches for the prevention of reading disabilities in at-risk young children, and found that a phonologically explicit approach produced the best growth in word reading skills. Elbro and Peterson (2004) provided at-risk kindergarten students with short-term phoneme awareness training, and followed their progress in reading for seven years. As late as the seventh grade, at-risk students who had received phonemic awareness training outperformed similar students, who received no training, on measures of word reading and non-word decoding. Torgesen, Alexander, Wagner, Rashotte, Voeller, and Conway (2001) evaluated the effectiveness of one-to-one intensive, phonologically-based intervention provided to children with RD who were 8-10 years of age. The intervention produced substantial gains on measures of reading accuracy and reading comprehension that were maintained at a two-year follow up. Hatcher and colleagues (2006) evaluated the effectiveness of a short-term, small-group reading intervention for beginning readers. The intervention, which emphasized phonological skills, produced significant gains in letter knowledge, word reading, and phonological awareness. These findings, and others (e.g., Torgesen et al., 1997; Foorman et al.), support the claim that explicit training of phonological awareness skills is essential to early intervention for at-risk and reading-disabled young students.

Further research has suggested that intervention that combines a core phonological component with systematic decoding strategy training improves the reading skills of severely disabled readers in elementary and middle school grades (Lovett, Lacerenza, Borden, Frijters, et al., 2000; Morris et al., in press). Lovett and colleagues (Lovett, Lacerenza, Borden, Frijters, et al., 2000) compared the effectiveness of short-term, intensive reading intervention for a sample of RD students in elementary and middle school and found that optimal outcomes were achieved when phonologically-based approaches were combined with instruction on reading strategies. A later study of elementary school students with RD (Morris et al., in press) supported a similar conclusion; intervention was most successful when phonological awareness training was combined with instruction in either decoding strategies or vocabulary and word retrieval strategies. A substantial research base supports these findings, advocating for the integration of strategy training into intervention programs for students with reading disabilities (e.g., Lovett et
al., 1994; Lovett et al., 1996; Chan, Cole, & Barfett, 1987; McGee & Johnson, 2003; Forness, Kavale, Blum, & Lloyd, 1997; Pressley, Johnson, Symons, Goldrick, & Kurita, 1989).

3 Reading Remediation: Bridging the Gap between Younger Students and Adolescents

While researchers continue to investigate elementary- and middle-school students with RD and their response to intervention, less is known about struggling adolescent readers and what constitutes effective remediation for their reading problems (Lovett, Lacerenza, DePalma, & Frijters, in press). There is some evidence that remedial reading gains can be achieved into adolescence: Lovett and Steinbach (1997) reported that severely disabled readers in sixth grade made gains in reading skills equivalent to those made by counterparts in second through fifth grades while participating in an intensive remediation program; the lack of evidence for a developmental window in remediation response in this elementary sample is encouraging. Further, Lovett and colleagues (1996) found that older struggling readers in seventh and eighth grades were responsive to short-term, intensive remediation addressing text comprehension deficits.

Although little evidence exists evaluating the efficacy of remediation programs for adolescents with RD, a few recent studies do suggest that systematic intervention may be effective for struggling readers in secondary school. Scheffel, Shroyner, and Strongin (2003) collected data on 552 sixth through tenth grade students participating in a multiple component reading remediation program that included phonemic awareness training, direct instruction in letter-sound correspondence, and vocabulary skills training. Students demonstrated improvement in word recognition, decoding, and reading comprehension that did not vary systematically by grade. The Enhanced Reading Opportunities (ERO) study, a large-scale randomised control trial (RCT), undertaken by the US Department of Education has evaluated first and second year cohorts of 2916 and 2171 ninth grade students in 34 secondary schools assigned to one of two supplemental literacy programs or to a control condition (Kemple et al., 2008; Corrin et al., 2008). In both cohorts, participation in the literacy programs was associated with a modest increase in reading comprehension beyond that demonstrated by control participants (0.09 standard deviations in the first cohort, and 0.08 standard deviations in the second cohort; Kemple et al., 2008; Corrin et al., 2008).
Efficacy data have also been reported for a quasi-experimental study of 268 adolescents with RD participating in either a research-based reading intervention designed for secondary school students, PHAST PACES, or a waiting list control (Lovett, Lacerenza, DePalma, & Frijters, in press). Following a semester of intervention, students in the treatment group demonstrated gains on standardized tests of word attack, word reading, and passage comprehension, as well as on experimental measures of letter-sound knowledge and multisyllabic word identification relative to controls (Lovett, Lacerenza, DePalma, & Frijters, in press).

These studies provide direct preliminary evidence that the sizeable deficits evidenced by struggling readers in secondary school are amenable to intensive, direct, and systematic remediation. Research has suggested reading intervention for adolescents should maintain a multiple component focus, including systematic remediation of core phonological deficits, instruction in the alphabetic principle, and letter-sound and letter cluster-sound mappings (Lovett, Lacerenza, DePalma, & Frijters, in press; Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001; Lovett et al., 2008). For remediation to be effective, students must also be taught explicit strategies for decoding and comprehension, receive training in fluency, and learn metacognitive approaches for evaluating the success of strategy implementation (Lovett, Lacerenza, DePalma, & Frijters, in press; Lovett et al., 2008).

4 Variable Response to Remediation: How do Individual Differences Account for Divergent Outcomes?

There is ample evidence that effective intervention programs for struggling readers should include direct and systematic remediation of phonologically-based deficits in reading skills and instruction in the alphabetic principle (Shaywitz, Morris, & Shaywitz, 2008; Elbro & Petersen, 2004; Ball & Blachman, 1991; Hatcher et al., 2006). These programs are most effective when they are carefully constructed to include elements of strategy instruction (Lovett, Lacerenza, Borden, Frijters, et al., 2000; Lovett, Steinbach, & Frijters, 2000). Several programs, varying in structure and scriptedness, are available for struggling readers at the elementary- and middle-school levels (Lovett, Lacerenza, Borden, Frijters, et al., 2000; Foorman et al., 1997; Vellutino et al., 1996), and evidence-based programs for struggling readers in secondary school are increasingly being developed and evaluated (Kemple et al., 2008; Corrin et al., 2008; Lovett,
Lacerenza, DePalma, & Frijters, in press). Yet, despite the careful construction and evidence bases of these programs, it is also clear that not all students respond equally well to intervention (Frijters, 2004; Morris et al., in press; Lovett et al., 2008; Lovett, Benson, & Olds, 1990; Stage, Abbott, Jenkins, & Berninger, 2003). There is much to be learned about what influences individual differences in treatment outcomes.

Substantial individual differences in remediation outcomes are evident, even among struggling readers taking part in the same phonologically-based remediation programs (Frijters, 2004; Morris et al., in press; Lovett et al., 2008; Lovett, Benson, & Olds, 1990; Stage, Abbott, Jenkins, & Berninger, 2003). Even when struggling readers start with similar initial reading skills, phonological awareness, and rapid automatized naming speed, and are taught the same program by the same highly-skilled teacher, growth patterns in response to remediation may be widely divergent, and variability is greater for older than younger students with RD (Frijters, 2004; Morris et al., in press; Lovett et al., 2008; Lovett, Benson, & Olds, 1990; Stage, Abbott, Jenkins, & Berninger, 2003). These findings suggest that well-characterised predictive factors, such as phonological awareness and rapid automatized naming, may fail to account for much of the variance in skill growth for struggling readers participating in evidence-based remediation programs. Other, less well-characterised factors must also play a role in determining response to remediation.

Research attention has focussed recently on attempting to characterize the individual differences that influence remedial response, with mixed success. Vellutino and colleagues (1996) found that measures of visual, semantic, and syntactic skills did not differentiate between responders and non-responders to treatment in a sample of first grade students who were struggling with reading acquisition. Foorman and colleagues (1997) found that phonological and orthographic processing accounted for much of the variability in remediation response in their sample of third grade students.

Morris and colleagues (in press) investigated the roles of ethnicity, socioeconomic status, and IQ in predicting response to remediation. In their elementary sample, none of these factors was a significant predictor of remediation outcomes. Frijters and colleagues (in press) used growth curve analyses to investigate the contribution of several neurocognitive factors to the prediction of response to remediation in the same sample of young struggling readers.
Neurocognitive factors appeared to moderate outcomes, even when controlling for phonological awareness and naming speed. Lovett and colleagues (2008) investigated the role of primary language background in response to remediation. In their sample of elementary and middle school struggling readers, primary language background was not predictive of remediation success; oral language abilities, however, were a powerful predictor of remediation outcome.

Some investigators have suggested that differences in sensory processing variables (Stein, 2003; Tallal, 1980; Goswami, et al., 2002), working memory (Swanson & Jerman 2007; Swanson, Howard, & Sáez, 2006; Gathercole, Alloway, Willis, & Adams, 2006), or attention (Stage, Abbott, Jenkins, & Berninger, 2003) may be possible influences on response to remedial intervention. Reports of these differences, however, are conflicting and controversial, and their relationship to reading disabilities and outcomes remains unclear (Gabrieli, 2009; Savage, Lavers, & Pillay, 2007).

5 Variable Response to Remediation: Accounting for Conation

While some progress has been made in understanding what influences individual differences in treatment outcomes, much remains to be learned. Perhaps the current failure to fully characterise contributors to variable response has been the exclusive focus on cognitive, linguistic, and neuropsychological factors to the exclusion of other intra-individual differences. Frijters (2004) has suggested that a separate set of individual differences outside the cognitive, linguistic, and neuropsychological realms—conative functions—may also have the potential to explain much variability in remediation response. These individual differences may be especially important in explaining remediation response variability among adolescent struggling readers.

5.1 Conation

A number of historical critiques of intelligence have suggested that traditional intelligence and cognitive tests often measure much more than the constructs they purport to measure (e.g., Sternberg, 1999; Wicherts & Scholten, 2010; Richardson, 2002; Snow, 1980). A central argument is that general and specific measures gain at least some of their concurrent and predictive validity from implicit culture-bound and/or context-specific motivational and volitional factors (e.g., Richardson, 2002; Sternberg, 1999; Wicherts & Scholten, 2010). When
tasks require rapid adaptation to changing task structure and detection of cues, individual
differences in motivational and volitional biases to detect cues and adapt within the context of
the task will result in divergent outcomes. Reitan and Wolfson (2004, 2005) have conducted a
series of studies investigating the differential effects of individual differences in motivational and
volitional factors on the outcome of intelligence and neuropsychological testing (Reitan &
Wolfson, 2004, 2005) of normal and brain-damaged adults, and found effects that vary in a test-
dependent manner. Individual differences in motivation and volition are termed conative (Snow,
1980; Frijters, 2004), and authors have suggested that any account of intelligent functioning
requires integration of these conative functions with more widely-characterised cognitive and
affective functions (Snow, 1980).

Snow, Corno, and Jackson (1996) constructed an extensive taxonomic overview of
conation. The authors define conation as a set of non-affective, non-cognitive, motivational and
volitional constructs underlying human behaviour. Others have contributed to this definition
using phrases like “purposeful striving toward” goals or task completion to describe the essence
of conation (Reitan & Wolfson, 2005). Included under this broad heading are several sub-
constructs, like achievement motivations, attributions and self-efficacy beliefs, and attitudes
about subject-matter learning, as well as learning styles and orientations, persistence, and
impulsivity. Snow, Corno, and Jackson (1996) emphasize the relevance of conative constructs to
education, pointing to their usefulness in understanding student commitment to learning (Snow,
Corno, & Jackson, 1996). Conation has been neglected in the educational literature and
assessment fields until relatively recently, however (Snow, Corno, & Jackson, 1996).

Responding to this and other calls for attention to conation in education, policy makers
and researchers are becoming increasingly aware of the need for research that approaches
education, instructional outcomes, and assessment with conative factors in mind (Frijters 2004;
Pintrich, 2003; Taboada, Tonks, Wigfield, & Guthrie, 2009; Wigfield et al., 2008). The “Report
of the Subgroups” from the U.S. National Reading Panel (2000) reviewed the available research
on reading and reading disabilities, and concluded that there was a lack of rigorous empirical
investigation into motivational factors that moderate reading acquisition success. Frijters (2004)
has suggested that, in fact, a broader range of conative factors requires thorough investigation to
allow variability in response to remediation to be more fully understood and characterised, and
remediation efforts made more uniformly successful. The conative factors that will be examined
In the present study include attributions, intrinsic motivation (particularly for reading), and effortful control of behaviour.

6 Intrinsic Motivation

Motivation describes the impetus to undertake, invest effort in, and persist on a task (Wigfield & Eccles, 2000; Ryan & Deci, 2000). Motivation theorists posit that motivation, which can vary by task or domain (Ryan & Deci, 2000), has much to do with performance outcomes for a given task (Wigfield & Eccles, 2000). This is not surprising, since motivation is intimately intertwined with other aspects of conation, particularly effortful control (Frijters, 2004): A student who is highly motivated to competently complete an academic task, for instance, is very likely to exert effortful control over her behaviour. The relationships among motivation and other conative functions are complex and reciprocal (Wigfield & Wagner, 2005). Students who feel competent and attribute their successes to internal, controllable factors are motivated to invest effort in tasks. Students with poor competence beliefs who attribute success to external, uncontrollable causes are less motivated to invest effort in academic tasks (Wigfield & Wagner, 2005). The successes or failures that result from these investments of effort perpetuate cycles of attribution, motivation, and further effort investment.

Ryan and Deci (1985, 2000) have proposed a three-factor model of motivation, Self-Determination Theory (SDT), based on essential human needs for competence, relatedness, and autonomy. In this model, environmental, situational, or social factors impeding the fulfillment of any of these basic needs will result in decreased levels of motivation, functioning, and personal well-being (Ryan & Deci, 2000). Within SDT, motivation to pursue a goal may result from any number of internal or external factors (Ryan & Deci, 2000); factors that motivate individuals to the highest levels of performance, to greater persistence, and to enhanced creativity, tend to be those that are internally-generated and personally-defined (Ryan & Deci, 2000; Deci & Ryan, 1991).

Ryan and Deci (2000) have described the construct of intrinsic motivation. Activities that are intrinsically motivating are engaged in for their own sake, with no likely reward beyond the act of engaging in the activity itself (Snow, Corno, & Jackson, 1996; Frijters, 2004). This concept can be contrasted with extrinsic motivation; an extrinsically motivating activity is engaged in for rewards outside the activity itself—perhaps praise, or a passing grade. Ryan and
Deci (2000) argue that intrinsic motivation, though innate and evident in the natural play of babies and children, requires a supportive environment for its maintenance. Specifically, if needs for competence, autonomy (or an internal locus of causality), and relatedness are not met, intrinsic motivation will not be maintained (Ryan & Deci, 2000, 1985). Put another way, in environments where negative feedback, external control, and alienation predominate, intrinsic motivation suffers.

A common framework for understanding the differing nature of goals or motivations for engaging in an activity within SDT distinguishes “mastery” from “performance” goals (Ames, 1992; Wigfield & Wagner, 2005; Elliot & Dweck, 1988). Mastery goals are conceptually and practically tied to effort attributions, or the belief that successes and failures are the result of varying levels of effort input (Ames, 1992). The focus of a mastery goal is development of new skill, arrival at new understanding, or achievement of new competence (Ames, 1992; Elliot & Dweck, 1988). A student who engages in a learning task with a mastery orientation is intrinsically motivated to learn (Ames, 1992; Elliot & Dweck, 1988) and is willing to put energy into achieving mastery because of a belief that success is the result of effort (Wigfield & Wagner, 2005).

Performance goals stand roughly in contrast to mastery goals. Performance goals are associated with ability attributions, or the belief that successes and failures in a domain are the result of adequate and inadequate levels of ability, respectively (Ames 1992; Elliot & Dweck, 1988). A student who engages in a learning task with a performance orientation is extrinsically motivated (Ames, 1992), hoping to outperform peers or receive favourable evaluation (Wigfield & Wagner, 2005; Elliot & Dweck, 1988). Performance goals presuppose that success is defined by normative standards. The expenditure of energy in the pursuit of performance goals is seen as risky because effort may not lead to success, and may instead reveal the limits of ability (Ames, 1992; Elliot & Dweck, 1988).

6.1 Relationship with Reading Achievement and Instruction

Reading is an activity that requires choice and effort. Merely possessing the appropriate cognitive skills will not suffice; motivation is a necessary pre-condition for success (Baker & Wigfield, 1999). A student who is motivated to read will read for different purposes, use prior knowledge to generate new understandings of texts, and process textual materials deeply and
strategically (Baker & Wigfield, 1999; Guthrie, Alao, & Rinehart, 1997). Of importance, motivated readers will read more frequently, gaining the advantages in fluency and vocabulary that increased reading experience will confer (Baker & Wigfield, 1999; Gabrieli, 2009). Conversely, readers who are not motivated will read less often (and less widely) than their motivated peers (Wigfield & Guthrie, 1997), process material in superficial ways that lack metacognitive engagement (Guthrie, Alao, & Rinehart, 1997), and consequently fail to reap the benefits of meaningful time spent on reading activities.

Changes associated with adolescence—biological changes associated with puberty, social and school transitions, and changes in cognition and the ability to exert effortful control over behaviour—may prompt substantial changes in motivation and related goal orientations (Wigfield & Wagner, 2005). In the academic domain, students report decreasing levels of intrinsic motivation, which stabilize as they age and progress through school (Gottfried, Fleming, & Gottfried, 2001; Wigfield & Wagner, 2005). A developmental trend toward decreasing intrinsic motivation for reading in the middle school years has been reported (Guthrie, Alao, & Rinehart, 1997), and this deceleration is particularly severe for struggling or disabled readers. When McKenna, Kear, and Ellsworth (1995) surveyed first- through sixth-grade students in a stratified U.S. national sample, they observed an overall developmental decline in attitudes toward reading, with the most precipitous decline in motivation for reading occurring among the lowest-achieving readers. In investigating a mildly reading-impaired sample in the first-through seventh grades, Das, Schokman-Gates, and Murphy (1985) found that these students became relatively more extrinsically motivated for reading by fifth grade, while normal counterparts maintained intrinsic motivation for reading activities. It was suggested that these results may reflect the substantial reading failure these students have experienced by the fifth grade, since first grade RD students in this sample were as intrinsically motivated as normal peers (Das, Schokman-Gates, & Murphy, 1985).

A large part of the decline in intrinsic motivation for reading, and possible increase in extrinsic motivation, observed among struggling readers may arise from the fact that disabled readers may be denied the intrinsic rewards of reading (Frijters, 2004), as a result of interactions between their poor reading skills and the instructional environment. Early self-assessments of competence are likely to rely on effort, social feedback, and mastery. Later assessments are likely to align with those provided by the school environment, becoming increasingly normative.
and performance-based (Stipek & MacIver, 1989). This transition may result in changes in their beliefs about their own competence that undermine intrinsic motivation (Wigfield & Wagner, 2005), and reflect a shift from mastery-oriented goals and self-evaluations to performance-related orientations. This shift is likely to have a disproportionately negative effect on poorer readers because the normative, performance-based evaluation they receive is overwhelmingly negative.

