

**Improving Academic Outcomes for Children in Foster Care Through Tutoring or Working  
Memory Training: Three Randomized Trials**

Andrea Hickey, MSc.

Thesis submitted to the  
Faculty of Graduate and Postdoctoral Studies  
in partial fulfillment of the requirements  
for the Doctorate in Philosophy degree in Clinical Psychology

School of Psychology  
Faculty of Social Sciences  
University of Ottawa

© Andrea Hickey, Ottawa, Canada, 2018

## Abstract

Children in care (e.g., foster care) are at risk of a variety of negative developmental outcomes. Of particular concern are their often poor academic outcomes. Indeed, children in care often have below grade-level performance on math and reading, increased rates of school drop out, and learning disabilities. Despite these difficulties, relatively little research has been conducted to try to ameliorate the problem. The present thesis, consisting of three independent randomized controlled trials (RCTs), sought to address the need for improved educational outcomes for children in care.

The first RCT was an evaluation of a one-on-one tutoring program, *TutorBright*. Children in care were randomized to either a tutoring group or a waitlist control group and assessed on their math and reading skills, as well as on other educationally relevant domains (executive functioning, behaviour, and caregiver involvement in school-related activities), pre and post test. ANCOVA via multiple regression revealed that the children in care that had received tutoring, compared to the waitlist control group, made significantly greater gains in reading comprehension (Hedges'  $g = 0.34$ ), reading fluency ( $g = 0.16$ ), and math calculation ( $g = 0.39$ ). Moreover, executive functioning and self-reported symptoms of PTSD (for older children) were significant moderators of the effects of tutoring. No significant spill-over effects of tutoring were found.

The second RCT, building upon previous RCTs by Flynn et al. (2012) and Harper and Schmidt (2016), evaluated whether a shorter version (i.e., 15 weeks) of a one-on-one Direct Instruction tutoring program, *Teach Your Children Well* (TYCW), was as effective as a longer version of TYCW (i.e., 25 weeks) on improving the math and reading skills for children in care. ANCOVA via multiple regression did not reveal any significant group differences in academic

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

performance for any of the WJ-III subtests. Collapsing across the two intervention conditions, follow-up paired samples *t*-tests revealed significant improvement in Letter-Word Identification (Cohen's  $d = 0.22$ ), Reading Fluency ( $d = 0.36$ ), Calculation ( $d = 0.38$ ), Math Fluency ( $d = 0.47$ ), Applied Problems ( $d = 0.30$ ), and Broad Reading ( $d = 0.30$ ) and Broad Math ( $d = 0.40$ ) composite scores, suggesting that the 15-week and 25-week TYCW programs were equally effective in improving math and reading skills. Moreover, an attribute-treatment interaction analysis revealed that children with higher executive functioning benefited more from the shorter tutoring dosage for Calculation.

The third RCT was a small pilot study that aimed to assess whether working-memory training (WMT) can enhance: 1) working memory capacity, in the short and longer term (i.e., immediately following the completion of WMT and 6-months later), 2) symptoms of Attention Deficit Hyperactivity Disorder (i.e., inattention, hyperactivity, and executive functioning) in the short and longer term, and, 3) math and reading skills at 6-months post WMT. The findings from this study suggested that WMT can improve verbal working memory ( $g = 0.35$ ) as well as visuo-spatial short-term memory ( $g = 1.10$ ) in the shorter term but not in the longer term. Moreover, WMT did not have a significant impact on improving symptoms of ADHD or math and reading skills.

Together, the results of this dissertation indicate that the math and reading skills of children in care can be improved via tutoring. The findings highlight the importance of providing children in care with effective academic supports in order to help them reach their full potential.

*Keywords:* Foster care, academics, tutoring, math, reading, randomized control trial

**Statement of Contributors, Collaborators, and Co-Authors**

This thesis is comprised of three studies. Andrea J. Hickey, was the primary investigator and author of all three study manuscripts. The thesis supervisor and co-investigator, Dr. Robert J. Flynn, was the second author. In collaboration with Dr. Flynn, Mrs. Hickey took the lead in every aspect of the thesis project, including the literature review and conceptualization of the thesis, development and implementation of study procedures and methods, selection of validated measures, training of assessors at each of the participating agencies, data scoring and analysis, and writing of the thesis document itself.

## **Acknowledgments**

This thesis could not have been possible without the help and support from a great number of people. First, I would like to thank my supervisor, Dr. Robert Flynn, for his guidance and encouragement over the past several years. Bob, your passion for research is inspiring. From you I have learned that interest in a cause and a good scientific question can fuel the research that can make real positive changes in our world. I am grateful for all of the lessons you have taught me and I am a better scientist and person for them.

Next, I wish to extend many thanks to the members of my thesis committee, Drs. Elisa Romano, Maria Rogers, and John Lyons. Thank you for your guidance, support, and helpful feedback throughout the development and execution of this research. I also wish to extend an enormous thank you to all of our collaborators at each of the participating Children's Aid Societies – children in care are lucky to have you all as advocates. To Sunny Verma, Jim Judgey, and Michael Maloney, thank you for your interest in this research and for providing your valuable consultation and support throughout this process. To my research assistant, Joanna Lostracco, thank you for all of your hard work, patience, and dedication to this thesis. I would also like to thank all of the past, present, and future foster parents that devote their time to helping young children in need.

Finally, I would like to thank all of my friends and family for their steadfast support, humour, and encouragement throughout this journey. This would have been an arduous process without all of you by my side. To my husband, Steve, thank you for your unwavering support, infinite patience, humour, and love. Thank you for always believing in me. To Lily, I am most proud to be your mom -- I love you.

This thesis was funded by a Doctoral Vanier Award from the Social Sciences and Humanities Research Council.

**Table of Contents**

Abstract.....	ii
Statement of Contributors, Collaborators, and Co-Authors .....	iv
Acknowledgements.....	v
Table of Contents.....	vi
General Introduction.....	1
Low Academic Achievement of Children in Care.....	1
Long Term Academic Outcomes of Children in Care.....	2
Factors that Influence Academic Outcomes for Children in Care.....	3
Academic Interventions for Children in Care.....	9
Current Dissertation.....	14
References.....	16
Study 1: Effectiveness of a one-to-one tutoring program on the math and reading skills of children in foster care: A randomized controlled trial	
Abstract.....	30
Method.....	39
Results.....	56
Discussion.....	70
References .....	79
Study 2: How much tutoring is enough? A randomized control trial of a shorter vs. longer tutoring intervention for children in foster care	
Abstract.....	93
Method.....	101
Results.....	116
Discussion .....	122
References.....	131
Study 3: The impact of working memory training on the working memory capacity and academic skills of children in foster care: A pilot study	
Abstract .....	146
Method.....	153
Results.....	167
Discussion.....	171
References.....	178
General Discussion	
Brief Review of Findings.....	193
Collective Implications Across Studies.....	197
Limitations and Directions for Future Research .....	198
Conclusion .....	201
References.....	202

**List of Tables**

Table 1. Summary of published academic interventions for children in care.....10

**Study 1: Effectiveness of a one-to-one tutoring program on the math and reading skills of children in foster care: A randomized controlled trial**

Table 1. Means (or percentages), standard deviations, Cronbach’s alphas, theoretical range, and skewness statistics for study variables, post attrition, at the pre and post-test.....89

Table 2. Inter-correlation matrix for variables in the study at the pre-test.....90

Table 3. Sample descriptives at pre-test, post attrition (Means, SDs, or Percentages) .....91

Table 4. Means and standard deviations on the pre-test and the unadjusted and adjusted post-test scores on the 7 WJ-III subtests and overall broad math and broad reading scores.....92

**Study 2: How much tutoring is enough? A randomized trial of 15 vs. 25 weeks of Direct Instruction one-to-one tutoring for children in care**

Table 1. Means (or percentages), standard deviations, Cronbach’s alphas, theoretical range, and skewness statistics for study variables, post attrition, at the pre and post test.....139

Table 2. Means, SDs, paired-t-tests, effect sizes (Cohen’s d), and 95% confidence intervals for pretest and posttest WJ-III subtests.....140

Table 3. Inter-correlation matrix for variables in the study at the pre-test.....141

Table 4. Sample descriptives at pre-test, post attrition (Means, SDs, or Percentages) .....142

Table 5. Descriptive statistics for the children’s feedback post completion of the tutoring programs.....143

Table 6. Caregiver reported benefits of the TYCW program.....144

**Study 3: The impact of working memory training on the working memory capacity and academic skills of children in foster care: A pilot study**

Table 1. Demographic Summary (means, standard deviations or percentages) .....190

Table 2. Means and SDs of the pre-test, post-test, and 6-month follow-up scores of the experimental and placebo control groups on the AWMA sub-tests, the WJ-III, and the Conners Parent Rating Scale.....191

Table 3. *n* values and percentage of participant responses to the 6-week follow-up questionnaire about their experience with the Cogmed WMT program.....192

**List of Figures**

**Study 1: Effectiveness of a one-to-one tutoring program on the math and reading skills of children in foster care: A randomized controlled trial**

Figure 1. CONSORT diagram.....41

Figure 2. Experimental and control groups’ WJ-III Letter Word Identification pre-test and adjusted post-test mean standard scores.....57

Figure 3. Experimental and control groups’ WJ-III Reading Fluency pre-test and adjusted post-test mean standard scores.....58

Figure 4. Experimental and control groups’ WJ-III Passage Comprehension pre-test and adjusted post-test mean standard scores.....59

Figure 5. Experimental and control groups’ WJ-III Spelling pre-test and adjusted post-test mean standard scores.....60

Figure 6. Experimental and control groups’ WJ-III Broad Reading Composite pre-test and adjusted post-test mean standard scores.....61

Figure 7. Experimental and control groups’ WJ-III Math Calculation pre-test and adjusted post-test mean standard scores.....62

Figure 8. Experimental and control groups’ WJ-III Math Fluency pre-test and adjusted post-test mean standard scores.....63

Figure 9. Experimental and control groups’ WJ-III Applied Problems pre-test and adjusted post-test mean standard scores.....64

Figure 10. Experimental and control groups’ WJ-III Broad Math Composite pre-test and adjusted post-test mean standard scores.....65

**Study 2. How much tutoring is enough? A randomized trial of 15 vs. 25 weeks of Direct Instruction one-to-one tutoring for children in care**

Figure 1. CONSORT diagram.....113

**Study 3. The impact of working memory training on the working memory capacity and academic skills of children in foster care: A pilot study**

Figure 1. CONSORT diagram.....155

**List of Appendices**

Appendix A. Foster Child Assent and Foster Parent Consent Forms – Studies 1, 2, & 3 .....206

Appendix B. Referral Information Form for CAS – Studies 1, 2, & 3.....215

Appendix C. Pre-test Caregiver Questionnaire – Studies 1, 2, & 3.....218

Appendix D. 6 week Post-test Caregiver Questionnaire – Study 3.....223

Appendix E. 6-week Post-test Child Survey—Study 3.....227

Appendix F. 6-month Post Test Caregiver Questionnaire – Studies 1, 2, & 3.....229

Appendix G. Tutoring Experience Questionnaire: Child version – Studies 1 & 2.....232

Appendix H. Test-Retest Correlations for Select WJ-III Subtests and Covariates.....234

Appendix I. Study 1 – ANCOVA Results for Research Question #1.....235

Appendix J. Tutor Data Monitoring Forms – Studies 1 & 2 .....239

## **General Introduction**

### **Low Academic Achievement of Children in Care**

Annually, across Canada, approximately 67,000 children and adolescents experience out-of-home care (e.g., foster care; Mulcahy & Trocmé, 2010). Although the number of children in care in Ontario is declining, there are still approximately 26,629 children in out-of-home care (hereafter ‘in care’) in the province (Commission to Promote Sustainable Child Welfare, 2012). Children in care are one of society’s most complex and high need populations and are at risk of future adverse outcomes (Baum, Crase, & Crase, 2001; Boivin & Hertzman, 2012; Burns et al., 2004). Of particular concern are the often poor academic outcomes of these children. Indeed, research in many countries, including Canada, suggests that one of the greatest needs of children in care is improvement in their educational achievement (Flynn, Ghazal, Legault, Vandermeulen, & Petrick, 2004; Jackson, 2007; Trout, Hagaman, Casey, Reid, & Epstein, 2008). For decades, researchers have consistently reported that many children in care perform poorly in school and are at high risk of entering adulthood with relatively low levels of formal education (Cheung & Heath, 1994; Courtney, & Dworsky, 2006). Compared to children in the general population, children in care, on average, have below-grade academic performance, inconsistent school attendance, higher rates of grade retention, and lower scores on standardized tests of academic achievement, in reading, writing, and in mathematics (Jackson, 2007; Mitic & Rimer, 2002; Stone, 2007). As a result, they are approximately three times as likely as their peers in the general population to be involved in special education and often lag one or two years behind them (Trout, Hagaman, Casey, Reid, & Epstein, 2008).

The academic difficulties that are often experienced by children in care have been found to be present at an early age and tend to persist into adulthood (Weegar, Hickey, Bell, Romano,

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Flynn, 2014). A national foster care study conducted in the US by Cook, Fleishman, and Grimes (1991) evaluated the status of 810 children in foster care, two to four years after being discharged from the foster care system. Of the total sample, 54% of the children who had been in care had completed high school, compared to 78% of the general population (Cook, Fleishman, & Grimes, 1991). More recently, Pecora et al. (2006) found that by the age of 23-24, only 34% of children who had aged out of foster care had attained a high school diploma or GED. In Ontario, it has been estimated that only 46% of children in care graduate from high school in the usual time limits, compared with 82% of children in the general population (OACAS, 2012). Taken together, these results suggest that, although a number of children in care obtain a high school diploma or GED, this number remains low relative to the general population. Moreover, even among those youths who do graduate from high school, many may find post-secondary education (PSE) programs to be daunting. For, as Courtney, Dworsky, Lee, and Raap (2010) have found in the US, there is a trend among young people in care of increasing PSE enrollments but decreasing PSE graduation rates, compared with young people in the general population.

### **Long Term Academic Outcomes of Children in Out-of-Home Care**

The academic discrepancies observed between children in care and the general population can persist into adulthood and contribute to reduced future social, emotional, and employment success (Tideman, Vinnerljung, Hintze, & Aldenius Isakson, 2011). For example, previous researchers have found that approximately 53% of youth in care between the ages of 18 and 24 who are discharged from the foster care system are living below the poverty line (Cook-Fong, 2000), with more than 20% experiencing some degree of homelessness (Pecora et al., 2006). Indeed, it has been estimated that a youth aging out of the child welfare system will earn about \$326,000 less than the average Canadian over his or her lifetime (Bounajm, Beckman, &

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Thériault, 2014). It is thus important to recognize that these difficulties are not short term or limited to childhood. In many instances, the academic difficulties of children in care, if not addressed, can contribute to lifelong struggles and challenges. For example, using longitudinal register data on more than 7500 Swedish foster children, Forsman, Brannstrom, Vinnerljung, & Hjern (2016) found a causal link between poor school performance and later psychosocial problems (i.e., illicit drug use, mental health problems, and economic hardship). Thus, the research on the long-term academic outcomes of children in care raises significant concerns about their future well-being. Mastering basic academic skills and increasing education achievement can be a protective factor associated with improved adult outcomes, such as completing high school or post-secondary education (Forsman et al., 2016). This, in turn, can lead to significant positive outcomes such as improved future employment and quality of life (Trout et al., 2008). Therefore, interventions aimed at improving the often poor academic outcomes of children in care may improve their overall future and well-being.

### **Factors that Influence Academic Outcomes for Children in Care**

Despite the documentation of existing difficulties in educational performance among so many children in care, considerable debate remains regarding the causes (Aldgate, Colton, Ghate, & Heath, 1992). Some authors have proposed that young people in care do not receive the same level of family and social support that many children in the general population receive, thus placing these young people at further and disproportionate educational disadvantage and risk (Zetlin, Weinberg, & Shea, 2006). Other reasons include the fact that the education of children in care has not been a priority by the child welfare system, including by the children's social workers or foster parents, while others have suggested that it is the low expectations of foster parents, social workers, and teachers, with regard to foster children's attainment that are

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

contributing to their ongoing difficulties (Ferguson & Wolkow, 2012; Tideman, Vinnerljung, Hintze, & Isaksson, 2011). Extant literature also suggests a link between placement instability and poor academic outcomes. Indeed, placement instability is universally considered disadvantageous to children in general (Barber, 2003). Placement changes in foster care have been found to frequently lower school stability and a child's educational performance (Pecora, 2012). Substantial research also suggests a link between mental health difficulties and poor academic outcomes for children in care that can interfere with learning. Moreover, cognitive difficulties as well as decreased caregiver involvement in academic activities have been found to influence academic outcomes. The current dissertation aims to assess the impact of two academic interventions on these educationally relevant domains (i.e., mental health/behaviour, cognitive functioning, and caregiver academic involvement). A more detailed overview of the relationship between these factors and academic outcomes follows.

**Mental health and academic achievement.** Research has demonstrated that children who endure maltreatment tend to experience varying degrees of mental health difficulties (e.g., emotional, behavioural and social developmental disturbances). Indeed, children in care have been found to have significantly higher rates of mental health difficulties (ranging from 10 to 80%, with a higher prevalence in older children) than children in the general population (about 10 to 20%; Burge, 2007; Canadian Mental Health Association (CMHA), 2010; Leslie, Gordon, Meneken et al., 2005; Tarren-Sweeney, 2008). Among the mental health outcomes of child maltreatment, one is particularly relevant, Post Traumatic Stress Disorder (PTSD). Research has found that between one-third and one-half of all abused children meet criteria for PTSD (Ackerman, Newton, McPherson, Jones, & Dynman, 1998; Salazar, Keller, Gowen, & Courtney, 2013). PTSD has been found to negatively impact academic performance. For example, children

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

with a history of maltreatment and a diagnosis of PTSD have been found to perform significantly lower on standardized tests of math and reading compared to age-matched controls (De Bellis, Woolley, & Hooper, 2013). Children in care have also been found to have increased rates of depression, anxiety, attention deficit hyperactivity disorder (ADHD), learning disabilities, and substance abuse (McMillen et al., 2005; Turney & Wildeman, 2016). Moreover, many children in care experience behavioural difficulties (e.g., conduct disorder, oppositional defiant disorder). For example, Heflinger, Simpkins, and Combs-Orme (2000) found that 34% of their sample of children in state care had significant behaviour problems, most commonly aggression, delinquency, and withdrawn behaviour. The presence of such mental health difficulties, either alone or in combination, has the capacity to interfere with children's ability to self-regulate their behaviour and emotions or to appropriately engage in interpersonal and social relationships with peers and adults. These problems can also impede young peoples' ability to achieve academically by affecting their ability to concentrate in class and subsequently apply information learned or successfully complete school work. In support of this, Tessier, O'Higgins and Flynn (2017) found that for young people in care (aged 12-17;  $N = 962$ ), more positive mental health was predictive of better academic success over a three-year period. The association between mental health difficulties and school performance is believed to be bidirectional (DeSocio & Hootman, 2004; Flemming et al., 2005; Reid, Gonzalez, Nordness, Trout, & Epstein, 2004; Trout et al., 2008), however recent research suggests that for children in care, poor academic skills may be causally related to poor psychosocial functioning later in life (Forsman, Brännström, Vinnerljung, & Hjern, 2016). Indeed, deficits in basic academic skills (i.e., reading, writing and arithmetic) have been found not only to impair a child's ability to function academically, but also to be positively correlated with emotional and behavioural problems

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

(Hinshaw, 1992; Trout, Nordness, Pierce, & Epstein, 2003). Chronic negative academic outcomes have been found to generate feelings of anxiety, anger, disinterest, unworthiness and negative self-perception (Roeser, Eccles, & Strobel, 1998; Trout et al., 2003), which, in turn, can lead to or exacerbate externalizing difficulties and strained teacher and peer relationships (Lane, 1999).

**Cognitive functioning and academic achievement.** A substantial number of studies have demonstrated that early adversity (e.g., maltreatment) can be associated with global cognitive difficulties, including decreased intellectual performance, memory difficulties, and language delays (Pechtel & Pizzagalli, 2011; Colvert et al. 2008; Pollak et al. 2010; Pears & Fisher, 2005; Snow, 2009; Trickett, Noll, & Putnam, 2011). Maltreated children are also at risk of being impaired on measures of executive functioning (DeGregorio & McLean, 2013; Nikulina & Spatz Widom, 2013; Webster, Hackett & Joubert, 2009). *Executive functioning* skills refer to the set of higher order cognitive processes that underlie flexible goal-directed behaviors, such as inhibitory control, working memory, planning, and set shifting (Garon, Bryson, & Smith, 2008; Hughes, 2002). Deficits in executive functioning have been associated with academic difficulties (Best, Miller, & Naglieri, 2011; Bull, Espy, & Wiebe, 2008; Clark, Pritchard, & Woodward, 2010; Miller & Hinshaw, 2010). For example, performance on working memory tasks has been consistently found to relate to both math and reading achievement (Swanson & Beebe-Frankenberger, 2004; McVay, & Kane, 2012). Moreover, children with greater inhibitory control manifest fewer teacher-reported behavioural problems (Riggs, Blair, & Greenberg, 2004). Previous research also suggests a link between poor executive functioning (particularly working memory) and symptoms of ADHD (Martinussen, Hayden, Hogg-Johnson, & Tannock, 2005), which can negatively impact academic functioning (Loe, & Feldman, 2007). Together, these

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

findings suggest that executive functioning abilities are likely a vital prerequisite for success in education.