Baker and Wigfield (1999) have supported the idea that when students do not feel they are competent readers, they will avoid reading activities. Their survey of students at multiple levels of reading achievement revealed that students who were disengaged from reading, expressing little interest in and motivation for reading activities, also performed poorly on standardized reading measures. A study by Frijters (2004) suggested that differences in intrinsic motivation may account for some of the variability observed in response to remedial reading intervention. In a study of elementary- and middle-school students with RD, Frijters found that students did not adhere to a single motivational profile. Instead, students varied with respect to their enjoyment and interest in reading, the effort they reported expending on reading, and their sense of competence with respect to reading.

Research investigating intrinsic motivation in struggling readers offers a discouraging perspective. Yet, Guthrie, Alao, and Rinehart (1997) offer reason for hope. In their review of reading engagement in young adolescents, the authors suggest that motivation for reading may be context-specific and amenable to change given appropriate programming. Integrative curricula that promote strategic, self-directed learning may facilitate the discovery or rediscovery of the intrinsic rewards or reading (Guthrie, Alao, Rinehart, 1997; Sweet, & Guthrie, 1996).

7 Attributions

Attributions are perceptions of the causes of success and failure (Weiner, 1979); they are the explanation individuals provide for success and failure outcomes (Weiner, 1980), and they are used to generate expectations about the outcomes of different actions (Hyland, 1988). Weiner (1979) proposed that attributions for success and failure outcomes could be classified along three broad dimensions or continua: locus of causality (internal/external), stability (variance/invariance in time), and controllability (within/beyond volitional control). The causal outcomes that arise
from the many combinations of these factors give rise to a variety of motivational and volitional outcomes (Weiner, 1979; Winograd & Niquette, 1988).

One consequence of attributions for success and failure is the amount of effort expended on a given task in the hopes of achieving success (Hyland, 1988). Attributions may play a determining role especially in the face of setbacks or failure (Hong, Chiu, Dweck, Lin, & Wan, 1999), influencing task-specific emotions, expectancies for success, motivation and effortful behaviour (Weiner, 1980). As an example, consider two students who fail on a reading task. The first attributes her failure to a lack of ability—an internal, stable, and possibly uncontrollable cause. The second attributes her failure to a combination of bad luck—an external, unstable, and uncontrollable cause—and lack of effort—an internal, unstable, and controllable cause. The second student is likely to remain motivated to exercise volitional control over her behaviour, putting in increased effort to succeed on the next reading task, whereas the first student is likely to respond with lassitude. These attributions may become self-perpetuating, as the first student sees little success and continues to have her beliefs about her lack of ability confirmed, and the second student sees variable results and continues to attribute these to varying levels of effort and unpredictable environmental factors (Winograd & Niquette, 1988; Weiner, 1980). Affective states that are reciprocally related to attributions, such as feelings of confidence, frustration, satisfaction, or guilt, further contribute to the maintenance of motivational, volitional, and attributional outcomes (Weiner, 1980).

Certain attributions may be viewed as relatively more adaptive than others (Weiner, 1980). Attributing failure to global, stable factors mediates maladaptive reactions (Hong et al. 1999), resulting in low effort input and expectations of further failure, and leading to deterioration of performance (Diener & Dweck, 1978), depression, apathy, and resignation (Weiner, 1979). This is because ability is understood to be relatively insensitive to volitional control. Conversely, attributing failure to unstable or controllable factors, like effort, mediates adaptive, success-producing reactions (Hong et al., 1999; Weiner, 1979, 1980).

Attributions have been traditionally conceived as generated following an outcome (Hong et al., 1999). More recent empirical work has suggested, however, that individuals subscribe to stable implicit theories that create a framework or model within which attributions are formed (Hong et al., 1999). Two suggested frameworks are entity and incremental self-theories (Hong
et al., 1999; Elliot & Dweck, 1988), which can be applied to a variety of traits, including reading ability. An individual who holds an incremental theory will view a trait as malleable (Hong et al., 1999; Elliot & Dweck, 1988). A student who holds an incremental theory of reading will see reading ability as subject to change, and will be relatively more likely to pursue mastery goals than performance goals (Elliot & Dweck, 1988). A study who holds an entity theory will view a trait as a fixed ability, and attributions and goals will reflect that. A student who holds an entity theory of reading ability will see reading ability as fixed, and ability level to be displayed or hidden through effort or lack thereof. He is likely to pursue performance goals (Elliot & Dweck, 1988). Students who are incremental theorists attribute their successes and failures to effort, empowering themselves to achieve their mastery-oriented goals (Elliot & Dweck, 1988) through increased effort input, even following negative feedback or failure (Elliot & Dweck, 1988). Students who are entity theorists attribute their outcomes to ability or lack thereof, becoming helpless to achieve their performance-oriented goals (Elliot & Dweck, 1988) in the face of failure (Hong et al., 1999; Elliot & Dweck, 1988), especially if they believe their abilities are low (Elliot & Dweck, 1988). This may result in divergent outcomes for students of similar abilities (Elliot & Dweck, 1988; Diener & Dweck, 1978).

7.1 Relationship with Reading Achievement and Instruction

Attributions become central to reading achievement through metacognition, the “thinking about thinking” that allows readers to monitor, manage, and guide their own learning (Winograd & Niquette, 1988). Metacognition in reading facilitates the selection and use of reading strategies, which, it has been argued, distinguishes experts from novices in any domain (Winograd & Niquette, 1988). It has been proposed that a good reader is one who is purposeful, active, and flexible in applying cognitive strategies to the task of reading (Winograd & Niquette, 1988). Winograd and Niquette (1988) have argued that children with reading problems frequently fail to be “good readers” in part because they make attributions that minimize the role of effort in reading outcomes, with the result that they may fail to use appropriate skills and strategies; because they make attributions that emphasize their own lack of ability, with the result that they become apathetic; and finally because they make attributions that result in negative affect about reading, with the result that they are not motivated to read. In short, they do not pursue reading with the mastery goals characteristic of incremental theorists, and are instead characterised by a
profile of learned helplessness, characteristic of entity theorists when their performance goals are not attained.

Dweck and Reppucci (1973) reported that, in fact, a subset of students, with “learned helpless” profiles will fail to provide appropriate responses following an initial failure, even though they appear capable of making correct responses and motivated to do so. It has been suggested that this is due to the nature of the attributions these students make: They are likely to attribute their successes and failures to ability rather than effort, in cases where they take responsibility for these outcomes at all (Dweck, 1975; Elliot & Dweck, 1988; Hong et al., 1999). In a seminal study, Diener and Dweck (1978) monitored the self-talk of learned helpless and mastery-oriented fifth-grade students as they completed a discrimination learning task with a built-in failure component. Although both groups of students experienced equal amounts of failure on the task, learned helpless students were significantly more likely than their mastery-oriented counterparts to attribute failures to uncontrollable factors, particularly lack of ability. Mastery-oriented students tended not to make explicit attributions during completion of the task, but engaged in self-instruction and self-monitoring, which the authors interpreted as implicit attributions for failures to effort.

In an attempt to examine maladaptive attributions and learned helplessness in struggling readers, Butkowsky and Willows (1980) investigated the attributions students make for success and failure on reading tasks and found that poor readers took less personal responsibility for successful reading outcomes than stronger readers. When they did take responsibility for success, poor readers attributed their successes to effort, whereas better readers attributed their success to superior ability. Poor readers consistently attributed their failures, however, to lack of ability (Butkowsky & Willows, 1980). Similar results were obtained by Frijters and colleagues (Frijters et al., 2009), who investigated the attributions of RD students: poor readers were more likely to ascribe their failures to lack of ability, than were stronger readers. In this sample, however, disabled readers were also more likely to attribute their successes and failures to external causes than were normal students.

It has been suggested that learned helpless students, or students with maladaptive attributional styles, may benefit from both attributional retraining and metacognitive training in self-monitoring and self-instruction to increase appropriate strategy use (e.g., Diener & Dweck,
1978; Toland & Boyle, 2008; Chan, 1996). Considerable focus has been directed at attributional retraining programs as a mechanism for improving achievement in a number of domains (Weiner, 1980). The focus of such programs is changing attributions (especially those for the perceived cause of failure) in order to facilitate increased effort and greater probability of success (Weiner, 1980). Such programs attempt to induce students to ascribe failure to a lack of effort instead of to a lack of ability; this describes a shift in thinking about failure as internal, but stable and likely uncontrollable to internal, but amenable to change and under volitional control (Weiner, 1979). The goal is for students to shift from resignation and apathy to productive goal-oriented behaviour. Programs such as these are based on findings that students who begin a task with equivalent performance may experience divergent outcomes following failure, correlated with attributions of their failure to stable or unstable causes (Diener & Dweck, 1978; Elliot & Dweck, 1988).

In an early example of attributional retraining, Dweck (1975) identified children who fit the profile of extremely helpless students (i.e., following failure, they consistently made attributions that led to performance deterioration). An intensive attributional retraining program retraining attributions for failure from stable and uncontrollable factors (e.g., ability) to unstable and controllable factors (effort), produced maintenance or improvement in performance following failure that was not achieved with a program that did not include attributional retraining.

Borkowski, Weyhing, and Carr (1988) studied attributional retraining within the context of reading comprehension strategy instruction, and found that instruction was more successful when students also received attribution retraining. Students who received attributional retraining demonstrated significant performance improvements relative to those who did not receive attributional retraining; these gains were associated with increases in goal-directed behaviours and strategy implementation. These findings were confirmed by Chan (1996) who also investigated the effects of attributional retraining combined with small-group reading comprehension strategy instruction. Poor readers who received attributional retraining while also receiving instruction in comprehension strategies increased their comprehension strategy use and performance, and reduced their perceptions of learned helplessness.
More recently, Frijters and colleagues (Frijters et al., 2009) studied the attributions of middle school students enrolled in the PHAST Reading Program (Lovett, Lacerenza, & Borden, 2000), a reading intervention including an embedded attributional retraining component. At pre-test, students with RD demonstrated attributional profiles that emphasized ascription of failure to ability, as well as attributions of both success and failure to external causes. By the end of the program, these students with RD had become more like normal controls in their attributional profiles; they were less likely to ascribe their failures to ability, and less likely to make attributions to external causes.

8 Effortful Control

Effortful control describes the ability to inhibit a prepotent response in favour of one that is more desirable, but less dominant (Rueda, Rothbart, Saccomanno, & Posner, 2007). Its development, concomitant with developmental processes taking place in the prefrontal attention network (Rueda, Rothbart, & Posner, 2004), is associated with the development of several higher-order aspects of social cognition, including conscience (Koschanka, 1995), theory of mind (Carlson & Moses, 2001), and empathy (Rothbart, Ahadi, & Hershey, 1994).

The executive attention network is considered the neural substrate for the regulation of behaviour through effortful control (Lenroot, & Giedd, 2006; Rothbart, Sheese, & Posner, 2007). Neurobiological evidence suggests that the resolution of cognitive conflict—deciding which of two competing responses to perform—engages this network (Fan et al., 2002). Response times on tasks that require participants to resolve cognitive conflict therefore provide a measure of executive attention (Fan et al., 2002; Rothbart, Sheese, & Posner, 2007). Executive attention, measured as such, is correlated with effortful control throughout childhood (Rueda, Rothbart, Saccomanno, & Posner, 2007; Rueda, Posner, & Rothbart, 2005; Berger, Jones, Rothbart, & Posner, 2000).

Rueda, Rothbart, McCandliss, Saccomanno and Posner (2005) have reported significant success in training effortful control in young children using short-term programming designed to induce cognitive conflict and require inhibition of a dominant response in favour of one that is secondary. Young children (ages 4-6 years) trained under these paradigms showed better effortful control ability at post-testing than did similar children in control conditions, suggesting that effortful control is trainable. Interestingly, children with the most initial difficulty resolving
cognitive conflict showed the greatest gains following training. Some variability in initial levels of effortful control in the children studied was associated with genetic factors (Rothbart, Sheese, & Posner, 2007; Rueda et al., 2005)

8.1 Relationship with Reading Achievement and Instruction

Because effortful control involves the inhibition of competing behavioural responses (Frijters, 2004), it provides the vehicle for learning material that does not satisfy a student’s immediate emotional biases or needs (Rueda, Rothbart, Saccomanno, & Posner, 2007). A student who is motivated to engage in an activity other than reading may still obtain substantial benefit from reading instruction if that student is able to exercise effortful control over their attentional and cognitive processes and behaviours. When students must engage in reading activities despite emotional biases against reading, individual differences in effortful control are likely to play a significant role in learning.

Although the study of effortful control and literacy is relatively young, the construct appears positively correlated with reading outcomes. Blair and Razza (2007) found that high levels of effortful control conferred a significant advantage to children from low income homes; effortful control was a prominent correlate of early reading ability for these children. It is suggested that curricula emphasizing enhancement of self-regulation skills might improve outcomes for a range of young students. Welsh and colleagues (2010) also found effortful control to be a strong predictor of emergent literacy skills and later reading skill growth for young children taking part in the Head Start Program (Welsh, Nix, Blair, Bierman, & Nelson, 2010).

Frijters (2004) investigated the effortful control of elementary- and middle-school struggling readers, using a cognitive measure that evaluated accuracy and response times. He found that the responses of students with RD were slower and more variable than those of normal students, and suggested that these students may suffer a constitutional difference in effortful control relative to normal students. Frijters also suggested, however, that effortful control predicted performance on outcome reading measures, implicating effortful control as a potential necessary precondition for participants’ success in remedial intervention.
9 Conation in Context: Adolescent Struggling Readers

By secondary school, adolescent struggling readers are severely disadvantaged in relation to their typically-developing peers (Gabrieli, 2009). Failure to acquire skill in reading early and easily results in reduced exposure to print and subsequent failure to develop vocabulary and word knowledge (Gabrieli, 2009). Initial deficits in phonological awareness interact with pre-reading and reading skills (Wagner et al., 1997; Stanovich, 1986; Snyder & Downey, 1997) such that struggling adolescent readers see their deficits compounded. Secondary students who are poor readers are likely to struggle in multiple subject areas; they are expected to read sophisticated texts for subject-specific information (Gabrieli, 2009), but continue to demonstrate large gaps in letter-sound knowledge and decoding abilities (Lovett, Lacerenza, DePalma, & Frijters, in press) that prevent them from accessing and understanding these texts (Gabrieli, 2009).

Recent research suggests that remediation for adolescents can be effective and result in improved reading achievement (Lovett, Lacerenza, DePalma, & Frijters, in press; Scheffel, Shroyner, & Strongin, 2003; Lovett et al., 2008). Substantial variability in remedial response, however, remains. Conative factors may account for some of this response variability. Conative factors may also provide a target for intervention, since conative functions, such as attributions and effortful control, appear accessible to retraining (Dweck, 1975; Borkowski, Weyhing, & Carr, 1988; Frijters et al., 2009; Guthrie, Alao, & Rinehart, 1997; Sweet & Guthrie, 1996; Rueda et al., 2005).

The extensive neural development and remodelling that takes place during adolescence (Lenroot & Giedd, 2006), suggests that this period may be an optimal time for retraining conative functions. The dorsolateral prefrontal cortex is particularly late to develop (Lenroot & Giedd, 2006), and is the neural substrate for the development of conative functions, including making judgements and decisions (Lenroot & Giedd, 2006), and exerting effortful control over cognition and behaviour (Lenroot & Giedd, 2006; Rueda, Rothbart, Saccomanno, & Posner, 2007). Adolescence may represent a particularly fruitful time to target the plastic neural substrates of conation with well-designed training programs. Further characterisation of conative functions in adolescents is needed to realize this goal.
Chapter 2
Research Aims and Hypotheses

1  Research Aims

The objectives of the present study are to investigate possible contributors to variability in remedial outcomes among struggling adolescent readers. The present study investigates reading and conative outcomes for adolescent struggling readers prior to and following participation in the PHAST PACES Program, a reading intervention program specifically designed for secondary school students. The focus of the present study is on conative factors, particularly intrinsic motivation, attributions, and effortful control of behaviour.

2  Hypotheses

2.1  Growth in Reading

Work by Lovett, Lacerenza, DePalma, and Frijters (in press) suggests that adolescent struggling readers in the PHAST PACES Program make gains on standardized and experimental reading measures. The first hypothesis of the present study is that students will make gains on standardized measures of word reading, word attack, and passage comprehension, and experimental measures of letter-sound knowledge and multisyllabic word identification, following participation in the PHAST PACES Program.

2.2  Changes in Conative Factors

2.2.1  Intrinsic Motivation

A second hypothesis of the present study is that struggling adolescent readers are likely to express low levels of intrinsic motivation for reading at pre-test. These students are expected to express higher levels of intrinsic motivation for reading following participation in PHAST PACES, having benefitted from attributional retraining to re-align ideas about personal causality of success and failure in reading, and having experienced positive feedback and personal success as competent readers. Specifically, it is expected that students will express increased levels of competence, effort, and interest and enjoyment, core components of intrinsic motivation, in the reading domain following the PHAST PACES Program.
2.2.2 Attributions

A third hypothesis is that the struggling adolescent readers participating in the PHAST PACES Program will progress from an initial state of learned-helpless maladaptive attributions, commensurate with performance goal orientation, to a post-test profile of more adaptive attributions, commensurate with mastery goal orientations. Students are expected to progress from ability attributions to effort attributions for success and failure.

2.2.3 Effortful Control

Struggling adolescent readers are likely to be emotionally biased against reading activities and instruction. Readers who demonstrate good effortful control should still be able to derive optimal benefit from the PHAST PACES Program. A fourth hypothesis is that students who score higher on effortful control will also score higher and demonstrate greater growth on standardized and experimental measures of reading. The PHAST PACES Program may promote higher levels of effortful control in two ways. First, the program is fast-paced and requires close attention to program content and cues. Second, a focus of the program is metacognitive training that encourages students to actively engage decoding and comprehension strategies, and reflect on their effectiveness in context. Hence, a secondary hypothesis is that students will demonstrate improved effortful control following remedial intervention.

2.2.4 Correlations and Directional Influences

This study seeks preliminary evidence that conative factors explain variability in initial status and response to remediation among adolescent struggling readers. This study is developed with the expectation that students who do exhibit adaptive attributions, and higher scores on measures of intrinsic motivation and effortful control will score higher on standardized and experimental reading measures than their less motivated, less controlled, less adaptive counterparts. A fifth hypothesis of the current study is that these influences will be bidirectional; that is, improvements on conative measures may cause improved reading performance, even as improved reading performance results in improvements on conative measures.
Chapter 3
Methods

1 Participants

Students participating in this study were recruited from ongoing programs conducted by the Learning Disabilities Research Program (LDRP) at the Hospital for Sick Children in Toronto, Ontario. The LDRP develops and evaluates research-based remediation programs for children and adolescents with reading disabilities, and offers these through research partnerships with a number of school boards in Ontario. The present study includes only the secondary school remediation program offered by the LDRP, the PHAST PACES Program.

Data for the present project were collected in 11 secondary schools within 3 school boards: 7 schools in the Toronto Catholic District School Board, 1 in the Waterloo Catholic District School Board, and 3 demonstration schools serving students with learning disabilities run by the Provincial Schools Branch of the Ontario Ministry of Education. Participating schools are located in Southern Ontario. Students served by these schools represent a range of cultural, linguistic, and socioeconomic backgrounds.