Extant literature suggests that the experience of maltreatment during childhood alters brain development and contributes to subsequent cognitive difficulties (Beers & DeBellis, 2002; Bremner & Vermetten, 2001). Several researchers have hypothesized that the observable consequences of maltreatment on children's development are most likely due to exposure to prolonged stress, which has the potential to exert changes within the brain (Beers & De Bellis, 2002; Glaser, 2000; Pears & Fisher, 2005; Snow, 2009). For example, early adversity is thought to disrupt the hypothalamic-pituitary-adrenal (HPA) axis, and the brain regions associated with it, particularly the prefrontal cortex (Bremner et al., 2003; Wilson, Hansen, & Li, 2011). These hypothesized effects of early trauma and stress on cortical developmental are thought to help explain the cognitive and academic difficulties that maltreated children often experience, including executive functioning.

These academic outcomes however, are not inevitable. Researchers have found that children in care have lower school performance compared to age-matched peers of similar cognitive capacity, suggesting that the poor academic outcomes of many children in care are not attributable to cognitive deficits, per se, but are rather attributable to children in care performing below their academic *potential* (Tideman, Vinnerljung, Hintze & Aldenius Isakson 2011).

**Parental involvement and academic achievement.** Family involvement in academics is one of the most neglected yet powerful supports for children's learning, both in and out of school (Weiss, Bourffard, Bridglall, & Gordon, 2009). Indeed, parental involvement in academics is an important predictor of school outcomes, including higher grades, better attendance, lower dropout, increased motivation, and better school adaptation (see Gonzales-DeHass, Willems, &

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Holbein, 2005, for a review). Parental involvement in their children's academics helps convey that education is valued, which is believed to foster higher motivation, perceived self-competence and expectations, and effort (Weiss et al., 2009). In general, it appears as though parents are more likely to become involved in their children's academics if they perceive that their involvement will have a direct positive impact on their children (Goodall & Vorhaus, 2011). Synthesizing the literature, Jeynes (2003; 2005) reported that parental involvement in children's academic achievement results in positive educational outcomes, such that as the children's academic achievement improves, parental involvement increases, an effect that is found regardless of the level of parental education, social economic status, or racial heritage. Despite the link between parental involvement and academic success for children in the general population, very little research to date, has examined how caregiver involvement (e.g., the foster parents) influences academic outcomes of children in care. In a sample of 85 youth in care (with 56 matched controls), Pears, Fisher, Bruce, Kim, & Yoerger (2010) found no significant mediating effect of caregiver involvement on academic competence; rather, children in care's own inhibitory control abilities mediated the relationship between maltreatment and academic competency. In contrast, using a cross sectional sample of 687 youth in care (aged 10-15 years), Cheung et al. (2012) found that caregiver home-based involvement and academic expectations were predictive of academic success of youth in care. Thus, given the limited and mixed results of research on the link between foster parent academic involvement and academic outcomes for children in care, more research is needed to help clarify the role of foster parents in child academic outcomes in order to determine possible areas of intervention.

Whatever the causes, poor school performance and low educational achievement are believed to be among the strongest risk factors for the futures of children in care (Jackson, 1994),

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

and the links between poor achievement and unfavourable psychosocial outcomes are strong, even after controlling for characteristics of birth parents, time in care, and age at first placement (Forsman, Brännström, Vinnerljung, & Hjern, 2016). As such, there is a great need to help improve academic outcomes for children in care to help them reach their full potential.

### **Academic Interventions for Children in Care**

Despite the well-documented educational difficulties of children in care, there have been relatively few attempts to improve their academic outcomes. As shown in Table 1, which is adapted from Forsman & Vinerljung (2012), there appear to be only 14 published studies, in English or the Scandinavian languages of Swedish, Danish, and Norwegian, in which researchers have designed and evaluated interventions specifically aimed at improving the educational performance of children in foster care. Tutoring programs appear to be the most widely used, theoretically grounded, and effective educational intervention to date for children in care (Forsman & Vinerljung, 2012). As shown in Table 1, reading skills were improved in most studies, whereas evaluated attempts to enhance mathematic skills yielded mixed results. The challenge associated with improving mathematic skills is of particular concern, given the strong link between early mathematic skills and general school performance (Duncan, et al., 2007). Moreover, of the existing academic interventions, very few utilize randomize controlled trials (RCTs), which arguably constitutes the most appropriate methodology to answer questions of effectiveness (Evans et al., 2017; Mezey et al., 2015). Taken together, the limited evaluations of academic interventions for children in care, paired with the lack of scientific rigor, calls for increased development and appraisal of academic interventions for children in care.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Table 1.

*Summary of published academic interventions for children in care*

Study	Country	Design	Population	Intervention modality	Intervention intensity	Training of Interventions	Intervention adherence	Outcome measures	Results
Peer Reviewed									
Flynn et al. (2012)	Canada	RCT, pre and post test	6-13 years <i>n</i> = 30 intervention group <i>n</i> = 34 wait-list controls	Tutoring by foster parents	3h/week for 30 weeks	6h	Yes	Word reading, sentence comprehension, spelling, math computation	+ sentence comprehension + math 0 spelling 0 word reading
Davidson and Wolfred (1977)	USA	Matched, pre and post test	7-17 years <i>n</i> = 42 intervention group <i>n</i> = 42 comparison group	Behaviour modification program	5h/day for 5 days/week; 14 weeks	NI	NI	Grade point average (GPA) and attendance	0 GPA 0 attendance
Harper and Schmidt (2016)	Canada	RCT, pre and post test	6-13 years <i>n</i> = 45 intervention <i>n</i> = 46 wait-list controls	Group (3-4 children/group) tutoring by university student volunteers	2h/week for 25 weeks	2 full days	Yes	Reading, spelling and math	+ word reading + spelling 0 sentence comprehension + math
Tideman et al. (2011)	Sweden	Pre and post test	7-11 years <i>N</i> = 24	Individualized educational support	24 months	No	No	Cognitive ability (IQ), reading, spelling, and math	+ IQ + reading + spelling 0 math

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Study	Country	Design	Population	Intervention modality	Intervention intensity	Training	Intervention adherence	Outcome measures	Results
Tordon et al. (2014)	Sweden	Pre and post test	Grades 1-6 N = 24	Individualized education plan  Working memory training (n = 11)	24 months	No	Yes	Cognitive ability (IQ), reading, writing, math skills, behaviour	+ IQ + WM + sentence comprehension + numeracy + self concept  0 word reading 0 reading speed 0 spelling 0 disruptive behaviour/depression/anxiety/anger
Mooney et al. (2016)	UK	RCT	7-11 years n = 60 intervention group  n = 56 control group	Letterbox club (books sent in mail to children)	Received book parcels 1/month for 6 months	No		Reading	0 Reading
Osbourne et al. (2010)	UK	Pre and post test	5-12 years N = 35	Paired reading; tutoring by foster parents	3x/week for 16 weeks; 20 mins sessions	Yes*	No	Reading	+ reading
Vinnerljung et al. (2014)	Sweden	Pre and post test	8-12 years N = 81	Paired reading with foster parents	16 weeks	Yes*	Yes	Cognitive ability (IQ), reading	+ reading + vocabulary 0 processing speed 0 non verbal problems solving

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Study	Country	Design	Population	Intervention modality	Intervention intensity	Training	Intervention adherence	Outcome measures	Results
Zetlin et al. (2004)	USA	Quasi-experimental, pre and post test	5-17 years <i>n</i> = 50 intervention <i>n</i> = 38 comparison group	Education liaison/social worker	12 months	Yes*	No	Reading, math, grade-point average	+ Reading +Math 0 GPA
Zinn & Courtney (2014)	USA	RCT	14-15 years <i>n</i> = 246 intervention <i>n</i> = 219 control group	Home based tutoring by college students	2x/week twice a week for up to 50h	1 full day	Yes	Reading and math	0 reading 0 math
Not Peer-Reviewed									
Griffiths et al. (2010)	UK	Pre and post test	7-11 years <i>n</i> = 316 in 2007 <i>n</i> = 536 in 2008	distribution of books, stationary, and games	1/month for 6 months	No	No	Reading and math	+ reading (in 2007 and 2008) + math (in 2007) 0 math (in 2008)
Olisa et al. (n.d.)	UK	Pre and post test	5-11 years <i>n</i> = 10 (reading group) <i>n</i> = 10 (math group) <i>n</i> = 3 control	Tutoring by teacher volunteers	20 sessions of one on one support over 1 year	Yes*	NI	Reading, vocabulary, spelling, and math	+ reading + vocabulary + spelling + math (math group) 0 math (reading group)

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Study	Country	Design	Population	Intervention modality	Intervention intensity	Training	Intervention adherence	Outcome measures	Results
O'Brien and Rutland (2008)	Canada	Pre and post test	4-13 years	Individualized learning program (Kumon)	30mins for 7 days/week for 12 months	Yes*	No	Reading and math	+ reading 0 math
Wolfendale and Bryans (2004)	UK	Pre and post test	9-14 years <i>n</i> = 58	Distribution of books and computers	NI	NI	NI	Reading, reading comprehension, and spelling	+ reading + comprehension + spelling

*Notes.* RCT = randomized control trial; *n* = number of children who completed pre and post-tests; + Significant positive results; 0 No

significant differences; NI = not indicated; \* training received but for an unknown amount of time. Adapted from Forsman &

Vinnerljung, 2012

### **The Current Dissertation**

Considering the frequency with which the low educational achievement of children in care is the subject of descriptive accounts in the literature, it is surprising that very few controlled interventions have been conducted to improve their academic skills (Barth & Ferguson, 2004; Trout et al., 2008; Evans, Brown, Rees, & Smith, 2017). The current dissertation contributes to the existing literature by addressing this area of need by conducting three randomized controlled trials (RCTs) that aim to improve academic outcomes for children in care.

The first study is an RCT that evaluates the effectiveness of a one-on-one in-home tutoring intervention, TutorBright, on improving the math and reading skills of children in care. This study compares the impact of TutorBright to that of a waitlist control group. As a secondary objective, we also explore whether age, gender, and academically relevant domains (behaviour, executive functioning, symptoms of PTSD, and caregiver academic involvement) moderate the impact of tutoring. Moreover, we explore whether TutorBright can produce ‘spillover’ effects in these same educationally relevant domains.

The second study is a randomized trial of tutoring in follow-up to that of Flynn et al. (2012). Given the encouraging results from the Flynn et al. (2012) study, which evaluated the impact of a 25-week, caregiver-delivered Direct Instruction tutoring program (Teach Your Children Well, TYCW), the goal of the second study is to assess whether a shorter version of the TYCW tutoring program (i.e., 15 weeks) is as effective in improving math and reading skills as a longer version (i.e., 25 weeks). Moreover, an attribute-treatment interaction was also conducted to assess potential moderating variables on the effectiveness of the 15 and 25-week tutoring group. We also explore possible spillover effects of tutoring into educationally relevant domains.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Given the link between executive functioning (particularly working memory capacity) and math and reading skills (Cantin, Gnaedinger, Gallaway, Hesson-McInnis, & Hund, 2016) the third study, a small pilot RCT, aims to assess the effectiveness of working memory training (WMT) in improving working memory capacity as well as math and reading skills. Moreover, given the relationship between working memory and attentional control (Shipstead, Lindsey, Marshall, & Engle, 2014), as a secondary objective, we assess whether WMT can also improve symptoms of ADHD (i.e., inattention, hyperactivity, and executive dysfunction) as measured by the Conners Parent Rating Scale.

**References**

- Ackerman, P. T., Newton, J. E. O., McPherson, W. B., Jones, J. G., & Dykman, R. A. (1998). Prevalence of post traumatic stress disorder and other psychiatric diagnoses in three groups of abused children (sexual, physical, and both). *Child Abuse and Neglect*, 22(8), 759-774.
- Aldgate, J., Colton, M., Ghate, D., & Heath, A. (1992). Educational attainment and stability in long-term foster care. *Children & Society*, 6(2), 91-103.
- Barber, J. G., & Delfabbro, P. H. (2003). Placement stability and the psychosocial well-being of children in foster care. *Research on Social Work Practice*, 13(4), 415-431.
- Barth, R. P., & Ferguson, C. (2004). *Educational risks and interventions for children in foster care*. Stockholm, Sweden: Institute for Evidence-Based Social Work Practice. The National Board of Health and Welfare.
- Baum, A. C., Crase, S. J., & Crase, K. L. (2001). Influences on the decision to become or not become a foster parent. *Families in Society: The Journal of Contemporary Human Services*, 82(2), 202-213.
- Beers, S. R., & De Bellis, M. D. (2002). Neuropsychological function in children with maltreatment-related posttraumatic stress disorder. *American Journal of Psychiatry*, 159(3), 483-486.
- Best, J. R., Miller, P. H., & Naglieri, J. A. (2011). Relations between executive function and academic achievement from ages 5 to 17 in a large, representative national sample. *Learning and Individual Differences*, 21(4), 327-336.
- Boivin, M., & Hertzman, C. (2012). *Early childhood development: Adverse experiences and developmental health*. Royal Society of Canada – Canadian Academy of Health Sciences

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Expert Panel. Ottawa, Canada: Royal Society of Canada. Retrieved from [https://rscsrc.ca/sites/default/files/pdf/ECD%20Report\\_0.pdf](https://rscsrc.ca/sites/default/files/pdf/ECD%20Report_0.pdf)
- Bounajm, F., Beckman, K., & Thériault, L. (2014). *Success for all: Investing in the future of Canadian children in care*. Ottawa, Canada: The Conference Board of Canada.
- Bremner, J. D., & Vermetten, E. (2001). Stress and development: behavioral and biological consequences. *Development and Psychopathology, 13*(3), 473-489.
- Bremner, J. D., Vythilingam, M., Vermetten, E., Adil, J., Khan, S., Nazeer, A., . . . Charney, D. S. (2003). Cortisol response to a cognitive stress challenge in posttraumatic stress disorder (PTSD) related to childhood abuse. *Psychoneuroendocrinology, 28*, 733-750.
- Bull, R., Espy, K. A., & Wiebe, S. A. (2008). Short-term memory, working memory, and executive functioning in preschoolers: Longitudinal predictors of mathematical achievement at age 7 years. *Developmental Neuropsychology, 33*(3), 205-228.
- Burge, P. (2007). Prevalence of mental disorders and associated service variables among Ontario children who are permanent wards. *The Canadian Journal of Psychiatry, 52*(5), 305-314.
- Burns, B. J., Phillips, S. D., Wagner, H. R., Barth, R. P., Kolko, D. J., Campbell, Y., & Landsverk, J. (2004). Mental health need and access to mental health services by youths involved with child welfare: A national survey. *Journal of the American Academy of Child and Adolescent Psychiatry, 43*(8), 960-970.
- Canadian Mental Health Association (CMHA). (2010). *Fast facts about mental health illness in youth*. Retrieved from <http://www.cmha.ca/media/fast-facts-about-mentalillness/#.UQQnZaVYg5Y>

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Cantin, R. H., Gnaedinger, E. K., Gallaway, K. C., Hesson-McInnis, M. S., & Hund, A. M. (2016). Executive functioning predicts reading, mathematics, and theory of mind during the elementary years. *Journal of Experimental Child Psychology, 146*, 66-78.
- Cheung, C., Lwin, K., & Jenkins, J. M. (2012). Helping youth in care succeed: Influence of caregiver involvement on academic achievement. *Children and Youth Services Review, 34*(6), 1092-1100.
- Cheung, S. Y., & Heath, A. (1994). After care: The education and occupation of adults who have been in care. *Oxford Review of Education, 20*(3), 361-374.
- Clark, C. A., Pritchard, V. E., & Woodward, L. J. (2010). Preschool executive functioning abilities predict early mathematics achievement. *Developmental Psychology, 46*(5), 1176.
- Colvert, E., Rutter, M., Kreppner, J., Beckett, C., Castle, J., Groothues, C., ... & Sonuga-Barke, E. J. (2008). Do theory of mind and executive function deficits underlie the adverse outcomes associated with profound early deprivation? Findings from the English and Romanian adoptees study. *Journal of Abnormal Child Psychology, 36*(7), 1057-1068.
- Commission to Promote Sustainable Child Welfare (2012). *Realizing a sustainable child welfare system in Ontario. Final report*. Toronto, ON: Ontario Ministry of Children and Youth Services.
- Cook, R., Fleishman, E., & Grimes, V. (1991). A national evaluation of Title IV-E foster care independent living programs for youth: Phase 2 (Final Report, Volume 1). Rockville, MD: Westat.
- Cook-Fong, S. K. (2000). The adult well-being of individuals reared in family foster care placements. *Child and Youth Care Forum, 29*(1), 7-25.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Courtney, M. E., & Dworsky, A. (2006). Early outcomes for young adults transitioning from out-of-home care in the USA. *Child & Family Social Work, 11*(3), 209-219.
- Courtney, M. E., Dworsky, A., Lee, J. S. & Raap, M. (2010). *Midwest evaluation of the adult functioning of former foster youth: Outcomes at ages 23 and 24*. Chapin Hall at the University of Chicago: Chicago.
- Davidson, W. S., & Wolfred, T. R. (1977). Evaluation of a community-based behavior modification program for prevention of delinquency: The failure of success. *Community Mental Health Journal, 13*(4), 296-306.
- De Bellis, M. D., Woolley, D. P., & Hooper, S. R. (2013). Neuropsychological findings in pediatric maltreatment: relationship of PTSD, dissociative symptoms, and abuse/neglect indices to neurocognitive outcomes. *Child Maltreatment, 18*(3), 171-183.
- DeGregorio, L. J., & McLean, S. (2013). The cognitive profiles of maltreated children in care and their educational needs: Supporting good outcomes. *Children Australia, 38*(1), 28-35.
- DeSocio, J., & Hootman, J. (2004). Children's mental health and school success. *The Journal of School Nursing, 20*(4), 189-196.
- Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., ... & Sexton, H. (2007). School readiness and later achievement. *Developmental Psychology, 43*(6), 1428.
- Evans, R., Brown, R., Rees, G., & Smith, P. (2017). Systematic review of educational interventions for looked-after children and young people: Recommendations for intervention development and evaluation. *British Educational Research Journal, 43*(1), 68-94.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Ferguson, H. B., & Wolkow, K. (2012). Educating children and youth in care: A review of barriers to school progress and strategies for change. *Children and Youth Services Review, 34*(6), 1143-1149.
- Fleming, C.B., Haggerty, K.P., Catalano, R.F., Harachi, T.W., Mazza, J.J., & Gruman, D.H. (2005). Do social and behavioral characteristics targeted by preventive interventions predict standardized test scores and grades? *The Journal of School Health, 75*, 342-349.
- Flynn, R. J., Ghazal, H., Legault, L., Vandermeulen, G., & Petrick, S. (2004). Use of population measures and norms to identify resilient outcomes in young people in care: An exploratory study. *Child & Family Social Work, 9*(1), 65-79.
- Flynn, R. J., Marquis, R. A., Paquet, M. P., Peeke, L. M., & Aubry, T. D. (2012). Effects of individual direct-instruction tutoring on foster children's academic skills: A randomized trial. *Children and Youth Services Review, 34*(6), 1183-1189.
- Forsman, H., Brännström, L., Vinnerljung, B., & Hjern, A. (2016). Does poor school performance cause later psychosocial problems among children in foster care? Evidence from national longitudinal registry data. *Child Abuse & Neglect, 57*, 61-71.
- Forsman, H., & Vinnerljung, B. (2012). Interventions aiming to improve school achievements of children in out-of-home care: A scoping review. *Children and Youth Services Review, 34*(6), 1084-1091.
- Garon, N., Bryson, S. E., & Smith, I. M. (2008). Executive function in preschoolers: a review using an integrative framework. *Psychological Bulletin, 134*(1), 31.
- Glaser, D. (2000). Child abuse and neglect and the brain—a review. *The Journal of Child Psychology and Psychiatry and Allied Disciplines, 41*(1), 97-116.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Gonzales-DeHass, Alyssa R., Patricia P. Willems, Marie F. Doan, and Holbein. 2005.

“Examining the Relationships between Parental Involvement and Student Motivation.” *Educational Psychology Review* 17(2), 99–123.

Goodall, J., & Vorhaus, J. (2011). *Review of best practice in parental engagement*. Retrieved from [http://opus.bath.ac.uk/51350/1/DFE\\_RR156.pdf](http://opus.bath.ac.uk/51350/1/DFE_RR156.pdf).