Students are referred to LDRP programs by teachers or school administrators concerned about their reading achievement. Most students in the present study received the remediation program during their Grade 9 year; these students were referred by their Grade 8 teachers or school administrators. Prior to participation, written consent from a parent or legal guardian was obtained, and verbal assent was obtained from the student. A brief assessment of the student’s reading ability and receptive vocabulary skills was conducted by research psychometrists from the LDRP to determine whether students met criteria for inclusion in the study. Students qualified for participation if they scored one standard deviation (SD) or more below age norm expectations (standard score <85) on two of three standardized reading achievement subtests (Word Identification, Word Attack, and Passage Comprehension) or the Total Reading (short scale) composite score of the Woodcock Reading Master Test – Revised (WRMT-R; Woodcock, 1987). This corresponds to a low achievement definition of RD, whereby students are classified as reading disabled based on failure to meet age expectations in reading (Morris et al., in press).
The present study included students for whom English is a second language, but excluded students who were English Language Learners (ELL) and had been in Canada for less than two years. Students were classified as ELL if the primary language spoken at home when they were first learning to speak was a language other than English (Lovett et al., 2008). This inclusion criterion has been used in a recent study evaluating the efficacy of the LDRP remediation program, PHAST PACES, implemented in the present study (Lovett, Lacerenza, DePalma, & Frijters, in press). Exclusionary criteria included cognitive or sensory deficits, and severe behavioural or psychiatric disorder.

A total of 119 adolescent struggling readers meeting criteria for inclusion were identified for participation, 35 female (29.4%), and 84 male (70.6%). Overall, participants were 14.3 years of age at entry (SD = 0.6), and most (105) participated during their Grade 9 year. A total of 84 students (70.6%) were coded as English First Language (EFL), and 35 students (29.4%) were coded as ELL. In addition to English, 9 languages were represented in this sample: Chinese, Filipino, French, Polish, Portuguese, Ruthenian, Spanish, Tagalog, and Twi. Students showed substantial achievement deficits on WRMT-R subtests, with average performance between 1.5 and 2 standard deviations below age norm expectations at program entry (WRMT-R Word Identification $M_{SS} = 75.1$, $SD = 16.1$; WRMT-R Word Attack $M_{SS} = 74.3$, $SD = 15.0$; WRMT-R Passage Comprehension $M_{SS} = 79.1$, $SD = 14.3$). Receptive vocabulary skills were, on average, somewhat less than one full standard deviation below age norm expectations (PPVT-3 $M_{SS} = 88.8$, $SD = 13.5$). Performance means and standard deviations for these descriptive measures are summarized in Table 1 according to intervention condition (PHAST PACES, Control).
Table 1. Characteristics of PHAST PACES and Control students at program entry.

<table>
<thead>
<tr>
<th>Measure</th>
<th>PHAST PACES (n = 105)</th>
<th>CONTROL (n = 14)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td>14.22 (0.63)</td>
<td>14.60 (0.70)</td>
</tr>
<tr>
<td>WRMT-R Word Identification SS</td>
<td>72.84 (12.99)</td>
<td>58.71 (18.31)</td>
</tr>
<tr>
<td>WRMT-R Word Attack SS</td>
<td>77.43 (11.04)</td>
<td>68.14 (13.04)</td>
</tr>
<tr>
<td>WRMT-R Passage Comprehension SS</td>
<td>72.12 (12.84)</td>
<td>62.57 (19.03)</td>
</tr>
<tr>
<td>PPVT-3 SS</td>
<td>86.39 (13.63)</td>
<td>93.79 (10.82)</td>
</tr>
</tbody>
</table>

2 Conditions

Most participating students were in the active intervention condition. A small waiting list control sample was available and outcome measures allowed for preliminary comparisons with treatment outcomes. The failure to recruit an adequate control sample was attributable to the fact that randomization of students to intervention versus control conditions was contaminated. The control sample consisted of students waitlisted for later participation in the PHAST PACES Program. Students received a course credit for participation in the PHAST PACES Program, and assignment to the intervention classes was ultimately under the control of secondary school personnel. There was a definite bias by secondary school staff to enrol as many struggling readers as possible in the intervention program. Consequently, the present control sample was limited to students from only two schools. A brief comparison of the intervention and control samples follows.
A total of 105 students participated in the intervention sample, 33 females (31.4%) and 72 males (68.6%). Of these students, 95 (90.5%) participated in their Grade 9 year, 8 (7.6%) participated while in Grade 10, and 2 (1.9%) participated while in Grade 11. The intervention sample included 72 students (68.6%) coded as EFL, and 33 students (31.4%) coded as ELL. Attrition was very low; one student received pre-testing but no post-test measures.

The control sample included 14 students, 2 females (14.3%), and 12 males (85.7%). Ten students (71.4%) participated during their Grade 9 year; the remainder (28.6%) participated during their Grade 10 year. The control sample included 12 students (87.5%) coded as EFL and 2 students (14.3%) coded as ELL. Attrition was, again, very low; two students received pre-testing but no post-test measures.

T-tests on entry descriptive statistics revealed that students in the control sample had lower scores on the WRMT-R Word Identification subtest ($M_{SS} = 58.7$, $SD = 18.3$) than did students in the treatment sample ($M_{SS} = 72.8$, $SD = 13.0$, $t(14.8) = 2.793$, $p = 0.014$); t-tests did not reveal any other differences in level of reading achievement at entry between the two groups. Chi-square tests comparing gender and EFL/ELL composition of the intervention and control samples indicated that these did not differ meaningfully.

3 The Intervention Program: PHAST PACES

All students in the intervention condition received the PHAST PACES Program developed by the LDRP (Lovett, Lacerenza, DePalma, & Frijters, in press). PHAST PACES is a research-based program designed for adolescent struggling readers. Students are taught word identification strategies, text structure knowledge, and reading comprehension strategies in small classes of 5-10 students at similar levels of reading skill.

Attribution retraining is woven throughout PHAST PACES. As students acquire multiple reading strategies, flexibility in their selection and application is emphasized. Scripted dialogue (see Appendix E) modeled by the PHAST PACES teacher emphasizes the role of effort in success. Students are taught to self-monitor reading success. A PACES Plan prompts the flexible use of multiple strategies, with the goal that students become independent, confident, and self-regulated readers (Lovett, Lacerenza, DePalma, & Frijters, in press). The PHAST PACES Program is not an effortful control training program, but it may facilitate the
development of higher levels of effortful control by encouraging engagement and metacognitive reflection, as well as requiring students to closely attend to teacher prompts during fast-paced lessons.

Lovett and colleagues (in press) have shown that after 70 hours of PHAST PACES instruction, struggling adolescent readers demonstrated significant gains on WRMT-R Word Identification, Word Attack, and Passage Comprehension subtests, as well as experimental measures of letter-sound knowledge and word identification relative to controls.

The PHAST PACES Program was taught by instructors who were English or Special Education Resource teachers in the participating secondary schools and were specially trained and mentored in delivery of the program. Experienced Senior Mentor Teachers from the LDRP provided ongoing professional development in the form of in-service training, as well as feedback and ongoing support through on-site visits. The training and mentoring models for PHAST PACES are described in by Lovett, Lacerenza, DePalma, and Frijters (in press; procedures for monitoring fidelity of program implementation are also detailed herein), and in greater detail in a separate report (Lovett et al., 2008).

Students received a course credit for successful completion of the PHAST PACES Program, which consisted of approximately 70 hours of instruction.

4 Measures

Study measures are grouped into two broad categories. The first category includes reading and reading-related measures that served primarily as remedial outcomes; these were collected as part of the regular course of a student’s participation in the PHAST PACES Program. The second category includes measures of conative functions, including measures of intrinsic motivation, attributions, and effortful control; these measures allowed for investigation of program-related changes beyond those in reading skill. The sections below describe the measures, their administration, and published and/or sample-specific psychometric properties.

All PHAST PACES students were assessed individually before and after approximately 70 hours of program instruction on a battery of experimental and standardized measures. Control students were assessed at comparable time points.
4.1 Reading and Reading-Related Measures

A primary outcome of the present study was growth in reading ability following intervention. Standardized reading tests, program-related and transfer-of-learning measures of reading skill were used to assess outcomes.

4.1.1 Standardized Reading Tests: The Woodcock Reading Mastery Test - Revised

Three subtests of the Woodcock Reading Mastery Test – Revised (WRMT-R; Woodcock, 1987) were administered as pre- and post-test reading measures. In the Word Identification subtest, the tester presents words in isolation, which the student must identify within a five-second time limit (Woodcock, 1987). Words are presented in order of increasing difficulty (Cooter, 1988). The Word Attack subtest is similar in presentation but requires the student to decode nonsense words using his or her knowledge of English spelling-to-sound patterns (Woodcock, 1987; Cooter, 1988). Finally, the Passage Comprehension subtest uses a modified cloze format, wherein the tester presents the student with a sentence or short passage that the student must read to identify a missing word using decoding, comprehension, and vocabulary skills (Woodcock, 1987; Cooter, 1988). All subtests of the WRMT-R possess excellent psychometric properties, including split-half reliabilities above .90, standard errors of measurement that are relatively constant across age and ability levels, and demonstrated concurrent validity with other reading tests (Woodcock, 1987).

4.1.2 Program-Related and Transfer-of-Learning Measures

The Challenge Words Test (Lovett et al., 1994; Lovett, Lacerenza, Borden, Frijters, et al., 2000) and the Sound Combinations subtest of the Sound-Symbol Test (Lovett et al., 1994; Lovett, Lacerenza, Borden, Frijters, et al., 2000) were administered at pre- and post-test as program-related and transfer outcome measures, respectively.

The Challenge Words Test presents students with difficult multisyllabic words that are not introduced in PHAST PACES classes (Lovett, Lacerenza, DePalma, & Frijters, in press). Challenge words are of low frequency within the English language (e.g., disenfranchised, unpretentious, uninhabitable), but are decodable via application of five PHAST PACES word identification strategies; thus, this test targets generalization of learning from program content.
This test has excellent internal consistency (coefficient alpha .97; Cirino et al., 2002) and good test-retest reliability in RD samples (Cirino et al., 2002).

In the Sound Combinations task, the tester presents the student one-by-one with a set of 30 letter clusters, or combinations, and the student must provide a valid oral representation of the target (prompting is provided for alternate pronunciations). The set includes vowel digraphs (ee, oa, ai, igh), diphthongs (oo, oy, oi, ou), and vowel-controlled consonants (ge, gi, ce, ci) (Lovett et al., 1994). The Sound Combinations task is a test of trained program content; these letter-sound clusters are explicitly taught in PHAST PACES (Lovett et al., 1994).

Both the Sound Combinations task and the Challenge Words Test have been used in previous intervention studies, and have been found to be sensitive measures of change in reading-related processes, these measures also demonstrate sound psychometric properties (Cirino et al., 2002). These measures were recently used in a study by Lovett, Lacerenza, DePalma, and Frijters (in press) evaluating the efficacy of PHAST PACES intervention for struggling readers in secondary school.

4.2 Measures of Conative Functions

A second outcome of the present study concerns changes in conative functions with intervention. This outcome was measured through self-report inventories of intrinsic motivation, attributions, and effortful control, and through a behavioural measure of effortful control. While well-constructed self-report measures offer the psychometric benefits of internal consistency and specificity in construct definition (Marsh, 1992; Marsh & Ayotte, 2003), the addition of a behavioural measure allowed for greater depth of analysis.

4.2.1 Motivation: The Intrinsic Motivation Inventory – Reading

The Intrinsic Motivation Inventory – Reading (IMI-R) is based on the Intrinsic Motivation Inventory (IMI) developed by Ryan and colleagues (Ryan, 2002; Ryan, Connell, & Plant, 1990) as a post-experimental measure of task commitment. Items in the original inventory are constructed for flexibility, and wording is meant to be modified to reflect task and context. Indeed, past research has found that the measure’s good internal consistency (above .80) in a variety of settings is not adversely affected by modifications to increase task- and context-relevance (Ryan, 2002).
The full original IMI contains seven subscales, consisting of Interest/Enjoyment, Effort, Perceived Competence, Pressure/Tension, Perceived Choice, Value/Usefulness, and Relatedness. The version used for the present study, the IMI-R, was developed by Frijters (2004), using the first three subscales, selected for inclusion because of their particular relevance for students experiencing severe reading difficulties, and because they could be tailored to the LDRP remedial programs. The IMI-R includes a revision of items to match reading activities that occur in the PHAST PACES Program. Negative items have been reworded, following Marsh (1986).

Appendix A provides the modified IMI-R items. For each item, students are asked to rate the truth of a statement about reading, such as “I think I read well” on a 4-point Likert-type scale. The IMI-R was administered in paper and pencil form; the tester read the items and possible responses, while the student had the opportunity to read along and select the appropriate response for each item. Scoring of the IMI-R was reversed for ease of interpretation.

An analysis of mean item correlations obtained during a pilot study of the IMI-R, (undertaken with secondary students enrolled in PHAST PACES during the 2008-2009 academic year) suggested that the IMI-R showed good internal consistency (i.e., above 0.78) for all scales at pre- and post-testing for these adolescent struggling readers. Basic psychometric analysis suggested that, for this group, responses were well-distributed, showing no marked floor or ceiling effects.

4.2.2 Attributions: The Sydney Attribution Scale – Reading

The Sydney Attribution Scale – Reading (SAS-R) is based on the Sydney Attribution Scale developed by Marsh (1986) as a measure of students’ perceptions of the causes of academic success and failure. The SAS-R presents hypothetical scenarios involving reading-related success or failure in which the student is asked to imagine him- or herself (Marsh, 1986; Marsh et al., 1984). The student is then presented with three possible explanations for the outcome, and is asked to indicate the likelihood of each explanation on a five-point Likert-like scale. Appendix B provides the modified SAS-R items. The SAS-R was administered in paper and pencil form; the tester read the items and possible responses, while the student had the opportunity to read along and select the appropriate response for each item.
SAS-R items load on subscales that result in a factorial combination of outcome (success or failure) and perceived cause (ability, effort, or external; Marsh, 1986; Marsh et al., 1984). Internal consistency is good (coefficient alpha .78).

An analysis of mean item correlations obtained during the pilot study of the SAS-R, conducted during the 2008-2009 academic year, suggested that the SAS-R showed modest internal consistency (i.e., above .71) for all scales at pre- and post-testing for this group of adolescent struggling readers. The one exception was attributions of success and failure to external causes at pre-testing only (0.41 and 0.50, respectively). It is possible that this low internal consistency at pre-testing (which was resolved at post-testing, with internal consistency above 0.8 for both scales) was due to the small number of students tested during the pilot study (n=21), and to the fact that the two scales consist of a small number of items (7 and 5, respectively). Basic psychometric analysis suggested that, for this group, responses were well-distributed, showing no marked floor or ceiling effects.

4.2.3 Effortful Control: The Early Adolescent Temperament Questionnaire – Revised (Effortful Control), and the Attention Network Test

The Early Adolescent Temperament Questionnaire – Revised (EATQ-R; Capaldi & Rothbart, 1992) was used to identify individual differences in persistent response styles, as self-reported by students in the intervention and control samples. The full EATQ-R short form is composed of 65 items derived from the original long form; these items form a set of 11 temperamental subscales. Exploratory analyses have revealed that these scales load on four factors: Effortful Control, Surgency, Affiliativeness, and Negative Affect (Capaldi & Rothbart, 1992). For the purposes of the present study, only the 16 items loading on the Effortful Control factor were administered (EATQ-R (EC)); these items were derived from the Attention (internal reliability .67), Activation Control (internal reliability .76), and Inhibitory Control (internal reliability .69) subscales.

Appendix C details instructions to students and constituent items for each scale for each subscale. The EATQ-R (EC) was administered in paper and pencil form; the tester read the items and possible responses, while the student had the opportunity to read along and select an appropriate response for each item, indicating responses on a 5-point Likert-type scale. Individual items were reverse-scored when necessary so that high scores on the composite
subscales reflected positive amounts of the temperament attribute in question. Because the EATQ-R (EC) was added to the testing battery after pre-test, it was administered at post-test only.

The Attention Network Test (ANT; Rueda, Rothbart, Saccomanno, & Posner, 2007; Fan et al., 2002) measures the efficiency of three attention networks—alerting, orienting, and executive attention—using reaction time (RT). The executive attention network is considered the neural substrate for the regulation of behaviour through effortful control (Lenroot & Giedd, 2006; Rothbart, Sheese, & Posner, 2007). Tasks that require participants to resolve cognitive conflict engage this network (Fan et al., 2002; Rothbart, Sheese, & Posner, 2007).

For each trial on the ANT, participants must indicate the direction of a central arrow appearing on a computer screen using the right and left mouse buttons. Trials begin with a blank interval, or with a cue that foreshadows the timing, location, or both the timing and location, of a target central arrow. The experimental procedure is illustrated in Figure 1.
Figure 1. Attention Network Test (ANT) experimental procedure (Fan, McCandliss, Sommer, Raz, & Posner, 2002). Each computerised trial begins with a blank interval, or with a cue that foreshadows the timing, location, or both the timing and location, of a target central arrow surrounded by flanking arrows. Participants indicate the direction of the central target arrow using right and left computer mouse buttons. Reaction Time (RT) of participants to the direction of the central arrow is measured.

Conflict is created when the central arrow is surrounded by flanking arrows pointing in the direction opposite the central arrow ("incongruent" trials). These trials are contrasted with trials on which all arrows are pointing in the same direction ("congruent" trials). Examples of congruent and incongruent trials are shown in Figure 2. Subtracting RTs for congruent from incongruent trials provides a conflict resolution score, and by extension a measure of effortful control.
Figure 2. Attention Network Test (ANT) congruent and incongruent trials (Fan, McCandliss, Sommer, Raz, & Posner, 2002). Conflict is created on the ANT when the target central arrow is surrounded by arrows that are pointing in a different, or incongruent, direction. Reaction times (RTs) on congruent trials are, where all arrows point in the same direction, are subtracted from RTs for incongruent trials to obtain a conflict resolution score, which is a measure of the efficiency of the executive attention network.

Appendix D details instructions provided to students. The instructions provided by Fan and colleagues (2002) were modified substantially following several initial administrations of the ANT to students in the PHAST PACES Program. Instructions were shortened and language was simplified to facilitate better understanding by students. The ANT was administered at pre- and post-test on laptop computers at students’ home schools. While efforts were made to standardize test administration, the laptops on which the tests were administered were not uniform, and testing conditions often differed among schools in terms of noise level, lighting, and unforeseen disruptions.

5 Design

The present study was a quasi-experimental prospective cohort study (Norman & Streiner, 1998), with all reading and most conative outcomes measured at pre-test and following 70 hours of remedial programming. Students in the control sample received instruction normally provided in their school, and were tested at comparable timepoints.
6 Plan of Analysis

6.1 Change in Reading

Two strategies were used to assess change in reading skill following participation in the PHAST PACES Program: Two-tailed paired samples t-tests and reliable change indices (Jacobson & Truax, 1991) were computed for all standardized and experimental reading measures. Intervention and control conditions were compared using a two-way mixed model analysis of variance (ANOVA; between-within design).

6.2 Change in Conative Functions

Changes in intrinsic motivation for reading and attributions were investigated using two-tailed paired samples t-tests computed separately for the three subscales of the IMI-R and the six subscales of the SAS-R. Students were then grouped according to the reliable change outcomes obtained for reading growth to allow for a more detailed secondary analysis. Intervention and control conditions were compared using separate multivariate analyses of variance (MANOVAs) for the IMI-R and SAS-R.