Griffiths, R., Comber, C., & Dymoke, S. (2010). *The Letterbox Club 2007 to 2009: Final evaluation report*. Leicester: University of Leicester School of Education.

Harper, J., & Schmidt, F. (2016). Effectiveness of a group-based academic tutoring program for children in foster care: A randomized controlled trial. *Children and Youth Services Review, 67*, 238-246.

Heflinger, C. A., Simpkins, C. G., & Combs-Orme, T. (2000). Using the CBCL to determine the clinical status of children in state custody. *Children and Youth Services Review, 22*(1), 55-73.

Hinshaw, S. P. (1992). Academic underachievement, attention deficits, and aggression: Comorbidity and implications for intervention. *Journal of Consulting and Clinical Psychology, 60*(6), 893.

Hughes, C. (2002). Executive functions and development: Emerging themes. *Infant and Child Development, 11*(2), 201-209.

Jackson, S. (1994). Educating children in residential and foster care. *Oxford Review of Education, 20*(3), 267-279.

Jackson, S., & Ajayi, S. (2007). Foster care and higher education. *Adoption & Fostering, 31*(1), 62-72.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Jeynes, W. H. (2003). A meta-analysis: The effects of parental involvement on minority children's academic achievement. *Education and Urban Society, 35*(2), 202-218.
- Jeynes, W. H. (2005). A meta-analysis of the relation of parental involvement to urban elementary school student academic achievement. *Urban Education, 40*(3), 237-269.
- Lane, K. L. (1999). Young students at risk for antisocial behavior: The utility of academic and social skills interventions. *Journal of Emotional and Behavioral Disorders, 7*, 211-223.
- Leslie, L. K., Gordon, J. N., Meneken, L. E. E., Premji, K., Michelmore, K. L., & Ganger, W. (2005). The physical, developmental, and mental health needs of young children in child welfare by initial placement type. *Journal of Developmental and Behavioral Pediatrics: JDBP, 26*(3), 177.
- Loe, I. M., & Feldman, H. M. (2007). Academic and educational outcomes of children with ADHD. *Journal of Pediatric Psychology, 32*(6), 643-654.
- Martinussen, R., Hayden, J., Hogg-Johnson, S., & Tannock, R. (2005). A meta-analysis of working memory impairments in children with attention-deficit/hyperactivity disorder. *Journal of the American Academy of Child & Adolescent Psychiatry, 44*, 377-384.
- McMillen, J. C., Zima, B. T., Scott, L. D., Auslander, W. F., Munson, M. R., Ollie, M. T., & Spitznagel, E. L. (2005). Prevalence of psychiatric disorders among older youths in the foster care system. *Journal of the American Academy of Child & Adolescent Psychiatry, 44*(1), 88-95.
- McVay, J. C., & Kane, M. J. (2012). Why does working memory capacity predict variation in reading comprehension? On the influence of mind wandering and executive attention. *Journal of Experimental Psychology: General, 141*(2), 302.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Mezey, G., Robinson, F., Campbell, R., Gillard, S., Macdonald, G., Meyer, D., ... & White, S. (2015). Challenges to undertaking randomised trials with looked after children in social care settings. *Trials*, *16*(1), 206.
- Miller, M., & Hinshaw, S. P. (2010). Does childhood executive function predict adolescent functional outcomes in girls with ADHD?. *Journal of Abnormal Child Psychology*, *38*(3), 315-326.
- Mitic, W., & Rimer, M. (2002, December). The educational attainment of children in care in British Columbia. In *Child and Youth Care Forum*, *31*, (6), 397-414.
- Mooney, J., Winter, K., & Connolly, P. (2016). Effects of a book gifting programme on literacy outcomes for foster children: A randomised controlled trial evaluation of the Letterbox Club in Northern Ireland. *Children and Youth Services Review*, *65*, 1-8.
- Mulcahy, M., & Trocmé, N. (2010). Children and youth in out-of-home care in Canada. *CECW Information Sheet*, 78.
- Nikulina, V., & Widom, C. S. (2013). Child maltreatment and executive functioning in middle adulthood: A prospective examination. *Neuropsychology*, *27*(4), 417.
- O'Brien, M., & Rutland, J. (2008). Outcomes of a supplemental learning program for children in care at family and children's services of Renfrew County. *Reading Time*, *1*(24), 5-50.
- Olisa, J., Stuart, M., Hill, V., Male, D., & Radford, J. (n.d.). *Intervention to promote good literacy in looked after children*. (Project 2001-02S30). London: London University Institute of Education.
- Ontario Association of Children's Aid Societies. (2012). *Child welfare report: 2012*. Retrieved from [http://www.oacas.org/newsroom/releases/04nov2013\\_CWR\\_2012.pdf](http://www.oacas.org/newsroom/releases/04nov2013_CWR_2012.pdf)

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Osborne, C., Alfano, J., & Winn, T. (2010). Paired reading as a literacy intervention for foster children. *Adoption & Fostering, 34*(4), 17-26.
- Pears, K., & Fisher, P. A. (2005). Developmental, cognitive, and neuropsychological functioning in preschool-aged foster children: Associations with prior maltreatment and placement history. *Journal of Developmental & Behavioral Pediatrics, 26*(2), 112-122.
- Pears, K. C., Fisher, P. A., Bruce, J., Kim, H. K., & Yoerger, K. (2010). Early elementary school adjustment of maltreated children in foster care: The roles of inhibitory control and caregiver involvement. *Child Development, 81*(5), 1550-1564.
- Pechtel, P., & Pizzagalli, D. A. (2011). Effects of early life stress on cognitive and affective function: an integrated review of human literature. *Psychopharmacology, 214*(1), 55-70.
- Pecora, P. J. (2012). Maximizing educational achievement of youth in foster care and alumni: Factors associated with success. *Children and Youth Services Review, 34*(6), 1121-1129.
- Pecora, P. J., Kessler, R. C., O'Brien, K., White, C. R., Williams, J., Hiripi, E., ... & Herrick, M. A. (2006). Educational and employment outcomes of adults formerly placed in foster care: Results from the Northwest Foster Care Alumni Study. *Children and Youth Services Review, 28*(12), 1459-1481.
- Pollak, S. D., Nelson, C. A., Schlaak, M. F., Roeber, B. J., Wewerka, S. S., Wiik, K. L., ... & Gunnar, M. R. (2010). Neurodevelopmental effects of early deprivation in postinstitutionalized children. *Child Development, 81*(1), 224-236.
- Reid, R., Gonzalez, J. E., Nordness, P. D., Trout, A., & Epstein, M. H. (2004). A meta-analysis of the academic status of students with emotional/behavioral disturbance. *The Journal of Special Education, 38*(3), 130-143.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Riggs, N. R., Blair, C. B., & Greenberg, M. T. (2004). Concurrent and 2-year longitudinal relations between executive function and the behavior of 1st and 2nd grade children. *Child Neuropsychology, 9*(4), 267-276.
- Roeser, R.W., Eccles, J.S., & Strobel, K.R. (1998). Linking the study of schooling and mental health: Selected issues and empirical illustrations at the level of the individual. *Educational Psychologist, 33*,153-176.
- Salazar, A. M., Keller, T. E., Gowen, L. K., & Courtney, M. E. (2013). Trauma Exposure and PTSD Among Older Adolescents in Foster Care. *Social Psychiatry and Psychiatric Epidemiology, 48*(4), 545–551.
- Shipstead, Z., Lindsey, D. R., Marshall, R. L., & Engle, R. W. (2014). The mechanisms of working memory capacity: Primary memory, secondary memory, and attention control. *Journal of Memory and Language, 72*, 116-141.
- Snow, P. C. (2009). Child maltreatment, mental health and oral language competence: Inviting speech-language pathology to the prevention table. *International Journal of Speech-Language Pathology, 11*(2), 95-103.
- Stone, S. (2007). Child maltreatment, out-of-home placement and academic vulnerability: A fifteen-year review of evidence and future directions. *Children and Youth Services Review, 29*(2), 139-161.
- Swanson, H. L., & Beebe-Frankenberger, M. (2004). The relationship between working memory and mathematical problem solving in children at risk and not at risk for serious math difficulties. *Journal of Educational Psychology, 96*(3), 471.
- Tarren-Sweeney, M. (2008). The mental health of children in out-of-home care. *Current Opinion in Psychiatry, 21*(4), 345-349.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Tessier, N. G., O'Higgins, A., & Flynn, R. J. (2017). Neglect, educational success, and young people in out-of-home care: Cross-sectional and longitudinal analyses. *Child Abuse & Neglect*.
- Tideman, E., Vinnerljung, B., Hintze, K., & Isaksson, A. A. (2011). Improving foster children's school achievements: Promising results from a Swedish intensive study. *Adoption & Fostering*, 35(1), 44-56.
- Tordön, R., Vinnerljung, B., & Axelsson, U. (2014). Improving foster children's school performance: a replication of the Helsingborg study. *Adoption & Fostering*, 38(1), 37-48.
- Trickett, P. K., Noll, J. G., & Putnam, F. W. (2011). The impact of sexual abuse on female development: Lessons from a multigenerational, longitudinal research study. *Development and Psychopathology*, 23(2), 453-476.
- Trout, A. L., Hagaman, J., Casey, K., Reid, R., & Epstein, M. H. (2008). The academic status of children and youth in out-of-home care: A review of the literature. *Children and Youth Services Review*, 30(9), 979-994.
- Trout, A. L., Nordness, P. D., Pierce, C. D., & Epstein, M. H. (2003). Research on the academic status of children with emotional and behavioral disorders: A review of the literature from 1961 to 2000. *Journal of Emotional and Behavioral Disorders*, 11(4), 198-210.
- Turney, K., & Wildeman, C. (2016). Mental and physical health of children in foster care. *Pediatrics*, e20161118.
- Vinnerljung, B., Tideman, E., Sallnäs, M., & Forsman, H. (2014). Paired Reading for foster children: results from a Swedish replication of an English literacy intervention. *Adoption & Fostering*, 38(4), 361-373.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Webster, L., Hackett, R. K., & Joubert, D. (2009). The association of unresolved attachment status and cognitive processes in maltreated adolescents. *Child Abuse Review, 18*(1), 6-23.
- Weegar, K., Hickey, A. J., Bell, T., Romano, E., & Flynn, R. J. (2014). Educational trajectories of Canadian children in care in primary school and the early years of secondary school. *13<sup>th</sup> European Scientific Association on Residential and Family Care for Children and Adolescents Conference*. Lecture conducted from Copenhagen, Demark.
- Weiss, H. B., Bouffard, S. M., Bridglall, B. L., & Gordon, E. W. (2009). Reframing Family Involvement in Education: Supporting Families to Support Educational Equity. Equity Matters. Research Review No. 5. *Campaign for Educational Equity, Teachers College, Columbia University*.
- Wilson, K. R., Hansen, D. J., & Li, M. (2011). The traumatic stress response in child maltreatment and resultant neuropsychological effects. *Aggression and Violent Behavior, 16*(2), 87-97.
- Wolfendale, S., & Bryans, T. (2004). Evaluation of the Looking After Literacy project in Kent for children in public care. *London: University of East London*.
- Zetlin, A., Weinberg, L., & Kimm, C. (2004). Improving education outcomes for children in foster care: Intervention by an education liaison. *Journal of Education for Students placed at Risk, 9*(4), 421-429.
- Zetlin, A. G., Weinberg, L. A. & Shea, N. M. (2006) Seeing the whole picture: Views from diverse participants on barriers to educating foster youths. *Children and Schools, 28*, 165–173.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Zinn, A., & Courtney, M. E. (2014). Context matters: Experimental evaluation of home-based tutoring for youth in foster care. *Children and Youth Services Review*, *47*, 198-204.