A two-tailed paired samples t-test was used to assess change in effortful control as measured by the ANT. Students were grouped according to reliable change outcomes for reading to allow for a detailed secondary analysis. Intervention and control conditions were compared using a two-way mixed model ANOVA.

Because the EATQ-R (Effortful Control) was administered at only one timepoint (post-test), it was not possible to evaluate change in effortful control as measured by the EATQ – R (EC). Instead, correlations between scores on the EATQ – R (Effortful Control) and those on the ANT were calculated for comparison between the self-report measure of effortful control and the behavioural measure.

6.3 Directionality

A cross-lagged panel correlation analysis (CLPC) was used to investigate issues of directionality between growth in reading and changes in conative functions. In CLPC, six correlations are computed based on a pair of variables measured at two or more timepoints: Each variable is correlated with the other at the same timepoint (synchronous correlations), each with itself at two
points in time (autocorrelations), and each variable with the other at a different point in time (the cross-lagged correlations). It has been suggested that the cross-lags should be calculated as partial correlations to control for autoregressive effects (Lundberg & Sterner, 2006); in this way, the influence of the first variable on the first timepoint to the second at the later timepoint can be determined while accounting for any previously-established relationships. The benefit of CLPC is that it allows for tentative assessments about causality among variables in a longitudinal design (Yee & Gage, 1968; Kenny, 1975; Kenny & Harackiewicz, 1979).

In order for the comparison of the cross-lags to yield meaningful results, assumptions of synchronicity and stationarity must be met in addition to the usual assumptions for correlations (Kenny & Harackiewicz, 1979). Synchronicity requires that both variables contributing to the correlations be measured at the same point in time; in this case, all test data collected at pre-test were collected during a period of one or two days, and all data collected during post-test were collected after approximately 70 instruction hours, in the same short time frame. Stationarity requires that the variables of interest are composed of the same internal “ingredients” at all timepoints. Kenny and Harackiewicz (1979) suggest a distinction between perfect stationarity, where synchronous correlations are equal, and quasi-stationarity, where the structural equation for each variable changes over time by a constant that is unique for each variable. In this case, as the same metric was used for each variable, it is unlikely that perfect stationarity was achieved, as using the same metric does not account for stage-like developmental change that may alter the composition of variables. Quasi-stationarity is, however, likely, since the same measures were used at pre- and post-test.
Chapter 4
Results

The following analyses were undertaken to evaluate struggling adolescent readers’ growth in reading following 70 hours of instruction in the PHAST PACES Program. A primary question was whether improvement on standardized and experimental measures of reading achievement could be predicted by pre-test measures of conative function, or change over time on these measures. Conative functions of interest included intrinsic motivation for reading, attributions for success and failure, and effortful control of behaviour. A second objective of the present analysis was to assess the directionality of any effects. These analyses also addressed the question of whether conative functions acted only on reading outcomes, or whether growth in reading also contributed to changes in conation. A small number of struggling adolescent readers on a waiting list allowed preliminary comparison of PHAST PACES and control condition outcomes.

The analysis is laid out as follows: First, growth in reading skill for students in the PHAST PACES condition was investigated; students in the PHAST PACES condition were then compared to the control condition. Second, changes in conative factors for students in the PHAST PACES condition were investigated; the PHAST PACES condition was again compared to the control condition. Finally, analyses that addressed whether reading skill gains were associated with changes in conation were undertaken, followed by analyses of directionality. No effect sizes are reported. This is because the small number of control students means that effect sizes would be misleading due to the lack of adequate adjustment for control response over the pre- to post-test time period.

1 Analyses of Standardized and Experimental Reading Measures

Two strategies were used to assess change in reading skills—statistical hypothesis testing (statistically reliable change) and calculation of reliable change indices (clinically significant change)—as described below.
1.1 Changes in the PHAST PACES Condition

A primary concern was whether growth in reading could be detected for adolescent struggling readers who had received 70 hours of instruction in the PHAST PACES Program.

1.1.1 Statistically Reliable Change

Growth in reading following PHAST PACES instruction was assessed using separate two-tailed paired samples t-tests for three standardized measures of reading achievement, the Word Identification, Word Attack, and Passage Comprehension subtests of the Woodcock Reading Mastery Test – Revised (WRMT-R; Woodcock, 1987), and two experimental measures, the Sound Combinations subtest of the Sound-Symbol Test (Lovett et al., 1994; Lovett, Lacerenza, Borden, Frijters, et al., 2000), and the Challenge Words Test (Lovett et al., 1994; Lovett, Lacerenza, Borden, Frijters, et al., 2000). To control for family-wise inflation of Type I error rate induced by performing multiple comparisons, a Sidak correction was applied (Uitenbroek, 1997; Abdi, 2007; Sidak, 1967). The mean correlation among all standardized and experimental reading measures was approximately .50, and degrees of freedom were 102, requiring a lowering of the per-test alpha level to .02 to maintain the family-wise probability of Type I error at .05 (Uitenbroek, 1997).

1.1.1.1 Standardized Reading Measures: WRMT-R Word Identification, Word Attack, and Passage Comprehension Subtests

Paired samples t-tests revealed reliable growth on Word Identification, Word Attack, and Passage Comprehension subtests of the WRMT-R for students in the PHAST PACES condition. On average, students gained 2.2 (SD = 6.1) standard scores on the Word Identification subtest \( (p < .001) \); group mean pre-test scores were 72.9 (SD = 13.0), and post-test scores were 75.13 (SD = 12.5). Students gained an average of 6.0 (SD = 7.0) standard scores on the Word Attack subtest \( (p < .001) \); group mean at pre-test was 77.3 (SD = 11.1), and group mean at post-test was 83.3 (SD = 10.6). Students gained an average of 5.2 (SD = 8.6) standard scores on the Passage Comprehension subtest \( (p < .001) \); group mean prior to intervention was 72.0 (SD = 12.9), and following intervention was 77.3 (SD = 12.4). Figure 3 shows WMRT-R standard score means for PHAST PACES students at pre- and post-test.
Figure 3. Mean Woodcock Reading Mastery Test – Revised (WRMT-R) standard scores for PHAST PACES students at pre- and post-test. Error bars indicate standard error of the mean. Asterisks indicate significance at $p < .001$.

1.1.1.2 Experimental Reading Measures: Sound-Symbol Test – Sound Combinations Subtest and Challenge Words Test

Paired sample t-tests revealed growth on the Sound Combinations subtest of the Sound-Symbol Test, and on the Challenge Words Test. On average, students gained 6.6 (SD = 3.8) sound-symbol correspondences ($p < .001$); at pre-test, students identified an average of 16.3 (SD = 4.2) letter-sound correspondences, and by post-test this had improved to 22.9 (SD = 3.4). Students were able to identify 3.3 (SD = 3.3) more multisyllabic words at post-test than at pre-test ($p < .001$); students began the program able to identify 13.0 (SD = 5.2) multisyllabic words, on average, and completed the program identifying 16.3 (SD =5.6). Figure 4 shows Sound Combinations subtest means for PHAST PACES students at pre- and post-test. Figure 5 shows Challenge Word Test means for PHAST PACES students at both time points.
Figure 4. Mean number of letter-sound correspondences correctly identified by PHAST PACES students at pre- and post-test on the Sound Combinations subtest of the Sound-Symbol Test. Error bars indicate standard error of the mean. Asterisks indicate significance at $p < .001$. 
Figure 5. Mean number of multisyllabic words correctly identified by PHAST PACES students at pre- and post-test on the Challenge Words Test. Error bars indicate standard error of the mean. Asterisks indicate significance at $p < .001$.

1.1.2 Clinically Significant Change

Statistical methods of analysing clinical data are both useful and important because they allow conclusions to be drawn about whether differences observed in a treatment group are genuinely due to the treatment, or are the result of chance (Lambert, Hansen, & Bauer, 2008). These methods do not provide information about variability in response to treatment within the sample, including whether some members of the treatment condition have made very large gains that resulted in movement of the sample mean while others have regressed or failed to make progress (Jacobson & Truax, 1991; Lambert, Hansen, & Bauer, 2008).

The reliable change index (RC) arose in the psychotherapy research literature as a response to concerns that statistical analyses of psychotherapies failed to elucidate the diversity of outcomes observed in various treatments and treatment modalities (e.g., Jacobson & Truax,
The overarching goal of the present study was to understand how variability in the reading skill acquisition of struggling adolescent readers is affected by individual differences in conation. RC provides a vehicle for assessing variability in response to remediation and facilitates a transparent assessment of skills growth variability as influenced by conative functions.

RC for the struggling readers in the PHAST PACES Program was calculated according to the Jacobson-Truax method (Jacobson & Truax, 1991; Lambert, Hansen, & Bauer, 2008). The first step in this method requires determining whether changes in individual participant scores are reliable, and this is achieved by dividing individual gain scores by the standard error of measurement (a complete description of this technique is available in Jacobson & Truax, 1991). Once changes are determined to be statistically reliable, a cut-point for clinically significant change must be established, and it is then determined whether individual participants have surpassed this cut-point. Jacobson and Truax (1991) provide three possibilities for cut-points, each depending on some combination of the means and standard deviations of the normal (reference) and treated populations.

Lambert, Hansen, and Bauer (2008), however, have pointed out that these stringent cut-point criteria may not be appropriate for all populations. They suggest that where recovery to normal functioning is an unlikely outcome, reliable change alone (as determined in the first step) may be considered an acceptable outcome criterion for reliable improvement. Treated individuals who do not achieve the RC criterion may be thought of as not improving, and those who have met the RC criterion in the opposite direction may be thought of as regressing. Since struggling adolescent readers 1.5 to 2 standard deviations below age-appropriate functioning are likely to improve but are unlikely to achieve normal functioning within a single semester of remedial intervention (e.g., Lovett, Lacerenza, DePalma, & Frijters, in press; Torgesen et al., 2006), this second, cut-point-free, method was adopted.

1.1.2.1 Standardized Reading Measures: WRMT-R Word Identification, Word Attack, and Passage Comprehension Subtests

Using the above procedure, reliable change (RC) indices were computed for 104 students in the PHAST PACES Program. Of these, 24 (23.1%) exceeded criteria for reliable clinical improvement on the Word Identification subtest, 38 (36.2%) improved but did not meet criteria
for reliable change, and 7 (6.7%) showed no change. Of the remaining students, 8 (7.8%) exceeded criteria for reliable change in the negative direction (i.e., regression), and 27 (25.8%) showed decreases on Word Identification subtest scores but did not exceed criteria for reliable change.

On the Word Attack subtest, 27 (26.1%) students exceeded criteria for reliable clinical improvement, while 56 (51.5%) students improved but did not meet criteria for reliable change, and 5 (4.8%) students showed no change. The remaining 17 (17.3%) students showed decreases on Word Attack subtest scores, but did not exceed criteria for reliable change.

On the Passage Comprehension subtest, 31 (29.8%) students exceeded criteria for reliable clinical improvement, while 43 (41.1%) students improved but did not meet criteria for reliable clinical significance and 4 (3.8%) students showed no change. Of the remaining students, 4 (4%) showed decreases in Passage Comprehension scores that exceeded criteria for reliable change, while 22 (21.2%) showed decreased scores that did not exceed reliable change criteria. Figure 6 shows the percentage of students in each change subgroup (reliably improved, improved, no change, regressed, reliably regressed) for each of the WRMT-R subtests.
1.1.2.2 Experimental Reading Measures: Sound-Symbol Test – Sound Combinations Subtest and Challenge Words Test

Reliable change (RC) indices were calculated for 104 students in the PHAST PACES Program. On the Sound Combinations subtest of the Sound-Symbol Test, 52 (49.6%) exceeded criteria for reliable improvement, while 47 (44.8%) students improved but did not meet criteria for reliable change. Three (2.9%) students showed no change, while 1 (1%) student showed decreases that exceeded reliable change criteria, and 1 (1%) student showed decreases that did not exceed reliable change criteria.

On the Challenge Words Test, 36 students (35.5%) showed increases that exceeded reliable change criteria, while 50 (47.5%) students improved but did not meet criteria for reliable...
change. Of the remaining students, 6 (5.7%) showed no change on Challenge Words Test scores, while 11 (10.6%) showed decreases that did not meet criteria for reliable change, while 1 student (1.0%) demonstrated a decrease that met criteria for reliable change. Figure 7 shows the percentage of PHAST PACES students in each change subgroup for the Sound Combinations subtest and the Challenge Words Test.

![Graph showing percentage of PHAST PACES students meeting criteria for reliable improvement, improvement, no change, regression, and reliable regression on experimental reading measures, according to calculated reliable change (RC) indices.]

**Figure 7.** Percentage of PHAST PACES students meeting criteria for reliable improvement, improvement, no change, regression, and reliable regression on experimental reading measures, according to calculated reliable change (RC) indices.

### 1.2 Comparison with the Control Condition

A secondary question was whether differences could be detected in reading skills growth between struggling adolescent readers who received 70 hours of instruction in the PHAST PACES Program, and those waiting to receive PHAST PACES in the next semester. Statistical power to detect differences was very limited due to the small size of the control group (n = 12 for this analysis); if between-group differences were evident, however, this would be suggestive of an overall trend toward a treatment/control effect.
A two-way mixed model analysis of variance (ANOVA; between-within design) was used to assess the effect of intervention condition (PHAST PACES versus waitlist control) on reading growth. As expected, there was a significant effect of time ($F(5, 109) = 18.438, p < .001$). Students tended to perform better on standardized and experimental reading measures at post-test than at pre-test. There was also a significant time x condition interaction ($F(5, 109) = 2.923, p = .016$). Further investigation revealed that this interaction reflected a post-test advantage for PHAST PACES students over control students on the Sound Combinations subtest of the Sound-Symbol Test ($F(1, 109) = 9.698, p = .002$), and on the Challenge Word Test ($F(1, 109) = 5.764, p = .018$). No significant time x condition interactions were evident for WRMT-R subtests. Figures 8 and 9 compare mean pre- and post-test scores for students in the PHAST PACES and control conditions on standardized and experimental reading measures, respectively.

Figure 8. Mean Woodcock Reading Mastery Test – Revised (WRMT-R) standard scores for PHAST PACES and control students at pre- and post-test. Error bars indicate standard error of the mean.
Figure 9. Mean letter-sound correspondences identified on the Sound Combinations subtest of the Sound Symbol Test and mean multisyllabic words identified on the Challenge Words Test by PHAST PACES and control students at pre- and post-test. Error bars indicate standard error of the mean.

2 Analyses of Conative Functions

A second major concern of the present study was whether changes in conation were evident for adolescent struggling readers who had received 70 hours of PHAST PACES instruction. Two strategies were used to assess conation—whole group analysis and analysis by grouping based on attainment of reliable change—as described below.

2.1 Intrinsic Motivation: Intrinsic Motivation Inventory – Reading

A first analysis asked whether adolescent struggling readers’ expression of intrinsic motivation changed following instruction in the PHAST PACES Program. Change in intrinsic motivation following instruction in the PHAST PACES Program was assessed using separate two-tailed
paired samples t-tests for the three subscales of the Intrinsic Motivation Inventory – Reading (IMI-R; Interest/Enjoyment, Effort, and Perceived Competence). To control for the family-wise Type I error rate inflation, a Sidak correlation was applied (Uitenbroek, 1997; Abdi, 2007; Sidak, 1967). The mean correlation among all subscales of the SAS-R was approximately .420, requiring a lowering of the test-wise alpha level to .027 to maintain the family-wise probability of Type I error at .05 (Uitenbroek, 1997).

2.1.1 Changes in the PHAST PACES Condition

Paired samples t-tests run on data collected from 86 students revealed no significant changes in any scores on any of the three subscales of the IMI-R for students in the PHAST PHACES condition when considered as a whole group. Table 2 shows pre- and post-test subscale scores and standard deviations for students in the PHAST PACES and control conditions.

Table 2. IMI-R Subscale scores for PHAST PACES and Control students at pre- and post-test.

<table>
<thead>
<tr>
<th>Time Point</th>
<th>Pre-Test</th>
<th>Post-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PHAST PACES</td>
<td>Control</td>
</tr>
<tr>
<td>IMI-R Subscale</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Interest/Enjoyment</td>
<td>2.09 (0.77)</td>
<td>2.23 (0.94)</td>
</tr>
<tr>
<td>Effort/Importance</td>
<td>2.91 (0.73)</td>
<td>2.97 (0.96)</td>
</tr>
<tr>
<td>Perceived Competence</td>
<td>2.40 (0.66)</td>
<td>2.27 (0.94)</td>
</tr>
</tbody>
</table>

A secondary analysis classified students based on reliable change attainment, using paired sample t-tests to assess change and again applying a Sidak correction for multiple comparisons. Students were grouped according to attainment of reliable improvement criteria on the WRMT-R, as these were the subtests that were originally used to screen students for eligibility for entry into the program based on low achievement criteria for RD. Students who
attained reliable improvement on two or three tests were grouped together (23 students); students who improved on two or more tests but did not achieve reliable change status were grouped together (61 students); and, students who did not improve on two or more tests were grouped together (20 students). Paired sample t-tests separately for each of these groups revealed no significant changes in intrinsic motivation between pre-test and post-test, although the highest achieving group showed non-significant trends toward increased effort (p = .05) and increased perceived competence (p = .035). These trends were not evident for either of the lower-achieving groups. Table 3 shows mean pre- and post-test subscale scores by group.

Table 3. IMI-R Subscale scores at pre- and post-test for PHAST PACES students divided by change groups as determined by reliable change indices.

<table>
<thead>
<tr>
<th>IMI-R Subscale</th>
<th>Time Point</th>
<th>Pre-Test</th>
<th>Post-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Most Improved</td>
<td>Middle Improved</td>
</tr>
<tr>
<td>Interest/Enjoyment</td>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.78 (0.59)</td>
<td>2.17 (0.83)</td>
</tr>
<tr>
<td>Effort/Importance</td>
<td></td>
<td>2.79 (0.73)</td>
<td>2.85 (0.76)</td>
</tr>
<tr>
<td>Perceived Competence</td>
<td></td>
<td>2.08 (0.66)</td>
<td>2.55 (0.67)</td>
</tr>
</tbody>
</table>

2.1.2 Comparison with the Control Condition

Struggling readers in the PHAST PACES Program were predicted to experience an environment where reading was valued as an intrinsically enjoyable activity; they were expected to become more competent and autonomous readers who related to others via reading as a social activity. It was expected that students in the PHAST PACES Program would demonstrate increases in
intrinsic motivation for reading. Control students were not expected to demonstrate increases in intrinsic motivation for reading. A secondary interest was whether differences could be detected in changes in intrinsic motivation for reading between struggling readers in the PHAST PACES Program versus those in the control condition. Statistical power to detect differences was again very limited due to the small size of the control group (n = 10 for this analysis); if between-group differences were evident, however, this might suggest an overall trend toward differential change in intrinsic motivation according to intervention condition.

A multivariate analysis of variance (MANOVA) incorporated the three subscales of the Intrinsic Motivation Inventory (IMI-R; Interest/Enjoyment, Effort, and Perceived Competence) as dependent variables, using time as a repeated factor and group (intervention versus control) as a grouping factor. Eighty-six PHAST PACES students and 10 students in the waitlist control were included in the present analysis. The analysis revealed no significant effects of time or program, nor any time by program interactions. (See Table 2.)