Effectiveness of a one-to-one tutoring program on the math and reading skills of children in  
foster care: A randomized controlled trial

Andrea Hickey & Robert J. Flynn

University of Ottawa

### **Abstract**

The aim of the current study was to evaluate the effectiveness of a new tutoring program, TutorBright, on improving the math and reading skills of children in out-of-home care (e.g., foster care). This study also explored the effect of educationally relevant moderator variables on the effectiveness of tutoring and the effect of tutoring on ‘spill-over’ effects in executive functioning, behavioural difficulties, and caregiver involvement in academic activities. The sample consisted of 70 children in foster care from a local Children’s Aid Society in Ontario, Canada. At the pre-test, the foster children were aged 5-16 years ( $M = 10.41$ ,  $SD = 2.94$ ), and were in school grades 1 through 11 ( $M = 5.53$ ,  $SD = 2.90$ ). Thirty-seven foster children were randomly assigned to the experimental (tutoring) group and 38 to the wait-list control group. Seven subtests from the Woodcock-Johnson III (WJ-III) served as the outcome measures. At the post-test, after attrition, the foster children in the experimental group ( $n = 34$ ) had made statistically greater gains than those in the control group ( $n = 36$ ) on the WJ-III subtests of: Reading Fluency, Reading Comprehension, and Math Calculation, but not on Letter-Word Identification, Spelling, Math Fluency, or Applied Math Problems. Executive functioning and self-reported symptoms of PTSD (for older children) were statistically significant moderators of the effects of tutoring. No significant spill-over effects of tutoring were found. The implications of the results for improving academic outcomes for foster children were discussed.

*Keywords:* foster care, math, reading, tutoring, randomized control trial

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

### Effectiveness of the TutorBright One-to-One Tutoring Program on the Math and Reading Skills of Children in Foster Care: A Randomized Controlled Trial

It is well documented that children in out-of-home care (hereafter, ‘in care’) are at risk of relatively poor academic attainment, compared to children in the general population. Globally, it has been consistently reported that many children in care have higher rates of learning disabilities, increased rates of grade retention and expulsion, and below-average performance in math and reading (Trout, Hagaman, Casey, Reid, Epstein, 2008; Jackson, 2007). Moreover, children in care often have significant cognitive and language-skill deficits and poor problem-solving and reasoning skills (Kavanaugh, Dupont-Frechette, Jerskey, & Holler, 2016; Kufeldt, Simard, & Vachon, 2000; Trout et al., 2008). Indeed, approximately 30–50% of children in care are eligible for special education (Lightfoot, Hill, & LaLiberte, 2011; Trout et al., 2008), compared to 10% of children in the general population (Zetlin, 2006). Furthermore, it has been estimated that 52% of youth leaving care have not completed Grade 12 (Rutman, Hubberstey, Feduniw, & Brown, 2007), compared with 13.5% of the general population (Ontario Ministry of Education, 2016). Moreover, for youths who do graduate from high school, many may find post-secondary education (PSE) programs to be difficult. For, as Courtney, Dworsky, Lee, and Raap (2010) have found in the US, there is a trend among young people in care of increasing PSE enrolments but decreasing PSE graduation rates. Without mastery of basic academic skills, children in care are at increased risk of academic failure, school dropout, involvement in criminal activity, and homelessness (Berlin, Vinnerljung, & Hjern, 2011; Snow, 2009; Trout et al, 2008, Viner & Taylor, 2005). Consistent with these findings, Forsman and colleagues (2016), using national longitudinal register data from Sweden, reported that for children in care, poor school

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

performance has a causal negative impact on later psychosocial problems, namely, economic hardship, illicit drug use, and poor mental health.

Despite the evidence of existing difficulties in educational performance for children in care, there remains limited theoretical and empirical consideration of the reasons why children in care often have poor educational outcomes. Researchers have proposed that children in care have weak family and social networks (Franzen & Vinnerljung, 2006; Berlin et al., 2011); low caregiver involvement in school-related behaviours and academic aspirations for their child in care (O'Higgins, Sebba, & Gardner, 2014; Pears, Fisher, Bruce, Kim, & Yoerger, 2010); emotional and behavioural difficulties, (e.g., Post Traumatic Stress Disorder (PTSD), Attention Deficit Hyperactivity Disorder; Romano, Babchishin, Marquis, & Fréchette, 2015; O'Higgins, Sebba, & Gardner, 2014; Tessier, O'Higgins, & Flynn, 2017; Pears, Fisher, Bruce, Kim, & Yoerger, 2010; Schelble, Franks, & Miller, 2010), home and school placement instability (Pecora, 2012; Sebba et al., 2015); poor cognitive skills (e.g., executive functioning; DeGregorio, & McLean, 2013) and insufficient accountability or monitoring of academic outcomes by the care system (Zetlin et al., 2006). However, numerous other pre-care factors such as a history of maltreatment, socioeconomic deprivation, and ethnicity not only predict entry into care but may also help to explain educational disadvantage (Romano, Babchishin, Marquis, & Fréchette, 2015; Stone, 2007; Sylva et al., 2014). Conversely, recent cross-sectional data have found several protective factors against poor educational outcomes: higher caregiver educational aspirations for the young person and, on the part of the young person in care, a longer placement with a caregiver, more internal developmental assets, more positive mental health, and higher educational aspirations have been found to be associated with greater educational success (Tessier et al., 2017). Regardless of the cause, poor school performance and low educational

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

achievement are believed to be among the strongest risk factors for the futures of children in care (Jackson, 1994). Indeed, the links between poor achievement and unfavourable psychosocial outcomes are strong, even after controlling for characteristics of birth parents, time in care, and age at first placement (Forsman & Vinnerljung, 2012; Forsman, Brannstrom, Vinnerljung, & Hjern, 2016).

Several meta-analyses have examined the impact of academic interventions for at-risk or low achieving students. For example, Lauer, Akiba, Wilkerson, Apthorp, Snow and Martin-Glenn (2006) conducted a meta-analysis of Out-of-School-Time programs for low-achieving students. They found an overall small effect size for the interventions assessed, but found the largest average effect size (Hedges  $g = .50$ ) for interventions using one-to-one tutoring to improve reading skills. Similarly, a recent meta-analysis of approximately 100 academic interventions for children of low socioeconomic status found that the most effective academic intervention for these children was tutoring (one-to-one or small groups;  $ES = .36$ ), followed by progress monitoring (i.e., teachers or students receive information about development;  $ES = .32$ ) and cooperative learning (i.e., peer-assisted learning;  $ES = .22$ ) (Dietrichson, Bog, Filges, & Klint Jorgensen, 2017). Similarly, Slavin et al. (2008) found that one-to-one tutoring is more effective than small-group tutoring and computer-assisted instruction programs for struggling readers in grades K-5. The beneficial impact of tutoring has also been found with volunteer tutors. In a recent meta-analysis of randomized field trials conducted with children in the general population, Ritter, Barnett, Denny, and Albin (2009) found that adult volunteer tutors were effective in improving word reading, reading fluency, and spelling for children in grades K to 8. Interestingly, math-based interventions tended to produce relatively smaller effect sizes when compared to reading-based interventions; however, a recent meta-analysis of math-based

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

interventions for elementary school students demonstrated that instructional process approaches (e.g., classroom management and supplemental tutoring programs) have, on average, moderate evidence of effectiveness ( $ES = 0.33$ , Slavin & Lake, 2008). These results are particularly promising, given that evaluations of educational interventions that use RCT designs and standardized outcome instruments typically yield smaller effect sizes when compared to quasi-experimental studies (i.e.,  $+0.16$  and  $+0.23$ , for randomized experimental studies and quasi-experimental studies, respectively; Cheung, & Slavin, 2016). Taken together, these findings highlight the potential benefit of tutoring (particularly one-to-one tutoring) in improving academic skills for children.

Among the many social, mental health, and developmental needs of children in foster care, educational achievement stands out as a pivotal factor that will affect their long-term psychosocial adjustment and success in adulthood. Indeed, previous researchers have found that school engagement and success are among the most predictive variables of adult resilience and healthy outcomes (Finnie et al., 2016). As such, policy makers and child welfare advocates have become increasingly concerned about the academic outcomes of children in care, and, as a result, there has been an increased call for research related to improvement of academic outcomes for these children.

Despite the widely documented academic difficulties of children in care, there have been relatively few evaluated attempts aimed at remediating the problem (Forsman & Vinnerljung, 2012; Evans, Brown, Rees, & Smith, 2016). Forsman and Vinnerljung (2012) published a scoping review, restricting study inclusion to randomised controlled trials (RCTs), quasi-experiments and pre-post testing. They identified only 11 evaluations, with tutoring being the most frequently evaluated intervention. Overall, 9 of the 11 studies had reported positive

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

outcomes, with 4 out of 5 tutoring evaluations yielding positive results. However, given the limited number of academic interventions, Forsman and Vinnerljung (2012) were tentative in their conclusions regarding effectiveness and suggested that interventions targeting this population *may* have a chance of generating positive results. More recently, Evans and colleagues (2016) published a review of randomized controlled trials (12 projects and 15 RCTs) evaluating interventions with academic outcomes for children in care under the age of 19 years. Of the 12 projects, 9 demonstrated some evidence of effectiveness. Of the studies demonstrating some level of effectiveness, three utilized academic tutoring (either one-one-one [Flynn, Marquis, Paquet, Peeke, & Aubry, 2012; Marquis, 2013] or small-group-based tutoring; Harper & Schmidt, 2016). Despite these findings, Evans and colleagues (2016) concluded that it remains premature to draw any firm conclusions regarding the impact of educational interventions for children in care due to the variable quality of studies and reporting. However, they called for continued utilisation of RCTs, accompanied by more critical monitoring of methodological quality, to generate more convincing evidence regarding which academic interventions work and for whom (Evans et al. 2016).