2.2 Attributions: Sydney Attribution Scale – Reading

The present set of analyses focussed on whether attributions made by adolescent struggling readers changed over the course of the PHAST PACES Program. Change in attributions following the PHAST PACES Program was assessed using separate two-tailed paired samples t-tests for the six subscales of the Sydney Attribution Scale – Reading (SAS-R; Success to External Factors, Failure to External Factors, Success to Ability, Failure to Ability, Success to Effort, Failure to Effort). To control for the family-wise Type I error rate inflation, a Sidak correlation was applied (Uitenbroek, 1997; Abdi, 2007; Sidak, 1967). The mean correlation among all subscales of the SAS-R was approximately .052, requiring a lowering of the test-wise alpha level to .009 to maintain the family-wise probability of Type I error at 0.05 (Uitenbroek, 1997).

2.2.1 Changes in the PHAST PACES Condition

Paired samples t-tests run on data from 90 students revealed no significant changes in any scores on any of the six subscales of the SAS-R for students in the PHAST PHACES condition when considered as a whole group. Table 4 shows pre- and post-test subscale scores for students in the PHAST PACES and control conditions.
Table 4. SAS-R Subscale scores for PHAST PACES and Control students at pre- and post-test.

<table>
<thead>
<tr>
<th>SAS-R Subscale</th>
<th>Pre-Test PHAST PACES</th>
<th>Pre-Test Control</th>
<th>Post-Test PHAST PACES</th>
<th>Post-Test Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attributions of Success to External Causes</td>
<td>2.99 (0.66)</td>
<td>2.93 (0.65)</td>
<td>2.91 (0.71)</td>
<td>2.91 (0.77)</td>
</tr>
<tr>
<td>Attributions of Failure to External Causes</td>
<td>3.07 (0.64)</td>
<td>2.66 (0.76)</td>
<td>3.05 (0.65)</td>
<td>2.74 (0.77)</td>
</tr>
<tr>
<td>Attributions of Success to Ability</td>
<td>3.04 (0.86)</td>
<td>2.92 (1.15)</td>
<td>3.15 (0.85)</td>
<td>3.10 (1.1)</td>
</tr>
<tr>
<td>Attributions of Failure to Ability</td>
<td>2.97 (0.79)</td>
<td>2.73 (1.09)</td>
<td>2.85 (0.79)</td>
<td>2.47 (1.06)</td>
</tr>
<tr>
<td>Attributions of Success to Effort</td>
<td>3.65 (0.79)</td>
<td>3.73 (0.63)</td>
<td>3.80 (0.79)</td>
<td>3.62 (0.84)</td>
</tr>
<tr>
<td>Attributions of Failure to Effort</td>
<td>3.16 (0.73)</td>
<td>2.48 (0.74)</td>
<td>3.24 (0.77)</td>
<td>2.82 (0.70)</td>
</tr>
</tbody>
</table>

A secondary analysis classified students based on reliable change attainment, using paired sample t-tests to assess change and again applying a Sidak correction for multiple comparisons. Students were grouped according to attainment of reliable improvement criteria on the WRMT-R, as in the IMI-R secondary analyses. Paired sample t-tests separately for each of these groups revealed no significant changes in attributions between pre-test and post-test. Table 5 shows pre- and post-test subscale scores for students in the PHAST PACES condition divided by group.
Table 5. SAS-R Subscale scores at pre- and post-test for PHAST PACES students divided by change groups as determined by reliable change indices.

<table>
<thead>
<tr>
<th>Time Point</th>
<th>Most Improved</th>
<th>Middle</th>
<th>Least Improved</th>
<th>Most Improved</th>
<th>Middle</th>
<th>Least Improved</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-Test</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAS-R Subscale</td>
<td><em>M (SD)</em></td>
<td><em>M (SD)</em></td>
<td><em>M (SD)</em></td>
<td><em>M (SD)</em></td>
<td><em>M (SD)</em></td>
<td><em>M (SD)</em></td>
</tr>
<tr>
<td>Attributions of Success to External Causes</td>
<td>2.92 (0.59)</td>
<td>3.05 (0.65)</td>
<td>2.87 (0.85)</td>
<td>2.98 (0.66)</td>
<td>3.01 (0.71)</td>
<td>2.57 (0.66)</td>
</tr>
<tr>
<td>Attributions of Failure to External Causes</td>
<td>3.06 (0.68)</td>
<td>3.15 (0.60)</td>
<td>2.76 (0.59)</td>
<td>3.08 (0.51)</td>
<td>3.03 (0.66)</td>
<td>2.78 (0.68)</td>
</tr>
<tr>
<td>Attributions of Success to Ability</td>
<td>2.62 (0.90)</td>
<td>3.20 (0.86)</td>
<td>2.95 (0.71)</td>
<td>2.86 (0.77)</td>
<td>3.23 (0.88)</td>
<td>3.15 (0.82)</td>
</tr>
<tr>
<td>Attributions of Failure to Ability</td>
<td>3.25 (0.88)</td>
<td>2.88 (0.84)</td>
<td>2.99 (0.46)</td>
<td>3.17 (0.75)</td>
<td>2.75 (0.78)</td>
<td>2.75 (0.82)</td>
</tr>
<tr>
<td>Attributions of Success to Effort</td>
<td>3.42 (0.94)</td>
<td>4.68 (0.63)</td>
<td>3.76 (0.62)</td>
<td>3.91 (0.60)</td>
<td>4.64 (0.86)</td>
<td>4.11 (0.57)</td>
</tr>
<tr>
<td>Attributions of Failure to Effort</td>
<td>3.11 (0.71)</td>
<td>3.20 (0.71)</td>
<td>2.98 (0.84)</td>
<td>3.32 (0.82)</td>
<td>3.20 (0.69)</td>
<td>3.05 (0.78)</td>
</tr>
</tbody>
</table>

2.2.2 Comparison with the Control Condition

Struggling readers in the PHAST PACES Program received attributional retraining and were predicted to exhibit post-test change in attributional profile. Waitlisted students did not receive
attributional training and were expected to maintain pre-test attributional profiles. It was asked whether differences were evident in attributional profile change between PHAST PACES and control students. Statistical power to detect differences was again extremely limited due to the small size of the control group (n = 10 for this analysis); if between-group differences were evident, however, this would suggest an overall trend toward differential attributional profile change based on intervention.

A multivariate analysis of variance (MANOVA) incorporated the six subscales of the Sydney Attribution Scale – Reading (SAS-R; Success to External Factors, Failure to External Factors, Success to Ability, Failure to Ability, Success to Effort, Failure to Effort) as dependent variables, using time as a repeated factor and group (intervention versus control) as a grouping factor. Data from 90 students in the PHAST PACES condition and 10 students in the waitlist control condition were included in the analysis. The analysis revealed no significant effects of time or program, nor any time by program interactions. (See Table 4.)

2.3 Effortful Control

The primary interest of the following analyses was to evaluate whether effortful control of behaviour improved in adolescent struggling readers receiving the PHAST PACES intervention.

2.3.1 Attention Network Test

Change in effortful control following instruction was assessed using a paired samples t-test of pre- and post-test conflict resolution scores derived from the Attention Network Test (ANT).

2.3.2 Changes in the PHAST PACES Condition

Following Rueda and colleagues (2007), participants with overall response accuracy of less than 60% on the Attention Network Test (ANT) were excluded from the analysis; this resulted in the exclusion of 2 cases, and inclusion of 66 cases.

A two-tailed paired samples t-test revealed significant change between pre- and post-test on a measure of effortful control—conflict resolution score on the ANT. Conflict resolution scores were significantly improved following PHAST PACES instruction from a pre-test mean of 141 ms (SD = 75) to a post-test mean of 101 ms (SD = 45) (t(5.866), p < .001). Figure 10 shows mean pre- and post-test ANT conflict resolution scores for PHAST PACES students.
Figure 10. Mean conflict resolution scores (msec) of PHAST PACES students on the Attention Network Test at pre- and post-test. Error bars indicate standard error of the mean. Asterisks indicate significance at $p < .001$.

Paired samples t-tests on achievement groups defined by reliable change revealed that these improvements were not restricted to students who were higher- or lower-achieving in the context of the PHAST PACES program. Improvements occurred in the highest achieving group ($t (2.718), p = .018$), the middle group ($t (3.434), p < .001$), and the lowest achieving group ($t (4.971), p < .001$). Figure 11 shows mean pre- and post-test ANT conflict resolution scores for PHAST PACES students divided by group.
2.3.3 Comparison with the Control Condition

The literature surrounding effortful control and reading is sparse, but it was predicted that a combination of the fast pace and metacognitive instruction of the PHAST PACES Program would promote effortful control. Students in the control condition were not expected to demonstrate change. It was expected that students in the PHAST PACES Program would demonstrate increases in effortful control not seen in the waitlisted group.

A two-way mixed model analysis of variance (ANOVA; between-within design) was used to assess the effect of condition (PHAST PACES versus waitlist control) on effortful control as measured by the ANT. A significant time x program interaction was detected \( F(1, 73) = 6.527, p = .013 \): such that students in the PHAST PACES condition made gains while those in the waitlist control condition did not. Figure 12 shows mean pre- and post-test ANT conflict resolution scores for the PHAST PACES and control samples.
Figure 12. Mean Attention Network Test conflict resolution score (msec) for PHAST PACES and control students at pre- and post-test. Error bars indicate standard error of the mean. Asterisks indicate significance at \( p < .001 \).

2.3.4 Correlation with the Early Adolescent Temperament Questionnaire – Revised

Conflict resolution scores derived from the ANT at post-test were correlated with self-reported effortful control as gathered via the Early Adolescent Temperament Questionnaire – Revised (EATQ-R) at post-test. Data on both measures were available for 63 students. A correlation of .059 did not approach significance (\( p = .65 \)). The EATQ-R was added to the testing battery after pre-test; because EATQ-R data are available for post-test only, and were used only for the purpose of correlation with the ANT, individual and group data are not reported.
3 Correlation of Conative Functions with Reading Measures and Assessment of Directionality

An important goal of the present study was to evaluate whether conative factors explain any variability in intervention response for adolescent struggling readers. The final set of analyses seeks to investigate the association of growth in reading with conation at pre- and post-test through the use of cross-lagged panel correlation analysis.

While experimental manipulation of variables allows more direct examination of the source and direction of causal influences, cross-lagged panel correlation analysis allows for preliminary determination of which variable or variables act as dependent variables and which as independent in situations where strict experimental control is not possible (McCullough, 1978; Yee & Gage, 1968). Cross-lagged panel correlation analysis allows for discrimination of the mutual effects of continuous variables measured at two or more time points (McCullough, 1978), through the computation of six combinations of correlations (at minimum): two autocorrelations (correlations of each of the variables with itself at each time point), two synchronous correlations (correlations of each of the variables with the other at the same time point) and two cross-lagged correlations, which are the correlations of interest (correlations of each of the variables with the other at each time point; Kenny & Harakiewicz, 1979). The use of partial correlations allows for the control of autoregressive effects (Lundberg & Sterner, 2006).

The results of cross-lagged panel correlation analysis are valid if two assumptions are met. The first is the assumption of synchronicity, the requirement that both variables are measured at the same point in time (Kenny & Harakiewicz, 1979). All variables were measured within days of each other at each time point in the present study, satisfying the synchronicity assumption. The second assumption is that of stationarity, or the requirement that each measure is composed of the same key “ingredients” at pre- and post-testing (Kenny & Harakiewicz, 1979). Perfect stationarity requires equal synchronous correlations, whereas quasi-stationarity requires only that the structural equation for each variable changes over time by a constant that is unique to that variable (Kenny & Harackiewicz, 1979).

In this case, as the same metric was used for each variable, it is unlikely that perfect stationarity was achieved, as using the same metric does not account for stage-like developmental change that may alter the composition of variables. Quasi-stationarity is,
however, likely, since the same measures were used at pre- and post-test. The present study is best suited to satisfy the assumption of quasi-stationarity, since the measures being used at both time-points are the same and are not gathered during a period of rapid, stage-like development; it is assumed that true scores remain stationary (Kenny, 1975).

3.1 Correlations with Reading and Directionality – Intrinsic Motivation: Intrinsic Motivation Inventory – Reading

A cross-lagged panel correlation analysis was constructed that included all reading measurements at both time points, and all three subscale scores of the IMI-R. To maintain family-wise error at .05 with the six correlations per variable pair, test-wise error was adjusted to .008. Autocorrelations provide information about the stability and change of conative factors. Synchronous correlations in the present analysis are reported, as they provide information about whether conative factors are associated with reading skills. Cross correlations provide information about directionality; figures are shown where cross-lagged correlations are significant.

Interest in, and enjoyment from, reading as reported at pre-test on the IMI-R was significantly correlated with interest and enjoyment at post-test ($r = .584, p < .001$), suggesting relative stability of this construct. Reported interest and enjoyment showed no significant synchronous or cross-lagged correlations with any standardized or experimental measures of reading skill. Reported post-test interest and enjoyment were similarly uncorrelated with measures of reading skill at pre- and post-test.

Effort invested in reading at pre-test was significantly correlated with effort reported at post-test ($r = .564, p < .001$). No significant synchronous correlations were evident. Partialling out pre-test performance on individual reading measures, effort reported at pre-test was negatively correlated with post-test performance on the Word Attack subtest of the WRMT-R ($r = -.324, p = .001$), suggesting causal flow from high reported effort to lower Word Attack outcomes, as shown in Figure 13. Effort reported at pre-test was not significantly correlated with any other standardized or experimental measures of reading at post-test. Effort invested in reading as reported at post-test on the IMI-R was not correlated with measures of reading skill at pre-test.
Perceived competence for reading as reported on the IMI-R at pre-test was significantly correlated with perceived competence at post-test ($r = .526, p = .001$), indicating relative stability. Analysis of synchronous correlations revealed that perceived competence as reported at pre-test was significantly correlated with performance on the Word Identification subtest of the WRMT-R at pre-test ($r = .343, p < .001$), and with performance on the Challenge Words Test at pre-test ($r = .300, p = .001$). Perceived competence as reported at post-test was significantly correlated with Word Identification performance at post-test ($r = .307, p = .002$). When pre-test performance on individual reading measures was controlled using partial correlations, perceived competence at pre-test showed no significant cross-lagged correlations with any standardized or experimental post-test measure of reading. Perceived competence at post-test was similarly uncorrelated with measures of reading skill at pre-test, suggesting that though perceived competence in reading is consistently moderately correlated with two measures of reading, no causal relationship was established between pre- and post-test.

3.2 Correlations with Reading and Directionality – Attributions: Sydney Attribution Scale – Reading

A cross-lagged panel correlation analysis was constructed that included all reading measurements at both time points, and all six subscale scores of the SAS-R. To maintain family-
wise error at .05 with the six correlations per variable pair, test-wise error was adjusted to .008. Autocorrelations provide information about the stability of conative factors. Synchronous correlations in the present analysis provide information about whether conative factors are associated with reading skills. Cross correlations provide information about directionality; figures are shown where cross-lagged correlations are significant.

Attributions of success to external causes as reported at pre-test on the SAS-R were significantly correlated with external attributions for success at post-test ($r = .546, p < .001$). Attributions of failure to external causes as reported at pre-test were significantly correlated with external attributions for failure at post-test ($r = .479, p < .001$). Attributions of success and failure to external causes as reported at pre-test on the SAS-R evidenced no significant synchronous or cross-correlations with any standardized or experimental measure of reading skill. Post-test attributions of success and failure to external causes were similarly uncorrelated with measures of reading skill at pre- and post-test.

Attributions of success to ability as reported at pre-test on the SAS-R were significantly correlated with attributions of success to ability at post-test ($r = .635, p < .001$). Analysis of synchronous correlations revealed that attributions of success to ability at pre-test were significantly correlated with performance on the Word Identification subtest of the WRMT-R at pre-test ($r = .396, p < .001$), performance on the Word Attack subtest at pre-test ($r = .306, p = .001$), and performance on the Challenge Words Test at pre-test ($r = .295, p = .002$). Attributions of success to ability as reported at post-test were significantly correlated with performance on the Word Identification subtest of the WRMT-R at post-test ($r = .506, p < .001$), performance on the Word Attack subtest at post-test ($r = .433, p < .001$), and performance on the Challenge Words Test at post-test ($r = .389, p < .001$). Controlling for pre-test performance on individual reading measures, pre-test attributions of success to ability were not significantly correlated with standardized or experimental reading measures. Controlling for pre-test attributions of success to ability, post-test attributions of success to ability were significantly correlated with pre-test performance on the Word Identification ($r = .386, p < .001$), as shown in Figure 14, and Word Attack ($r = .420, p < .001$) subtests of the WRMT-R, as shown in Figure 15, and pre-test performance on the Challenge Words Test ($r = .290, p = .003$), as shown in Figure 16. This pattern of results suggests possible causal flow from high pre-test reading scores to more attributions of success to ability at post-test.
Figure 14. The pattern of cross-lagged correlations between attributions of success to ability as reported on the SAS-R and WRMT-R Word Identification standard score. Asterisks indicate significance.

Figure 15. The pattern of cross-lagged correlations between attributions of success to ability as reported on the SAS-R and WRMT-R Word Attack standard score. Asterisks indicate significance.
Figure 16. The pattern of cross-lagged correlations between attributions of success to ability as reported on the SAS-R and Challenge Words Test score. Asterisks indicate significance.

Attributions of failure to ability as reported at pre-test on the SAS-R were significantly correlated with attributions of failure to ability at post-test ($r = .479, p < .001$). Analysis of synchronous correlations revealed that attributions of failure to ability as reported at pre-test were significantly negatively correlated with performance on the WRMT-R Word Identification subtest at pre-test ($r = .381, p < .001$), with Word Attack performance at pre-test ($r = -.355, p < .001$), with Passage Comprehension performance at pre-test ($r = -.289, p = .002$), and with performance on the Challenge Words Test at pre-test ($r = -.380, p < .001$). Attributions of failure to ability as reported at post-test were significantly negatively correlated with performance on the Word Identification subtest of the WRMT-R at post-test ($r = -.272, p = .005$). When pre-test performance on individual reading measures was controlled, pre-test attributions of failure to ability were not significantly correlated with standardized or experimental reading measures. When pre-test attributions of failure to ability were controlled, post-test attributions of failure to ability were significantly negatively correlated with pre-test performance on the Word Identification subtest of the WMRT-R ($r = -.278, p = .008$), as shown in Figure 17, indicating possible causal flow from higher pre-test Word Identification scores to fewer post-test attributions of failure to ability.
Attributions of success to effort as reported at pre-test on the SAS-R were significantly correlated with attributions of success to effort at post-test ($r = .418, p < .001$). Attributions of failure to effort as reported at pre-test on the SAS-R were significantly correlated with attributions of failure to effort at post-test ($r = .585, p < .001$). When pre-test performance on individual reading measures was controlled, pre-test attributions of success and failure to effort were not significantly correlated with standardized and experimental reading measures. Post-test attributions of success and failure to effort were similarly uncorrelated with reading measures.

### 3.3 Correlations with Reading and Directionality – Effortful Control: Attention Network Test

A cross-lagged panel correlation analysis was constructed that included all reading measurements at both time points, and conflict resolution scores on the ANT. To maintain family-wise error at .05 with the six correlations per variable pair, test-wise error was adjusted to .008. Autocorrelations provide information about the stability and change of conative factors. Synchronous correlations in the present analysis are reported, as they provide information about whether conative factors are associated with reading skills. Cross correlations provide information about directionality.
Conflict resolution scores, an indicator of effortful control, gathered from the ANT at pre-test were significantly correlated with conflict resolution scores at post-test ($r = .384, p = .001$). Analysis of synchronous correlations revealed that pre-test conflict resolution scores were not significantly correlated with pre-test reading outcomes. Post-test conflict resolution scores were significantly negatively correlated with performance on the Passage Comprehension subtest of the WRMT-R at post-test ($r = -.310, p = .003$), and with performance on the Challenge Words Test at post-test ($r = -.277, p = .008$). When pre-test performance on individual reading measures was partialled out using partial correlations, pre-test conflict resolution scores were not significantly correlated with standardized and experimental reading measures. Post-test conflict resolution scores were similarly uncorrelated with standardized and experimental pre-test reading measures. Negative correlations in this instance mean that faster response times (and lower conflict resolution scores) were associated with higher reading outcome scores. The pattern of results arising from this analysis suggests that while conflict resolution scores at post-test and some reading outcomes at post-test are moderately correlated, no direction of causality can be established.
Chapter 5
Discussion

The objective of the present study was to investigate influences on the variability in intervention outcomes observed among struggling adolescent readers. This was achieved by evaluating reading achievement and conation prior to and following participation in the PHAST PACES Program, a research-based reading intervention program designed for secondary school students meeting criteria for reading disability (RD). The present study focussed on the impact of attributions, intrinsic motivation, and effortful control of behaviour, and their reciprocal relationships with the development of reading skill in adolescents with RD.

1 Delimitations

Within the broader context of investigating variability in intervention response, the scope of the present study was limited to investigating the effect of specific conative factors on the outcomes of struggling adolescent readers. Within the realm of conation, the project was further delimited by the selection of three factors for study—attributions, intrinsic motivation, and effortful control. Adolescent reading intervention remains under-studied, and variability in remediation response poorly characterised; the following section explains the choice of these factors, and the general focus on conation more generally.

1.1 Phonological and Naming Speed Deficits in Adolescent Struggling Readers

The two cognitive processes most frequently described as important factors in developmental reading disabilities are phonological awareness and rapid automatized naming (Vaessen & Blomert, 2010). A long history of research has suggested that dysfluent reading and difficulties with decoding arise from a core deficit in phonological awareness (Wagner et al., 1997; Shaywitz, Morris, & Shaywitz, 2008). The ability to analyze and manipulate the sound structure of spoken language is consistently predictive of reading ability (Shaywitz, Morris, & Shaywitz, 2008; Wagner et al., 1997; Scarborough, 1984), and deficits in these processes are widely accepted as the basis for the majority of reading disabilities (RD; Wolf & Bowers, 1999). Difficulties in acquiring reading skills are frequently, however, also associated with deficits in rapid automatized naming, the ability to fluently name sequences of items presented in a visual...
array (Wolf & Bowers, 1999). Naming speed is correlated concurrently and longitudinally with early reading skill (Compton, 2003; Lervag & Hulme, 2009), and is predictive of word-reading in children (Wagner et al., 1997) and of reading rate and comprehension in adult samples (Arnell, Joanisse, Klein, Busseri, & Tannock, 2009). Naming speed also contributes significantly to reading fluency in adolescent samples (Barth, Catts, & Anthony, 2009).

Although the double deficit model of reading disabilities is predicated on the independent contributions of phonological awareness and naming speed to RD (Wolf & Bowers, 1999; Vaessen & Blomert, 2010; Vaessen, Gerretsen, & Blomert, 2009), there is considerable evidence to suggest that these deficits are interrelated and that phonological awareness and naming speed are not independent constructs (e.g., Schatschneider et al. 2002; Wagner et al., 1997; Vaessen, Gerretsen, & Blomert, 2009).

The present study did not aim to investigate the roles of phonological awareness and naming speed on remedial reading outcomes for struggling adolescent readers. Phonological processing ability has well-established predictive power for remedial reading outcomes in younger students (Torgesen et al., 2001; Lovett, Steinbach, & Frijters, 2000; Waring, Prior,anson, & Smart, 1996; Lovett, Benson, & Olds, 1990). Similarly, naming speed has been shown to predict the response of elementary students to certain remediation programs (Lovett, Benson, & Olds, 1990; Compton, 2000; Stage et al., 2003). Naming speed and phonological awareness have been found to be predictors of both final outcomes and of growth in intervention (Morris et al., in press). It is likely that phonological processing ability and naming speed continue to predict remedial reading outcomes and skill growth in response to remediation in adolescence. Adolescent samples tend to be less well-characterised, but recent work has suggested that phonological skills are predictive of rate of skill acquisition and remediation outcomes in this population (Lovett, Lacerenza, DePalma, & Frijters, in press). In both elementary (Frijters, 2004; Frijters et al., 2009), and secondary (Lovett, Lacerenza, DePalma, & Frijters, in press) populations, however, phonological processing does not account for all of the variability in response to remediation.

There is evidence that suggests that conative factors may account for some of this variability in response among younger students (Frijters, 2004). These effects are poorly characterised in adolescent struggling readers, providing the impetus to focus on conation as a possible adjunct to previous and ongoing studies into the role of phonological processing.
Conative factors, such as attributions, seem directly relevant to academic achievement and readily amenable to retraining (Dweck, 1975; Borkowski, Weyhing, & Carr, 1988; Frijters et al., 2009; Guthrie, Alao, Rinehart, 1997; Sweet, & Guthrie, 1996; Rueda et al., 2005). Conative factors offer a potentially fruitful avenue for investigation, both for theoretical and for practical educational purposes.

2 Understanding Remediation for Struggling Adolescent Readers

Struggling adolescent readers may differ in some important ways from older elementary and middle school students with reading disabilities. The consequences of early failure to acquire basic literacy skills are potentially devastating: Children who do not learn to read easily may resist reading activities outside the classroom, and consequently fail to develop vocabulary and word knowledge at the same rate as their more proficient peers (Gabrieli, 2009). It is speculated that a proficient fifth-grader may read as many words in two days as a struggling reader would in an entire year (Gabrieli, 2009). Initial deficits in phonological awareness appear to interact with pre-reading and reading skills in a complex bidirectional fashion (Wagner et al., 1997; Stanovich, 1986; Snyder & Downey, 1997), such that students who do not practice reading see their deficits compounded. Early difficulties in skill acquisition, and lack of practice, results in poor comprehension when students enter later grades and are expected to read texts for subject information (Gabrieli, 2009).

By secondary school, struggling adolescent readers lack a tremendous amount of reading experience relative to their more proficient peers. They are known to demonstrate large gaps in letter-sound knowledge, decoding abilities, and reading fluency (Lovett, Lacerenza, DePalma, & Frijters, in press), and are likely to have missed substantial opportunities for vocabulary and subject knowledge development (Gabrieli, 2009). Yet, they are expected to read texts of increasing sophistication to obtain subject-specific information in their courses.

By adolescence, poor readers are likely to struggle with more than just reading; lacking the requisite reading skills for success in a wide range of subject areas, struggling adolescent readers are likely to have experienced long histories of academic frustration and failure. What may have started as a fairly specific set of reading-related learning problems has generalized to widespread
academic underachievement, limited reading comprehension skills, and poor written output (Moats, 2001; Gabrieli, 2009).

2.1 Remediation Works for Older Readers

Despite discouraging findings of growing deficits and inadequate reading practice among older struggling readers, there is some promising evidence that improvements can be made in the literacy skills of older students with RDs. Remedial reading intervention programs are effective for struggling readers (Shaywitz, Morris, & Shaywitz, 2008; Lovett & Steinbach, 1997; Lovett et al., 1996; Lovett et al., 2008; Vellutino, Scanlon, Small, & Fanuele, 2006; Torgesen et al., 2001). Moreover, a recent evaluation of the efficacy of the PHAST PACES Program, a phonological and strategy-based remediation program specifically designed for struggling readers in secondary school, has provided evidence that intensive, short-term interventions can be successful for adolescent students with RD (Lovett, Lacerenza, DePalma, & Frijters, in press).

The present study supports findings that intensive remediation with an evidence-based phonological and strategy-based program can produce gains in reading skill for struggling adolescent readers. Students participating in the PHAST PACES Program gained an average of 2.2 standard scores on the Word Identification subtest of the Woodcock Reading Mastery Test – Revised (WRMT-R; Woodcock, 1987), 6.0 standard scores on the Word Attack subtest, and 5.2 standard scores on the Passage Comprehension subtest following 70 hours of instruction. Although these gains were not significantly different from gains made by control students, it is possible that this negative finding is due to the very low statistical power afforded by the small size of the control sample. Students in the PHAST PACES condition also made significant gains on the experimental reading measures. Students gained an average of 6.6 sound-symbol correspondences on the Sound Combinations subtest of the Sound-Symbol test (Lovett et al., 1994; Lovett, Lacerenza, Borden, Frijters, et al., 2000) and correctly identified 3.3 more multisyllabic words at post-test than at pre-test on the Challenge Words Test (Lovett et al., 1994; Lovett, Lacerenza, Borden, Frijters, et al., 2000). These program-related gains were sufficiently robust to reveal a significant advantage for PHAST PACES students over control students, despite limited statistical power.

In addition to assessing statistically meaningful change through hypothesis testing, the present study investigated clinically meaningful change through the use of reliable change
indices. Analysis of the clinical change characteristics (Jacobson & Truax, 1991) of the PHAST PACES Program participants revealed that on the WRMT-R subtests, many students exceeded criteria for reliable clinical change on the Word Identification subtest (23.1% of students), the Word Attack subtest (26.1%), and the Passage Comprehension subtest (29.8%). A substantial number of the remaining students showed improvement at post-test but did not meet criteria for reliable clinical change (36.2% on the Word Identification subtest; 51.5% on Word Attack; 41.1% on Passage Comprehension). Similarly, many students exceeded criteria for reliable clinical change on the Sound Combinations subtest (49.6% of students) or improved but did not meet reliable change criteria (44.8%). On the Challenge Words Test, many students exceeded reliable change criteria (35.5%) or improved but did not meet reliable change criteria (47.5%).

These results add to the literature supporting the value of intensive, phonological and strategy based remediation for adolescent struggling readers. Students made encouraging gains on standardized and experimental measures of reading following 70 hours of intervention in a single semester course in secondary school.

3 Understanding Variability in Adolescent Response to Remediation: The Promise and Limitations of Conative Factors

Even when reading remediation is successful, response can be highly variable. Much of the variability in younger samples may be attributed to individual differences in factors like phonological processing ability (Torgesen et al., 2001; Lovett, Steinbach, & Frijters, 2000; Waring, Prior, Sanson, & Smart, 1996; Lovett, Benson, & Olds, 1990) and naming speed (Lovett, Benson, & Olds, 1990; Compton, 2000; Stage et al., 2003). In adolescent samples, a significant portion of variability in response to remediation is accounted for by processing factors (Lovett, Lacerenza, DePalma, & Frijters, in press). Substantial variability remains unexplained, however (Frijters, 2004; Frijters et al., 2009; Lovett, Lacerenza, DePalma, & Frijters, in press). Some variability may be accounted for by neurocognitive variables (Frijters, et al., in press), but the remainder is not accounted for by ethnicity, socioeconomic status, or IQ (Morris et al., in press). Students respond equally well to these interventions whether English is their first or later language (Lovett et al., 2008).
Recent research (Frijters, 2004) has suggested that conative functions may account for some of this response variability in younger students. This makes sense, as the most successful remediation programs include components of attributional retraining (Lovett, Lacerenza, DePalma, & Frijters, in press; Lovett, Lacerenza, & Borden, 2000). Conative functions may provide both an explanation for variability in response to remedial reading intervention, and a practical target for intervention, as conative functions such as attributions and effortful control appear amenable to retraining (Dweck, 1975; Borkowski, Weyhing, & Carr, 1988; Frijters et al., 2009; Guthrie, Alao, Rinehart, 1997; Sweet, & Guthrie, 1996; Rueda et al., 2005).

Adolescence marks a period of extensive neural development and remodelling; peak total cerebral volume is achieved in late middle school (around 11.5 years of age) for females, and around the beginning of secondary school (around 14.5 years of age) in males (Lenroot & Giedd, 2006). The dorsolateral prefrontal cortex is particularly late to reach maturity (Lenroot & Giedd, 2006), and provides a substrate for the development of conative functions, including making judgements and arriving at decisions (Lenroot & Giedd, 2006), and exerting effortful control over cognition and behaviour (Lenroot & Giedd, 2006; Rueda, Rothbart, Saccomanno, & Posner, 2007). Conative functions may be especially important to consider during this time of extensive neural remodelling. Adolescence may represent a particularly fruitful time to target the plastic neural substrates of conation with well-designed retraining programs.

3.1 Intrinsic Motivation for Reading

Motivation describes the commitment to pursue, invest effort in, and persist on a task (Wigfield & Eccles, 2000; Ryan & Deci, 2000). Varying by task and domain (Ryan & Deci, 2000), motivation may do much to determine performance outcomes for a given task (Wigfield & Eccles, 2000), possibly due to close interconnections with other aspects of conation. In particular, motivation appears a necessary precondition before a student will invest resources into the effortful control of behaviour (Frijters, 2004). The relationship is reciprocal: students with high self-efficacy and internal attributions for success are more motivated to invest effort into tasks than students with poorer competence beliefs and external attributions for success (Wigfield & Wagner, 2005). Ryan and Deci (1985, 2000) have proposed a three-factor model of motivation, known as Self-Determination Theory (SDT), based on essential human needs for
competence, relatedness, and autonomy. They posit that when these needs are not met, motivation suffers (Ryan & Deci, 2000).

Within the SDT framework, goals that are internally- and personally-generated motivate individuals to the highest levels of performance, to greater persistence, and to enhanced creativity (Ryan & Deci, 2000; Deci & Ryan, 1991). Inherent in this concept is the notion that students may be motivated to engage in academic activities for a variety of reasons. A typical framework for understanding students’ differing goals or motivations for engaging in an activity distinguishes between “mastery” from “performance” goals (Ames, 1992; Wigfield & Wagner, 2005). A mastery goal orientation describes one where the expressed desire is to learn and master new material (Wigfield & Wagner, 2005). When students engage in an activity with a mastery orientation, they do so with the belief that the effort they invest is closely tied to the goal outcome (Ames, 1992). Students who engage in an activity with this orientation tend to express more intrinsic motivation (Ames, 1992), or desire to engage in the activity for its own sake (Ryan & Deci, 2000); they are engaged in the activity and are willing to expend energy to achieve competence, or mastery, because they believe that energy expenditure is closely related to success. A performance goal orientation, in contrast, describes a desire to outperform others or to receive favourable evaluation (Wigfield & Wagner, 2005). Students endorsing performance goals believe that success is measured by normative standards and reveals ability characteristics; they may be less motivated to expend energy in goal pursuit because effort may be seen as risky if trying hard does not lead to success (Ames, 1992).

Motivation and related competence beliefs and goal orientations may undergo substantial change during adolescence due to biological changes associated with puberty, changing social roles and peer groups, school transitions, and changes in cognition and ability to self-regulate, or exert effortful control over behaviour (Wigfield & Wagner, 2005). In the academic domain, intrinsic motivation appears to become increasingly stable as students age and progress through school, with mean levels declining in higher grades for a range of subjects (Gottfried, Fleming, & Gottfried, 2001). Intrinsic motivation for academics declines steadily throughout elementary, middle, and secondary schools, with students who began school high in motivation maintaining higher overall levels of intrinsic motivation than students who began with low levels of intrinsic motivation (Wigfield & Wagner, 2005). In particular, declines in intrinsic motivation for reading have been reported (see Guthrie, Alao, & Rinehart, 1997), with especially severe trends evident
for students struggling with reading (McKenna, Kear, & Ellsworth, 1995). This is likely because students transition from early assessments of their own competence that rely on effort, social feedback, and mastery to later assessments that are normative and performance-based (Stipek & MacIver, 1989). This transition may result in changes in their beliefs about their own competence that undermine motivation, especially intrinsic motivation (Wigfield & Wagner, 2005). In other words, students appear to shift on a continuum from more mastery-related orientations to more performance-related orientations. This shift is facilitated by the school environment, which focuses increasingly on evaluative feedback as students progress. This focus is likely to affect poorer readers disproportionately because the normative evaluative feedback they receive is negative.

In a review of reading engagement in young adolescents, Guthrie, Alao, and Rinehart (1997) have suggested that motivation for reading may be context-specific and amenable to change given appropriate programming. Integrative curricula that promote strategic, self-directed learning may facilitate the discovery or rediscovery of the intrinsic rewards of reading (Guthrie, Alao & Rinehart, 1997; Sweet & Guthrie, 1996).

Based on the above, it was expected that students would express increased levels of competence, effort, and interest and enjoyment, core components of intrinsic motivation, in the reading domain following participation in the PHAST PACES Program relative to pre-test. In fact, this hypothesis was not supported by the present findings. Students in the PHAST PACES Program did not demonstrate an appreciable increase in expressed effort, interest and enjoyment, or competence in reading as reported on the Intrinsic Motivation Inventory – Reading.

It is possible that the present study was underpowered to detect small but important improvements in intrinsic motivation that may have taken place over the course of 70 hours of remedial reading intervention in the PHAST PACES Program. It is also possible that 70 hours of instruction in a supportive environment that promotes strategic learning may not have been enough to counter the many years of negative evaluative feedback and failure to master reading that struggling adolescent readers in secondary school have experienced. It is important to note, while PHAST PACES students demonstrated substantial improvement on reading outcome measures, scores remained well below age expectations following 70 hours of instruction. Struggling adolescent who are reading below age expectations may remain unlikely to endorse
statements suggesting competence, effort and importance, or enjoyment even following instruction in a non-evaluative environment that supports reading development. The subsample that was identified as showing reliable improvement on at least two subtests of the WRMT-R using clinical change criteria showed a non-significant but suggestive trend toward increased effort and perceived competence that was not evident for the groups that showed less improvement. This finding is interesting because it suggests that intervention may indeed be associated with improvements in intrinsic motivation, but only for students whose reading growth is sufficient to demonstrate significant improvements on objective measures of reading skill.

These findings, although not what had been predicted, remain encouraging. Perhaps with a longer period of remediation, improvements in intrinsic motivation for reading would be attained for a greater proportion of struggling adolescent readers. This possibility is being assessed by ongoing work in the LDRP. If intrinsic motivation leads to increased effort, these effects are likely to be bidirectional and have positive practical significance for remediation efforts.

3.2 Attributions for Success and Failure

Attributions are perceptions of the causes of success and failure (Weiner, 1979); they are the explanations individuals construct for success and failure outcomes (Weiner, 1980), and they are used to generate expectations about the outcomes of different actions (Hyland, 1988). Weiner (1979) proposed that attributions for success and failure outcomes could be classified along three broad dimensions or continua: locus of causality (internal/external), stability (variance/invariance in time), and controllability (within/beyond volitional control). The causal outcomes that arise from the many combinations of these factors give rise to a variety of motivational and volitional outcomes (Weiner, 1979; Winograd & Niquette, 1988).