To date, there have been only three randomized controlled evaluations of tutoring programs for children in care. The first (Flynn, et al., 2012) assessed the effectiveness of a foster-parent delivered direct-instruction tutoring program on improving math and reading skills for children in care. The sample consisted of 77 foster children aged 6 to 13 years who were in primary-school grades 2-7. Forty-two foster children were randomly assigned to the experimental group, which received Maloney's (1998) version of direct instruction tutoring (3 hours of individual tutoring per week provided by the children's foster parents, for 30 weeks), and 35 foster children were randomly assigned to a wait-list control group. At the post-test,

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

children that had received tutoring had made significantly more gains than those in the waitlist control condition on WRAT4 Sentence Comprehension (Hedges'  $g = 0.38, p < .05$ ), Reading Composite ( $g = 0.29, p < .10$ ), and Math Computation ( $g = 0.46, p < .01$ ), but not on Word Reading ( $g = 0.19, ns$ ) or Spelling ( $g = -0.08, ns$ ).

In a constructive replication of the study by Flynn and colleagues (2012), Harper and Schmidt (2016) also evaluated Maloney's (1998) Teach Your Children Well version of direct-instruction tutoring, using a small-group format and university students as tutors. The children were provided 2 hours of tutoring per week for 25 weeks. They were primarily of Indigenous origin (approximately 80%), 6-13 years of age, and in primary grades 1-8. Among the 45 children who received tutoring, compared with the 46 who remained in the control group, there were statistically significant effects on WRAT4 Word Reading (Hedges'  $g = 0.40, p < .001$ ), Spelling ( $g = 0.25, p < .02$ ), and Math ( $g = 0.34, p < .04$ ), but not on Sentence Comprehension ( $g = 0.15, ns$ ).

Lastly, Zinn and Courtney (2014) evaluated the impact of an individualized home-based tutoring program on the academic performance of children in care. The sample consisted of 465 youths aged 14-15 years who were 1-3 grades behind in school; 246 were randomly assigned to the tutoring group and 219 to the control group. The youth in the tutoring group were eligible for up to 65 hours of tutoring, including 15 hours that tutors could use for preparation, mentoring, and other activities. The results indicated no significant treatment effects, as measured by the Woodcock-Johnson III (Woodcock, McGrew, & Mather, 2001) on letter word reading, passage comprehension, or calculation. There were several possible reasons for such findings: on average, the youth received only 35 hours of tutoring (18 hours of math and 17 hours of reading/language), instead of the planned 65; 12% of the control group inexplicably received the

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

intervention; many in the control group received tutoring from other sources (e.g., school-based programs); and 38% of the youths randomly assigned to the tutoring group never took part in the intervention

Thus, from the limited research investigating the effects of educational interventions on improving academic success for children in care, particularly for younger children, the overall results are promising. Moreover, academic tutoring appears to be an effective method of improving academic outcomes for these children. However, given the inconsistent findings of the existing randomized controlled tutoring trials for children in care (i.e., the lack of significant findings in Zinn and Courtney (2014), and the improvement in somewhat different academic areas in Flynn et al. (2012) versus Harper & Schmidt (2016), more research is needed. Moreover, to our knowledge, there is no existing randomized controlled trial for children in care that has evaluated tutoring programs that, like TutorBright, incorporate homework help, a popular component in many academic enrichment programs (Cosden, Morrison, Albanese, & Macias, 2001).

Previous researchers have found that academic success is influenced by a variety of both individual factors (i.e., behavioural and mental health difficulties, such as conduct disorder, depression/anxiety, post-traumatic stress disorder (PTSD); Hinshaw, 1992; Trout, Nordness, Pierce, & Epstein, 2003, Thompson, & Massat, 2005) and contextual factors (e.g., caregiver involvement in school-related activities; Cheung, Lewin, and Jenkins, 2012). To date, however, very few studies have assessed the degree to which such factors can influence, or moderate, the effectiveness of academic tutoring, in either the general or in-care populations. Indeed, to our knowledge, only one previous study has explored whether gender moderated the impact of an academic intervention for children in care. In a follow-up analysis to the Flynn et al. (2012)

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

study, which assessed the impact of a caregiver delivered one-to-one tutoring intervention for children in care, Marquis (2013) found that gender moderated the effectiveness of the intervention (at the level of a trend), such that girls in care appeared to benefit more from tutoring than boys. Given the paucity of research in this area, in the current study, we examined the role of gender as well as other potential moderating variables on the effectiveness of tutoring in order gain a better understanding of how to strengthen the impact of academic interventions for children in care.

The current study had three objectives: the first was primary, and the second and third were exploratory. The primary objective was to evaluate the impact of an individualized, home-based tutoring program, known as TutorBright, on the academic performance in reading and math of children in foster care (<http://tutorbright.com>). In addition, we explored whether there was a 'dose-repose' relationship between the number of tutoring sessions, or tutoring minutes, and gains in reading and math. The second objective was to explore whether particular educationally relevant variables at pre-test would impact (moderate) the effectiveness of tutoring. More specifically, we explored whether age, gender, executive functioning, behavioural difficulties, symptoms of Post-Traumatic Stress Disorder, or caregiver involvement in academic activities in the home moderated the impact of tutoring on academic outcomes for children in care. Given the lack of existing research in this area, the choice of moderators was guided by previous research on factors related to academic performance. The third objective was to explore the extent to which tutoring may produce "spillover effects" in several educationally relevant domains for children in care, namely, executive functioning, behavioural difficulties, and caregiver involvement in academic activities in the home. In line with existing research, it was expected that children in care who received academic tutoring would improve significantly

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

more on math and reading skills than children in care who did not receive academic tutoring (i.e., waitlist control group).

### **Methods**

This study was an effectiveness trial, conducted under real-world conditions, rather than an efficacy trial, carried out under near-ideal, laboratory conditions (Singal, Higgins, Waljee, 2014). The study was approved by the Social Sciences and Humanities Research Ethics Board of the University of Ottawa.

### **Participants**

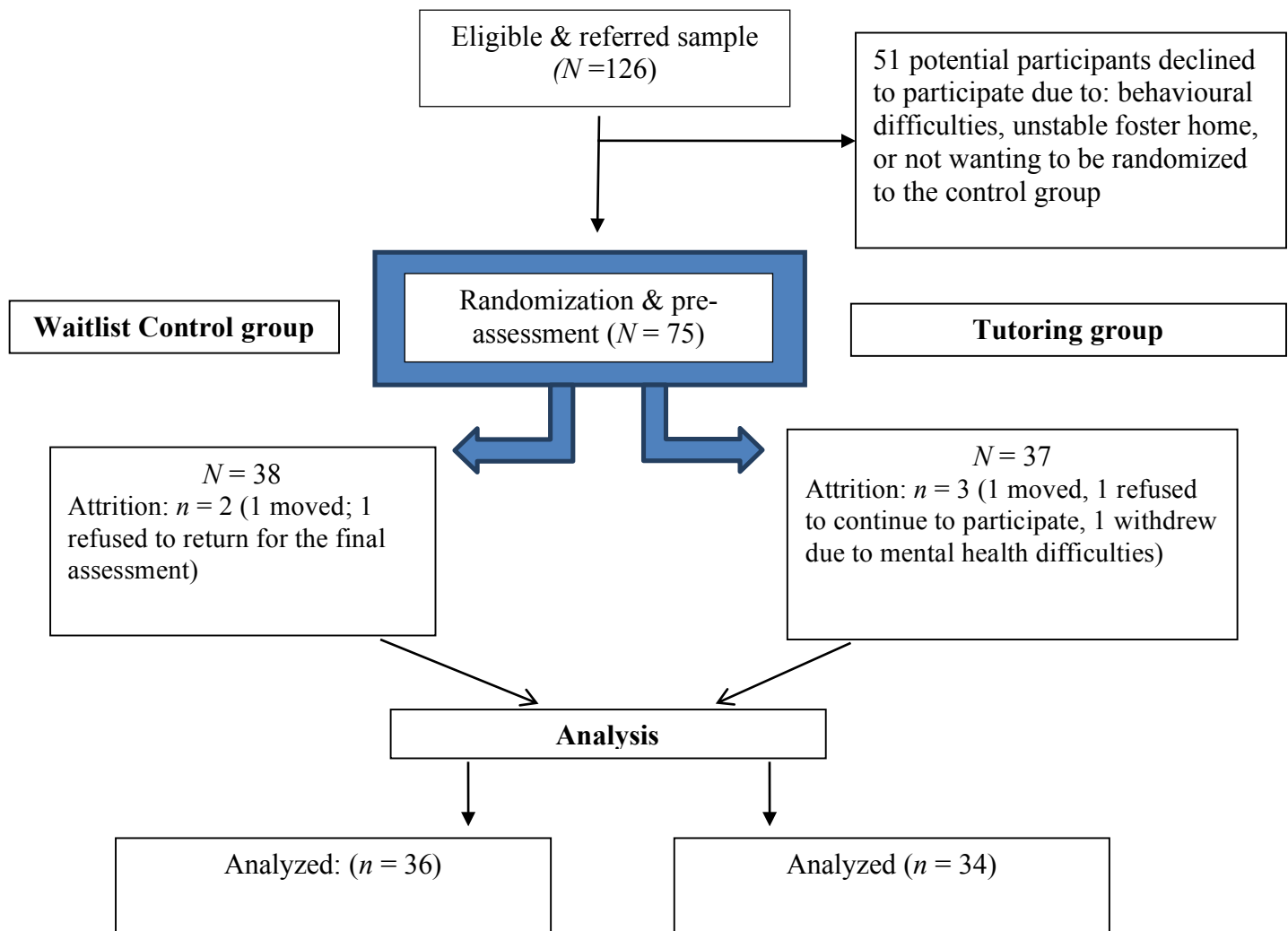
One local Children's Aid Society (CAS) approached the researchers to conduct an outcome evaluation of a novel tutoring program (TutorBright). Child welfare workers nominated foster children as candidates for the study. Eligible children were required to meet several eligibility criteria. They needed to be enrolled in grades 1 - 10, fluent in English (the TutorBright program existed only in English), living in a family-style placement (foster or kinship care placement or adoption probation), and assessed as stable by the child welfare worker (such that the child was likely to remain in their current placement for the duration of the study). Foster children were excluded from the study if they were living in a group home or if, in the judgment of the child welfare worker, they were either very strong students (and thus not likely to need the intervention) or else intellectually disabled or very behaviourally disturbed (and thus not likely to complete or benefit from the intervention). To maximize recruitment, up to two children in care per household were eligible to participate. In two cases, three children in one foster home were permitted to take part in the study (one group of three in the waitlist control group and the other group of three in the experimental group). The research data were collected over two school years (2014 to 2016). A sampling calculator (G\*Power; Buchner, Erdfelder, & Faul, 1996) was

used to determine the sample size required to find a medium effect. A total sample of 55 was deemed adequate to find a medium effect of  $f^2 = 0.15$  with 80% power and an alpha level of .05. However, Coyne, Thombs, and Hagedoom, (2010) suggest that a minimum of 35 participants per group, after attrition, is necessary for an adequate sample size in order to find a moderate effect size. Our sample size was thus very close to the recommended minimum.