One of the direct consequences of attributions for behaviour is the amount of effort that is expended on a given task in the hopes of achieving success (Hyland, 1988); attributions may play a determining role especially in the face of setbacks or failure (Hong et al., 1999). In these contexts, certain attributions are viewed as relatively more adaptive than others (Weiner, 1980). In particular, attributing failure to global, stable factors mediates maladaptive reactions (Hong et al., 1999), leading to expectations of further failure, low effort input, and deterioration of
performance (Diener & Dweck, 1978). The affective consequences are depression, apathy, and resignation (Weiner, 1979). Conversely, attributing failure to unstable or controllable factors mediates more adaptive reactions (Hong et al., 1999), producing motivational and volitional states that facilitate success (Weiner, 1979, 1980).

Though attributions have been traditionally conceived as generated following an outcome, more recent empirical work (Hong et al., 1999) has suggested that individuals subscribe to implicit theories that create a framework or model within which attributions are formed. Two such frameworks are entity and incremental self-theories (Hong et al., 1999; Elliot & Dweck, 1988). Such frameworks may be applied to any number of attributes, from intelligence to reading ability. When an incremental theory is held, a student will view the trait as relatively malleable (Hong et al., 1999; Elliot & Dweck, 1988). A student who holds an incremental theory of reading ability will see reading ability as something subject to change, and will be relatively more likely to pursue mastery goals than performance goals (Elliot & Dweck, 1988). When an entity theory is held, a student views the trait as a fixed ability, and attributions and goals reflect that belief. A student who holds an entity theory of reading ability will see reading ability as something fixed, with ability level to be displayed or hidden through a relative lack of effort, and she is likely to pursue performance goals over mastery goals (Elliot & Dweck, 1988). Students who are incremental theorists are relatively more likely to make attributions of success and failure to effort, while entity theorists are more likely to attribute their successes and failures to ability or lack thereof, becoming helpless to master material in the face of failure (Hong et al., 1999; Elliot & Dweck, 1988).

It has been suggested that students who demonstrate maladaptive attributional patterns and the corresponding goal orientations may benefit from both attributional retraining and metacognitive training (e.g., Diener & Dweck, 1978; Dweck, 1975; Weiner, 1980; Toland & Boyle, 2008; Chan, 1996). This training may provide important added value to existing reading remediation programs (e.g., Borkowski, Weyhing, & Carr, 1988; Chan, 1996; Frijters et al., 2009).

It was expected that students in the present study would progress from relatively maladaptive attributional profiles, commensurate with performance goal orientations, to relatively adaptive attributional profiles, commensurate with mastery goal orientations, following
participation in the PHAST PACES Program, which includes a strong attributional retraining component. Students were expected to progress from endorsing statements that ascribe success and failure to ability to endorsing statements that ascribe successes and failures to effort. In fact, this hypothesis was not supported in the present results. Students in the PHAST PACES Program demonstrated no significant changes in attributions between pre- and post-test as reported on the SAS-R. When students were grouped according to reliable clinical change criteria and analysed by subgroups, no new findings were revealed.

The lack of observed change in attributions may be due simply to a lack of statistical power. It is also possible that students had not sufficiently consolidated the new attributional sets they were adopting during class time for them to be reported on a self-report measure. It is more likely, however, that 70 hours of intensive remediation with embedded attributional retraining was insufficient to counter the effects of many years of maladaptive attributions and reading failure. Struggling adolescent readers may require a greater intensity or volume of attributional retraining, or may need more explicit attributional retraining to achieve the attributional change reported in younger samples. When Frijters and colleagues (2009) found evidence of attributional change in younger students, it was after 125 hours in an intensive remediation program with embedded attributional retraining; perhaps a program of this duration would also produce change in adolescents with RD.

Failure to achieve age level expectations in reading may also account for a lack of attributional change. PHAST PACES students demonstrated improvement on reading outcome measures, but scores remained well below age expectations following PHAST PACES instruction. Retraining may have minimal effect on the attributions of struggling adolescent readers when they continue to experience reading failure outside of the remediation context.

3.3 Effortful Control

Effortful control describes the inhibition of competing behavioural responses, favouring a desirable less-dominant response over a prepotent initial response (Rueda, Rothbart, Saccomanno, & Posner, 2007). Effortful control represents a self-regulatory capacity (Deater-Deckard, Mullineaux, Petrill, & Thompson, 2009) that is positively correlated with reading outcomes (Blair & Razza, 2007; Welsh et al., 2010), and early beliefs about competence for reading (Liew, McTigue, Barrois, & Hughes, 2008). Effortful control may be closely connected
with attributions and motivation because the agency it supports in guiding behaviour is a necessary precondition for successful performance (Liew, McTigue, Barrois, & Hughes, 2008). This relationship is likely to be reciprocal, with higher effortful control resulting in better domain performance, more positive and adaptive attributions and higher motivation, and subsequent increases in, or maintenance of, effortful control.

Effortful control, like attributions, has been subject to directed training (Rueda et al., 2005). The present study, however, is predicated on an as-yet-untested assumption that effortful control can be trained through indirect means. Effortful control is thought to be highly related to, and mediated by, attributions and motivation (Liew, McTigue, Barrois, & Hughes, 2008); with these relationships likely reciprocal. The PHAST PACES Program is fast-paced, intense, and emphasises the acquisition and monitoring of multiple decoding and comprehension strategies, meaning that students are likely to benefit most from the program when they have high levels of effortful control. This is perhaps even more relevant in the present situation in which older students must engage in reading activities despite possible emotional biases against reading resulting from many years of reading failure. The PHAST PACES Program contains a strong embedded attributional retraining component. One hypothesis of the present study was that students enrolled in PHAST PACES would show improvement on a measure of effortful control between pre- and post-test—this might be mediated by more positive attributions gained through attributional retraining and the demands of the fast-paced remedial intervention environment.

In fact, PHAST PACES students did demonstrate significant improvement on the Attention Network Test (ANT), a measure of effortful control. Students in the PHAST PACES Program improved conflict resolution scores (a proxy for effortful control) by an average of 40 msec, while control students did not improve significantly. Interestingly, these improvements occurred regardless of whether students demonstrated concomitant reliable clinical improvements on standardized reading measures.

These findings are encouraging, because they suggest that effortful control, which is associated with a number of positive outcomes, is amenable to training in adolescent struggling readers. Further, training does not need to take place in directed sessions, but can be achieved through participation in a remedial reading program that requires effortful control and includes an embedded attributional retraining component. The design of the PHAST PACES Program
deliberately targeted not only the reading and processing deficits of these adolescents with RD, but also their maladaptive conative profiles and their concepts of themselves as learners.

3.4 Understanding the Directional Effects of Conation on Reading

Conative functions and reading remediation outcomes may interact with one another in simple directional relationships, but it is very difficult at this point to predict directionality. Attributions of success to effort (perhaps arising out of mastery goal orientations) may result in a student investing significant effort into reading and seeing growth in reading skill. Alternatively, the student may perceive skill growth as an impetus to invest effort into reading and form an attributional orientation endorsing attributions of success to effort. A third and more complex possibility is that the student may have an existing mastery goal orientation for reading, resulting in the endorsement of attributions of success to effort. This may result in increased effort input and reading skill growth. When the student experiences reading skill growth, she may strengthen her mastery orientation, and make further endorsements of attributions of success to effort. A final objective of the present study was to conduct a preliminary investigation of the direction of causal influences between reading outcome variables and conative variables using cross-lagged panel correlation analysis.

Correlations of reading measures with the three subscales of the IMI-R revealed no significant correlations of reading outcomes at pre- and post-test with interest in and enjoyment of reading. Effort invested in reading was also not correlated with pre- or post-test reading measures. Of particular interest, perceived competence at pre- and post-test was moderately correlated with a measure of reading, the Word Identification subtest of the WRMT-R at pre- and at post-test. Cross-lagged analyses using partial correlations to control for autoregressive effects did not, however, reveal a causal relationship between reading performance and perceived competence.

Moderate correlations were found for attributions of success to ability as reported on the SAS-R at pre- and post-test to pre- and post-test reading measures. Cross-lagged correlations controlling for autoregressive effects revealed that pre-test reading scores were significantly correlated with post-test attributions of success to ability. Pre-test attributions of success to ability were not correlated with post-test reading outcomes. This pattern of results suggests that
better reading outcomes at pre-test may result in more attributions of success to ability at post-test.

Moderate negative correlations were found for attributions of failure to ability at pre- and post-test to some pre- and post-test reading measures. Cross-lagged analysis revealed that pre-test attributions of failure to ability were not correlated with post-test reading outcomes. Pre-test performance on the Word Identification subtest was significantly negatively correlated with post-test attributions of failure to ability. These preliminary correlations suggest that performance on reading measures may be negatively associated with attributions of failure to ability, but that the relationship may not be causal in nature, except for in the case of Word Identification, where it appears that higher scores at pre-test lead to fewer attributions of failure to ability at post-test.

Correlations of standardized and experimental reading measures with the external attributions scales of the SAS-R revealed that attributions of success and failure to external causes at pre- and post-test were not correlated with success on any measures of reading ability; this was not surprising, as the literature reports conflicting findings regarding external attributions. A more surprising finding, however, is that attributions of success and failure to effort were not correlated with performance on any reading measures at either time point.

Post-test conflict resolution scores on the ANT were moderately negatively correlated with two reading measures at post-test. In this context, a negative correlation indicates that a lower, or better, conflict resolution score was associated with higher scores on reading measures. Pre-test conflict resolution scores on the ANT were not correlated with pre- or post-test reading outcome measures. Cross-lagged correlations controlling for autoregressive effects revealed no causal relationship between conflict resolution scores and performance on reading measures.

4 Conative Profiles in a Developmental Context

Conative functions may take on special significance for adolescent struggling readers who have experienced long histories of academic failure (Gabrieli, 2009), and who are undergoing extensively remodelling of the neural substrates of conation (Lenroot & Giedd, 2006). The following places the present conative findings in developmental context.
In the present study, the IMI-R, a version of the Intrinsic Motivation Inventory that is modified to reflect perceived competence, effort and importance, and interest and enjoyment for reading, seemed to function as a reliable measure of these constructs. Pre-test scores were moderately correlated with post-test scores, and investigation undertaken with PHAST PACES students in a previous academic year revealed good internal consistency. An interesting feature of the present data, however, is that students endorsed statements of perceived competence, effort/importance, and interest/enjoyment approximately equally often. Further, the “flat” profile of these endorsements did not differ based on how much students improved on reading measures. In contrast, research with younger students has suggested that students may show distinct motivational profiles that differentiate their understanding of their reading abilities and their goal orientations (Frijters, 2004). For instance, a sample of elementary school students in general reported low perceived competence for reading, high effort, and high interest (Frijters, 2004). Profiles of this sort were not evident in the present sample.

The SAS-R, a modified version of the Sydney Attribution Scale (SAS) that reflects content of the PHAST PACES Program, appeared to be a reliable self-report measure of attributions; pre- and post-test attribution scales were moderately correlated, and preliminary investigation of the SAS-R with PHAST PACES students revealed good internal consistency. Current research literature suggests, however, that normally-development elementary students (Craven, Marsh, & Debus, 1991), and middle school students with and without learning disabilities (Nunez et al., 2005) demonstrate distinct adaptive and maladaptive (i.e., learned helpless) attributional profiles as reported on the SAS. Adaptive profiles have included high attributions of success to ability and effort, and relatively low attributions of success to external causes, and failure to ability, effort, and external causes (Craven, Marsh, & Debus, 1991; Nunez et al. 2005), whereas maladaptive profiles have included relatively higher attributions of failure to ability and effort and success to external causes, and relatively low scores on all other subscales. PHAST PACES students in the present study did not demonstrate these distinctive attributional profiles. The adolescent struggling readers in the present study endorsed all attribution types (i.e., external, ability, and effort) with approximately equal frequency and strength (see Table 4). Further, this pattern was roughly similar regardless of how much students improved on reading measures. The present results are unusual in that the attributional profiles of students in the present sample were largely “flat”, showing no differentiation among subscales.
The patterns of response on the IMI-R and SAS-R may not be what is expected of younger students, including those who are struggling with reading. These findings fit in the context of adolescents who are struggling with reading, however. Adolescents may be less likely than their younger counterparts to be invested in the testing process, including reporting on conative functions. An overall disaffection may result in poor or inaccurate reporting. This is not likely to reflect an effect strictly of age, but rather an interaction between age and poor reading skills. Students who are poor readers may be particularly disinclined to invest effort in fully and accurately reporting on conative factors related to reading in the testing context.

Research with the Attention Network Test (ANT) has revealed that normal adults have a mean conflict resolution score of between about 84 msec (Fan et al., 2002) and 98 msec (Jennings, Dagenbach, Engle & Funke, 2007). Normal middle school students attain conflict resolution scores of about 133 msec, while students with Attention Deficit Hyperactivity Disorder (ADHD) attain scores of about 158 msec (Johnson et al., 2008). Although the use of a different version of the ANT makes it difficult to draw direct comparisons to the conflict resolution scores of younger children, younger children appear to attain higher (i.e., longer) scores, progressively decreasing with age (Rueda et al., 2002). Present findings of a pre-test mean conflict resolution score of 141 msec suggests that students began the PHAST PACES Program with effortful control skills similar to those of middle school students, approaching the mean conflict resolution score of an impaired middle school population (i.e., those with ADHD). By post-test, PHAST PACES students had progressed to a mean conflict resolution score of 101 msec, suggesting that these students were gaining effortful control skills similar to a normal adult population. The PHAST PACES Program may facilitate students with RD achieving levels of effortful control commensurate with the expected developmental trend.

5 Limitations

The conclusions that can be drawn based on the present data are necessarily limited by elements of study design, sample, and measurement. The following section outlines limitations, any mitigating factors of these limitations, and their implications for interpreting the data presented in this thesis.
5.1 Study Design

The design of the present study was a quasi-experimental prospective cohort study (Norman & Streiner, 1998). Students were assigned to either a treatment condition, in which they received the PHAST PACES Program, or a waitlist control condition, in which they received the usual assistance and instruction available to them through their secondary school. Assignment was not under the control of researchers, however, and assignment to condition was not randomized. Assignment to treatment and control conditions was contaminated. Because the treatment condition was desirable (students received the PHAST PACES Program and a course credit), there was a significant bias by secondary school staff to enrol as many students as possible in the PHAST PACES Program, limiting control group membership to several students from two schools.

The present study is limited by its lack of randomization to PHAST PACES and control conditions. A major result of the lack of randomization is that the PHAST PACES and control conditions contained unequal numbers of students, rendering confident statistical comparisons difficult (Norman & Streiner, 1998). The small number of students in the control sample resulted in insufficient statistical power to detect all but the largest and most obvious treatment-related differences between the groups.

5.2 Sample Size

The present study was based on a sample of 119 struggling adolescent readers (105 PHAST PACES students, and 14 waitlist controls). The small sample size limited the power of the present study to detect effects on the same order of those that would be detected by the larger samples included in the aforementioned studies. For example, for a two-tailed paired samples t-test comparing pre- and post-test means for the PHAST PACES group, the present study had 54% power to detect a mean change of 3 standard scores on one of the WRMT-R standardized reading measures at a significance level of .05 (Uitenbroek, 1997), while the study by Lovett, Lacerenza, DePalma, and Frijters (in press), which included data from 351 struggling readers (197 PHAST PACES students and 71 controls) had 80% power to detect the same change (Uitenbroek, 1997). As previously mentioned, enrolment in the control condition was limited, resulting in a lack of statistical power to detect all but the largest effects of condition; the control
condition facilitated interesting preliminary comparisons between conditions but could not be considered to provide conclusive evidence for lack of effects in cases of non-significance.

5.3 Measures

The following section outlines limitations inherent to the conative function measures chosen for the present study.

5.3.1 Measures of Conative Functions: The SAS-R and IMI-R

The Intrinsic Motivation Inventory – Reading (IMI-R; Frijters, 2004) is a self-report measure of three aspects of task commitment: Interest/Enjoyment, Effort, and Perceived Competence. It is based on the Intrinsic Motivation Inventory developed by Ryan and colleagues (Ryan, 2002; Ryan, Connell, & Plant, 1990). The measure is known to have good internal consistency (above .80) that is not affected by context, or by modification to increase task- and context-relevance (Ryan, 2002). The Sydney Attribution Scale – Reading (SAS-R; Frijters, 2004) is a self-report measure of students’ perceptions of the causes of success and failure in reading, based on the more general Sydney Attribution Scale (Marsh, 1986). The SAS is known to have good internal consistency (coefficient alpha .78; Marsh, 1984).

A benefit of a well-constructed self-report measure is high internal consistency and specificity in the construct domain (Marsh, 2003). Self-report measures are often chosen because they are quick and easy to administer (Fulmer & Frijters, 2009). Yet, many problems with these measures remain. Primarily, self-report measures of the sort used in this study presume conscious access to information about motivation and attributions (Fulmer & Frijters, 2009), which may limit their validity. Fortunately, in a review of the literature, Fulmer and Frijters (2009) found that self-report measures of academic self-concept were consistently and moderately correlated with academic performance, suggesting that these measures are tapping into important aspects of academic functioning.

A further concern regarding self-report measures is that they are frequently poorly constructed and subject to only limited validation (Fulmer & Frijters, 2009); the IMI-R and SAS-R, however, were chosen largely because they have been carefully constructed and validated (Ryan, 2002; Ryan, Connell, & Plant, 1990; Marsh, 1984; 1986) and extensively used, including with samples of struggling readers (Frijters, 2004; Frijters et al., in press). Developmental
appropriateness may become a concern (Fulmer & Frijters, 2009); data collected during a pilot study of the IMI-R and SAS-R with struggling adolescent readers enrolled in the PHAST PACES Program, however, suggested that both measures functioned appropriately with these groups, with good internal consistency and well-distributed responses.

5.3.2 Measures of Conative Functions: The ANT

The Attention Network Test (ANT; Rueda, Rothbart, Saccomanno, & Posner, 2007; Fan et al., 2002) was administered as a measure of effortful control. A child and an adult version of this task are available (Rueda, Rothbart, Saccomanno, & Posner, 2007; Fan et al., 2002); for the purposes of the present study, the adult version (with modified instructions) was administered.

While the use of this measure is well-supported in children and adults, there is little literature reporting its use with adolescents, and no normative data against which to judge performance. No data currently exist regarding the generalizability of the constructs measured by the ANT to classroom behaviour, particularly for adolescents.

Currently there is no consensus agreement on what constitutes the best measure of effortful control. Effortful control is most often measured via self- or other-report questionnaires (e.g., Eisenberg et al., 2003, Morris et al., 2002; Eisenberg et al., 2001; Gathercole et al., 2008; Moilanen & Shaw, 2010; Bogg & Finn, 2010) or through behavioural observation (e.g., Eisenberg et al., 2003; Eisenberg et al., 2001). The present study employs a cognitive measure of effortful control. Effortful control measured cognitively may not be directly comparable to effortful control measured by other methods. Fortunately, the ANT is well-researched, and the relationship of ANT conflict resolution scores to effortful control is well-established (Rueda, Rothbart, Saccomanno, & Posner, 2007; Fan et al., 2002), supporting the choice of cognitive measurement.

At post-test, the effortful control scale of the Early Adolescent Temperament Questionnaire – Revised (EATQ-R; Capaldi & Rothbart, 1992) was administered to students to establish preliminary convergent validity with ANT conflict resolution scores. Questionnaires evaluating effortful control, including the EATQ-R, have been found to demonstrate convergent validity with performance measures; convergence, however, is greater with parent-report versions than with child-report versions (Verstraeten, Vasey, Claes, & Bijttebier, 2010),
suggesting a possible explanation for the lack of correlation between ANT conflict resolution scores and EATQ-R self-reported effortful control scores. Future studies should strive to develop a base of knowledge on use of the ANT with adolescents, and should incorporate other-reports of effortful control to establish convergent validity.
Chapter 6
Summary of Findings

The present study was designed to investigate the variability in remedial intervention outcomes reported for adolescents with RD. In particular, this study evaluated the reading skill growth of struggling adolescent readers participating in the PHAST PACES Program, a research-based reading intervention designed for struggling readers in secondary school. The present study focussed specifically on the impact of intrinsic motivation, attributions, and effortful control of behaviour, and their relationships with reading skill and reading growth.

Students enrolled in the PHAST PACES Program demonstrated improvement between pre- and post-test on standardized and experimental measures of reading skill. Their improvement was significantly greater than controls on the two experimental measures, but did not reach significance on standardised measures of reading skill. On a measure of effortful control, students in the PHAST PACES Program demonstrated significant gains between pre- and post-test, and these gains were not evident for students in the waitlist control condition. Further, these gains reflected a progression in these adolescents from effortful control skill similar to younger students to skill more similar to normal adult samples.

PHAST PACES students did not demonstrate more adaptive attributional profiles following intervention that included embedded attributional retraining. Similarly, they did not demonstrate increased intrinsic motivation for reading, though the most improved reading group showed a non-significant trend toward increased perceived competence and increased effort. Adolescent struggling readers in the present sample did not demonstrate motivational and attributional profiles expected based on past research with normally developing readers, and younger readers with RD. This may be due to developmental differences in this sample; adolescents who have experienced long histories of reading failure may invest relatively little effort in fully and accurately reporting on conative factors.

When data were analysed for correlations among reading and conative measures, it was found that students who performed best on reading outcome measures at pre- and post-test made attributions of success to ability and avoided attributions of failure to ability, while reporting high perceived competence for reading, and demonstrating good effortful control.
Chapter 7
Future Directions

Future studies of conative functions in the context of adolescent reading remediation should recruit larger samples and larger control samples to afford greater statistical power for evaluating changes in conative functions and differences between conditions. These studies should aim to assess changes in conation over a longer time frame because greater time in intervention is likely necessary for substantial change in struggling adolescent readers, given their long histories of academic failure and maladaptive conative styles. Further, students may require a greater volume of remediation to overcome substantial deficits and become confident readers who endorse positive statements about their personal control over reading outcomes, as well as statements of competence, effort and importance, and enjoyment of reading. Students who are closer to age level reading expectations may be more likely to demonstrate positive changes in attributional and motivational profiles. Convergent methods of data collection, including parent- and teacher-reports and direct behavioural and cognitive study should supplement self-report data to provide a more complete picture of conative change in struggling adolescent readers.

Beyond these design features, future studies must aim to more thoroughly investigate the influence of effortful control on remediation outcomes in struggling adolescent readers. It is important to know more about the influence and directional effects of effortful control, and about the environments, programs, and student characteristics that contribute to its development. The insights gleaned from such studies have the potential to add considerable value to reading intervention programs and to other academic programs. Integrating effortful control training components into instruction and intervention may mean that more students could experience greater success in a wide variety of subject areas.
Chapter 8
Conclusions: Contextualizing Adolescent Reading Remediation

The design of remedial interventions for struggling adolescent readers is necessarily complex, with the need to address not just core deficits in phonological processing, naming speed, and strategic learning, but also conative factors that may function differently in adolescents than in younger struggling readers, and may account for considerable variability in adolescents’ response to remediation. Current research supports the value of intensive, phonological and strategy-based remediation for struggling adolescent readers, but the present study also suggests a re-thinking of theory and instructional design to include a focus on intrinsic motivation, attributions, and effortful control in adolescent reading remediation.

Theories of motivation that surround mastery and performance goals suggest that students should do best when they subscribe to mastery goals and are intrinsically motivated. The students in the present study who reported high perceived competence and effort—two factors contributing to intrinsic motivation—tended to perform best on reading outcome measures. Conceptions of entity versus incremental theories of reading ability suggest, however, that students should do best when effort, rather than ability attributions are endorsed. In the present study, effort attributions were uncorrelated with success on reading outcome measures, while ability attributions for success were associated with good outcomes and ability attributions for failure were negatively correlated with reading performance. Taken together, these findings suggest that extant theories may fail to fully account for the attributions and motivational orientations of struggling adolescent readers.

Theories of performance versus mastery goals and incremental versus entity conceptions presume that individuals strive to resolve differences between initial states and goal states in a given domain. It may be, however, that struggling adolescent readers have experienced such long histories of failure that they experience no internal tension and consequently do not strive to resolve discrepancies between initial and goal states in the reading domain; they simply are not at all invested. In this case, the challenge for remedial intervention is fostering an environment that encourages valuation of reading. Enjoyment of, and interest in, reading may have been revealed here as unrelated to reading outcomes because students simply did not care about reading. That perceived competence, effort, and attributions of success to ability are associated
with success on remediation outcomes may reflect nothing more than a beginning engagement or re-engagement with reading. Attributions of success and failure to effort may have been non-significantly associated with remediation response, not because remedial intervention programs are incapable of retraining attributions, nor because effort attributions are unimportant, but rather because these attributions would reflect an engagement with reading that most struggling adolescent readers are not able to achieve.

The significant gains made by students on effortful control, and the association of effortful control with reading outcomes, supports this re-working of attribution and motivation theories to better fit the context of adolescent reading remediation. While students who are fully engaged in reading might be expected to engage in well-practiced effortful control in the academic domain and generally display less variability, students who are newly engaging or re-engaging with reading may be newly developing effortful control skills. These skills are likely to develop variably on a student-by-student basis, resulting in high associations with reading outcomes as students bootstrap reading and effortful control skills with one another. Perhaps the strongest recommendation arising from the current study is that effortful control training embedded into remedial reading intervention should be studied in greater breadth and depth in order to apply it fruitfully.
References


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Moats, L. C. (2001). When older students can't read. *Educational Leadership, March*


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Appendix A
Intrinsic Motivation Inventory – Reading

Instructions:

Below are some sentences about story reading. I will read each sentence to you and you can read along. There are no right or wrong answers. It is only important to say whether the statement is true for you.

Let’s do some examples first,

SAMPLES

A. Going to the doctor is fun.

B. I like to go to parties.
C. Blue is my favourite colour.

1. I think I read well.

2. I am a good reader.
3. I feel good about how well I can read.

4. When I choose a book to read I can read it easily.

5. I think I am good at reading.

6. I am skilled at reading.
7. I put a lot of effort into reading.

8. Overall, I enjoy reading.

9. I would describe reading as interesting

10. I put energy into reading.
11. I try hard to read well.

12. Reading is fun to do.

13. I like reading.
14. I try hard when I read something

15. I think reading is enjoyable

16. If I could choose what to do right now, I would read a book.

17. When I read, I think about how much I enjoy it.
Appendix B
Sydney Attribution Scale – Reading

This is not a test. There are no right or wrong answers. There are a number of things listed that could happen in school or at home. You are asked to show how true or false each reason for this happening is for you. Look at the first example. Someone called Terry has filled this in to show you how to do it.

Examples

<table>
<thead>
<tr>
<th>False</th>
<th>Mostly False</th>
<th>Sometimes False, Sometimes True</th>
<th>Mostly True</th>
<th>True</th>
</tr>
</thead>
</table>

A Suppose you won a race at the sports carnival. It would probably be because:

a) you were lucky ......................................................... ✓ ☐ ☐ ☐ ☐ ☐ a)

b) you are a good runner .................................................... ☐ ✓ ☐ ☐ ☐ ☐ b)

c) you tried hard to run fast .................................................. ☐ ☐ ☐ ✓ ☐ ☐ c)

(Terry put a tick in the False box for the first reason because for Terry that reason was not true at all. Terry put a tick in the True box for the second reason because Terry is a good runner and always wins races. Terry put a tick in the Mostly True box for the third reason because Terry did try pretty hard to run fast and it was mostly true.)

<table>
<thead>
<tr>
<th>False</th>
<th>Mostly False</th>
<th>Sometimes False, Sometimes True</th>
<th>Mostly True</th>
<th>True</th>
</tr>
</thead>
</table>

B Suppose you painted a picture at school and everyone said it was awful. It would probably be because:

a) you are a bad painter .................................................... ☐ ☐ ✓ ☐ ☐ ☐ a)

b) you only tried a little ...................................................... ☐ ☐ ☐ ✓ ☐ ☐ b)

c) they did not like you ......................................................... ☐ ✓ ☐ ☐ ☐ ☐ c)

(Terry picked Sometimes True, Sometimes False for the first reason because Terry is only a bad painter sometimes. Terry ticked mostly true for the second reason because Terry tried only a little on most paintings. Terry picked mostly false for the third reason as most of the time she knows some good methods she can use to paint.)
Now, you try these examples

<table>
<thead>
<tr>
<th>C</th>
<th>Suppose you made a model and it fell to pieces as soon as you finished it. It would probably be because:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a) you are not good at making models</td>
</tr>
<tr>
<td></td>
<td>b) you did not work carefully on it</td>
</tr>
<tr>
<td></td>
<td>c) the glue was bad</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>False</th>
<th>Mostly False</th>
<th>Sometimes True</th>
<th>Mostly True</th>
<th>True</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>D</th>
<th>Suppose you wrote a story that the teacher said was very good. It would probably be because:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a) you write good stories</td>
</tr>
<tr>
<td></td>
<td>b) you tried very hard</td>
</tr>
<tr>
<td></td>
<td>c) the teacher likes you</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>False</th>
<th>Mostly False</th>
<th>Sometimes True</th>
<th>Mostly True</th>
<th>True</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Suppose your teacher choose you to be in the top reading group in your class. It would probably be because:
   a) you are good at reading ...........................................[ ] [ ] [ ] [ ]
   b) you work hard at reading .........................................[ ] [ ] [ ] [ ]
   c) the teacher made a mistake ......................................[ ] [ ] [ ] [ ]

3. Suppose you had trouble trying to answer the teacher’s question about a story in a reading lesson. It is probably because:
   a) the story was too hard for everyone ............................[ ] [ ] [ ] [ ]
   b) you are a poor reader ..............................................[ ] [ ] [ ] [ ]
   c) you should have read it more carefully ..........................[ ] [ ] [ ] [ ]

6. Suppose the teacher asked you to read aloud part of a story for the class and you had trouble doing this. It is probably because:
   a) you are bad at reading aloud .....................................[ ] [ ] [ ] [ ]
   b) you had to read the hardest part of the story .................[ ] [ ] [ ] [ ]
   c) you were careless about reading the story ....................[ ] [ ] [ ] [ ]

9. Suppose you start a new story in reading and you find it hard to understand right away. It is probably because:
   a) the teacher picks hard stories ...................................[ ] [ ] [ ] [ ]
   b) you were day dreaming ............................................[ ] [ ] [ ] [ ]
   c) your reading is poor ..............................................[ ] [ ] [ ] [ ]
<table>
<thead>
<tr>
<th>Question</th>
<th>Option</th>
<th>False</th>
<th>Mostly False</th>
<th>Sometimes False, Sometimes True</th>
<th>Mostly True</th>
<th>True</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Suppose your parents tell you that your reading is good. It would probably be because:</td>
<td>a)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td></td>
<td>b)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td></td>
<td>c)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>13 Suppose your teacher says you are doing badly in reading work. It would probably be because:</td>
<td>a)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td></td>
<td>b)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td></td>
<td>c)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>14 Suppose you are chosen to read something to all the parents at a special assembly. It would probably be because:</td>
<td>a)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td></td>
<td>b)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td></td>
<td>c)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>15 Suppose the teacher congratulated you for today’s reading work. It would probably be because:</td>
<td>a)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td></td>
<td>b)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td></td>
<td>c)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
17. Suppose the teacher asked people in your class to try out to read a poem on a TV show but did NOT ask you. It would probably be because:

<table>
<thead>
<tr>
<th></th>
<th>False</th>
<th>Mostly False</th>
<th>Sometimes False, Sometimes True</th>
<th>Mostly True</th>
<th>True</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>[ ]</td>
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<td>b)</td>
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<tr>
<td>c)</td>
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</tbody>
</table>

18. Suppose you read a story well in front of your class. It would probably be because:

<table>
<thead>
<tr>
<th></th>
<th>False</th>
<th>Mostly False</th>
<th>Sometimes False, Sometimes True</th>
<th>Mostly True</th>
<th>True</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>[ ]</td>
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</table>

21. Suppose you really did well on a reading test. It is probably because:

<table>
<thead>
<tr>
<th></th>
<th>False</th>
<th>Mostly False</th>
<th>Sometimes False, Sometimes True</th>
<th>Mostly True</th>
<th>True</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
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<td>b)</td>
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<td>c)</td>
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</table>

22. Suppose you find it hard to understand a book you are reading. It is probably because:

<table>
<thead>
<tr>
<th></th>
<th>False</th>
<th>Mostly False</th>
<th>Sometimes False, Sometimes True</th>
<th>Mostly True</th>
<th>True</th>
</tr>
</thead>
<tbody>
<tr>
<td>a)</td>
<td>[ ]</td>
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<td>b)</td>
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<td>c)</td>
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</table>
Appendix C
Early Adolescent Temperament Questionnaire – Revised
(Effortful Control)

Directions

On the following page you will find a series of statements that people might use to describe themselves. The statements refer to a wide number of activities and attitudes.

For each statement, please circle the answer that best describes how true each statement is for you. There are no best answers. People are very different in how they feel about these statements. Please circle the first answer that comes to you.

You will use the following scale to describe how true or false a statement is about you:

<table>
<thead>
<tr>
<th>Circle number:</th>
<th>If the statement is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Almost always untrue of you</td>
</tr>
<tr>
<td>2</td>
<td>Usually untrue of you</td>
</tr>
<tr>
<td>3</td>
<td>Sometimes true, sometimes untrue of you</td>
</tr>
<tr>
<td>4</td>
<td>Usually true of you</td>
</tr>
<tr>
<td>5</td>
<td>Almost always true of you</td>
</tr>
</tbody>
</table>

NOTE: Please make certain to answer all questions on BOTH SIDES of the page.

Please tell us:

Your date of birth:  ___________

Your gender:  M  /  F

Family ID code:  __________
<table>
<thead>
<tr>
<th>EATQ-R (EC) Subscale</th>
<th>Item (R indicates reverse scoring)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attention</strong></td>
<td>It is easy for me to really concentrate on homework problems.</td>
</tr>
<tr>
<td></td>
<td>I find it hard to shift gears when I go from one class to another at school. (R)</td>
</tr>
<tr>
<td></td>
<td>When trying to study, I have difficulty tuning out background noise and concentrating. (R)</td>
</tr>
<tr>
<td></td>
<td>I am good at keeping track of several different things that are happening around me.</td>
</tr>
<tr>
<td></td>
<td>I pay close attention when someone tells me how to do something.</td>
</tr>
<tr>
<td></td>
<td>I tend to get in the middle of one thing, then go off and do something else. (R)</td>
</tr>
<tr>
<td><strong>Activation Control</strong></td>
<td>I have a hard time finishing things on time. (R)</td>
</tr>
<tr>
<td></td>
<td>I do something fun for awhile before starting my homework, even when I’m not supposed to. (R)</td>
</tr>
<tr>
<td></td>
<td>If I have a hard assignment to do, I get started right away.</td>
</tr>
<tr>
<td></td>
<td>I finish my homework before the due date.</td>
</tr>
<tr>
<td></td>
<td>I put off working on projects until right before they’re due. (R)</td>
</tr>
<tr>
<td><strong>Inhibitory Control</strong></td>
<td>It’s hard for me not to open presents before I’m supposed to. (R)</td>
</tr>
<tr>
<td></td>
<td>When someone tells me to stop doing something, it is easy for me to stop.</td>
</tr>
<tr>
<td></td>
<td>The more I try to stop myself from doing something I shouldn't, the more likely I am to do it. (R)</td>
</tr>
<tr>
<td></td>
<td>It’s easy for me to keep a secret.</td>
</tr>
<tr>
<td></td>
<td>I can stick with my plans and goals.</td>
</tr>
</tbody>
</table>
Appendix D
Attention Network Test Instructions to Students

In this task, you will show the direction of an arrow using the mouse buttons. The way you show the direction of an arrow when it appears on the screen is by pressing the mouse button that matches the way the arrow is pointing.

For example, if the arrow were pointing to the left, like this ← you would press the left mouse button. If the arrow were pointing to the right, like this → you would press the right mouse button.

Sometimes the arrow will be alone, the way you just saw, and sometimes the arrow will be with other arrows (for example → → → or → → ← → ← → ). When you see more than one arrow, your job is to show the direction of only the arrow in the middle. What matters is where the middle arrow is pointing. If the middle arrow points to the left, press the left mouse button. If the middle arrows points to the right, press the right mouse button.

You will see a plus-sign (+) in the middle of the screen, and you should keep your eyes on the plus-sign throughout the experiment. The arrows will appear either above or below the plus-sign.

A star (*) may appear to tell you when or where the arrow will appear. If the star is at the centre, or both above and below the plus-sign, this means the arrow will appear shortly. If the star is only above or below the plus-sign, it means that the arrow will appear soon, but it also tells you where the arrow will appear. For example, if the star appears above the plus-sign, the arrow will also appear above the plus-sign. Try to keep looking at the plus-sign.

Please work as quickly as possible, but not so quickly that you make mistakes.

First, you will practice for about two minutes. Then you will do three sessions. Each will take about five minutes. After each session, there will be a message, “take a break”, and you may take a short rest. After it, you can press the space bar to begin the next block.

Do you have any questions?
Appendix E
Example of PHAST PACES Dialogue

Metacognitive Decoding Dialogue: “When I see ea in a word, first, I’ll try ee (as in ‘bead’), then, I’ll try e (as in ‘head’). Then, I’ll try a (as in ‘break’), and see what gives me a real word. First, I’ll try ee. I sound out the word and see if it makes a word I know: breeth. It doesn’t make a real word, but I don’t give up. I go on to the next step. Now, I’ll try e: breath. Yes, that’s a real word! My strategy worked: First, I tried one sound, then, I tried another. I was flexible, I stuck at it, and I got it!”

Metacognitive Comprehension Dialogue:

“First, I will read the title and ask myself, ‘What do I predict I will learn?’ Based on the title, History of the Bicycle, I predict I will learn about when, where, and how bicycles were built.

“Now I will activate my prior knowledge and ask myself, ‘What do I already know about this topic?’ I know that bicycles are made of metal and rubber, are vehicles of transportation, and are used for pleasure, exercise, and work.

“This is a confusing word. I need to stop and clarify. I will look back and re-read the sentence and sentences surrounding the confusing word.

“Now I will check my understanding of the information in the text by asking myself the 3W2+ questions: What is the topic? What is the main idea? What are the supporting statements?”