**Foster children and foster parent participants.** 126 children in foster or kinship care or adoption probation met the inclusion criteria to participate in the project. Of the 126 eligibles, 75 children and their caregivers provided assent and consent, respectively, to participate and were enrolled in the study. They were then randomized to either the experimental or waitlist control conditions (see Appendix A for assent and consent forms). The reasons for not participating included foster home instability, too many behavioural difficulties, and not wanting to be randomized to the waitlist control group.

At the pre-intervention assessment, the 75 foster children were aged 5-16 years ( $M = 10.59$ ,  $SD = 2.98$ ) and in school grades 1-11 ( $M = 5.68$ ,  $SD = 2.95$ ). The foster parents (64 females and 6 males) had been providing care to the participating children in care for approximately 2 years ( $M = 2.05$ ;  $SD = 1.03$ ). Thirty-eight children were randomly assigned to the waitlist control group ( $n = 19$  males,  $n = 19$  females), and 37 to the intervention (tutoring) group ( $n = 20$  males,  $n = 17$  females). See Figure 1 for the CONSORT diagram.

Figure 1. CONSORT diagram (Schulz, Altman, & Moher, 2010)



### **Procedures**

**Research design and random assignment.** We used a pre-test/post-test waitlist-controlled group design. Random assignment to conditions, based on a table of random numbers, took place at the pre-test, immediately after the foster parents and foster children had signed their consent or assent forms and had completed their initial assessments. The children were assessed at two time points: Time 1 (pre-assessment) and Time 2 (post-assessment, approximately 10 months after the pre-assessment). The assessor was masked to the two conditions. At Time 1 and Time 2, all of the children were assessed on their math and reading skills, using selected subtests from the Woodcock-Johnson III (Woodcock, McGrew, & Mather, 2001). Foster parents were asked to complete a questionnaire package while their child in care was being assessed.

### **Measures**

**Woodcock-Johnson III Tests of Achievement—Third Edition (WJ-III; Woodcock, McGrew, & Mather, 2001).** The WJ-III is a norm-referenced, standardized series of tests that assess basic reading and math skills. It was developed for use with individuals between the ages of 2 years and 90+ years, or in Grades K through graduate school. The following subtests were administered for the current study: Letter-Word Identification, Reading Fluency, Story Recall, Understanding Directions, Calculation, Math Fluency, Spelling, Passage Comprehension, Applied Problems, Story Recall-Delayed, Picture Vocabulary, and Oral Comprehension. These subtests were selected for the current study because their use enables the calculation of an “intra-achievement” discrepancy score (Woodcock, McGrew, & Mather, 2001). More specifically, an Oral Language score (derived from the following subtests: Understanding Directions, Picture Vocabulary, and Oral Comprehension) can be used to predict the level of math and reading achievement, based upon the individuals’ level of oral language development. A significant

discrepancy between Oral Language ability and academic performance (i.e., math and reading) may be used to help substantiate the existence of a specific math or reading learning disability.

Scoring of the WJ-III provides an indication of how the individual compares to others of his/her age or grade. For each subtest, standard scores ( $M = 100$ ,  $SD = 15$ ) are computed from raw scores; a Reading Composite score (“Broad Reading”) is obtained by combining the Word Reading, Reading Fluency, and Sentence Comprehension standard scores. A Math Composite score (“Broad Math”) is obtained by combining Calculation, Math Fluency, and Applied Problems. The psychometric properties are excellent; subtest internal consistency reliability coefficients are between .87 and .96 (Woodcock, McGrew, & Mather, 2001)<sup>1</sup>. See Appendix H for one year test-retest correlations for selected WJ-III subtests and for pre-post test correlations for the current study.

**Comprehensive Executive Function Inventory—Parent Version (CEFI; Naglieri & Goldsetin, 2012).** The CEFI (Naglieri & Goldstein, 2012) is a norm-referenced standardized measure of executive functioning in children ages 5 to 18 years. The CEFI was completed by the child or youth’s foster parent. Items are rated on a six-point Likert scale, with end points labeled N (Never) and A (Always). Scoring of the CEFI provides a total standardized score ( $M = 100$ ,  $SD = 15$ ), based on all 100 items. Subscales are also computed for the following: Attention, Emotion Regulation, Flexibility, Inhibitory Control, Initiation, Organization, Planning, Self-monitoring, and Working Memory. Lower total standard scores indicate a greater likelihood that

---

<sup>1</sup> The internal consistency for the WJ-III subtests of the study sample was not calculated for the following reasons: 1) The method of data entry and scoring of the WJ-III did not allow for the calculation of internal consistency. More specifically, the data were entered as total raw scores for each WJ-III subtest and were not entered at the item level. This was done as the WJ-III scoring software utilizes total raw scores, 2) while internal consistency can be calculated using the Rasch method (Woodcock, McGrew, & Mather, 2001), this would require the data to have been entered at the item level, and 3) given the acceptable Cronbach alpha’s for all of the covariates (which have lower test-retest reliability as compared with the WJ-III subtests), it suggests that the reliability of the WJ-III study sample subtests is also acceptable (Appendix H).

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

the child would have difficulty with executive functioning. Internal consistency and test-retest reliability (over 1-4 weeks) are excellent (Naglieri & Goldstein, 2012). In the current study sample, coefficient alpha was .92 for the CEFI total score (see Appendix H for pre-test/post-test correlations).

**Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997).** The SDQ uses parent or caregiver ratings to assess mental health problems in children and youth aged 4-17, over the past 6-months (Goodman & Goodman, 2009, 2011). The scale is composed of 25-items, with five items assessing conduct problems (e.g., often fights with other children or bullies them), five items assessing emotional problems (e.g., often unhappy, depressed, or tearful), five items assessing hyperactivity (e.g., restless, overactive, cannot stay still for long), five items assessing peer relations (e.g., would rather be alone than with other youth), and five items assessing prosocial behaviour (e.g., considerate of other people's feelings). Each of the 25-items is scored on a 3-point Likert scale, ranging from 0 (Not True) to 2 (True). The Total Difficulties score, an amalgamation of the 4 negative behaviour scales (the prosocial subscale is excluded), ranged from 0 to 40, with a higher score reflecting a greater level of behavioural problems. For males, total difficulties scores ranging from 18-40 are in the severe difficulties range, scores ranging from 14-17 are in the borderline range, and scores from 0-13 are in the normal range. For females, total difficulties scores ranging from 16-40 are in the severe difficulties range, scores ranging from 13-15 are in the borderline range, and scores ranging from 0-12 are in the normal range. In the current study sample, coefficient alpha was .81 for the 20-item Total Difficulties scale. See Appendix H for pre-test/post-test SDQ correlations.

**Trauma Symptom Checklist for Children. (TSCC; Briere, 1996).** The TSCC (Briere, 1996) is a self-report instrument designed to identify a broad range of symptoms of traumatic

experiences in children and adolescents, ages 8–17; in the current study, the TSCC was administered to children aged 10 years and older. This 54-item questionnaire takes approximately 15 minutes to administer. The scale is composed of two validity scales (indicating over- and under-reporting of symptoms) and six clinical scales (Anxiety, Depression, Posttraumatic Stress, Sexual Concerns, Dissociation, and Anger). Each item is rated on a 4-point Likert scale, with endpoints ranging from 0 (Never) to 3 (Almost all of the time). T-scores can then be calculated, with elevated T-scores indicating greater symptom severity. For the purposes of this study, the alternate form of the TSCC was used (TSCC-A), as it makes no reference to sexual issues<sup>2</sup>. The TSCC-A is composed of a total of 44-items and comprises the same two validity scales and clinical scales (with the exception of the scale for sexual concerns). Moreover, given the reading level required to complete this questionnaire, this measure was administered only to children aged 10 years and older. The total Posttraumatic Stress score was used in the current study. Convergent and discriminant validity has been established (Briere, 1996; Sadowski & Friedrich, 2000), as well as adequate test-retest reliability (Nilsson, Wadsby, Svedin, 2008). In the current study sample, coefficient alpha was .97.

**Trauma Symptom Checklist for Young Children (TSCYC; Briere et al., 2001).** The TSCYC (Briere et al., 2001) is a parent-reported instrument designed to identify a broad range of symptoms of traumatic experiences in young children, ages 3-12; in the current study, the TSCYC was administered to the caregivers of children aged 5-9 years. The TSCYC is comprised of 90 items, rated on a 4-point scale with end points ranging from 1 (Not at all) to 4 (Very Often). Subscales are computed for the following: Anxiety, Depression, Anger/Aggression, Posttraumatic Stress-Intrusion, Posttraumatic Stress-Avoidance, Posttraumatic Stress-Arousal,

---

<sup>2</sup> This was at the request of the participating CAS.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Dissociation, and Sexual Concerns. A total Posttraumatic Stress scale (which was used in the current study) is obtained by summing the raw scores for Posttraumatic Stress-Intrusion, Posttraumatic Stress-Avoidance, and Posttraumatic Stress-Arousal. T-scores can then be calculated, with elevated T-scores indicating greater symptoms of posttraumatic stress. The TSCYC has been found to have adequate validity and test-retest reliability (Briere et al., 2001; Nilsson, Gustafsson, & Svedin, 2012). Coefficient alpha in the current study sample was .93.

**Parental Support for Learning Scale (PSLS; Rogers, Markel, Midgett, Ryan, & Tannock, 2014).** The PSLS was used to assess the extent of caregiver support for educational activities in the home. The PSLS is comprised of 48 items rated on a 5-point scale (1 = I strongly disagree to 5 = I strongly agree), and was completed by the caregiver. Two subscales are computed: instrumental parental involvement and controlling parental involvement. *Instrumental parental involvement* measures the degree of warmth, patience, and independence regarding school-related choices, with higher scores suggesting more effective involvement. *Controlling parental involvement* measures the use of commands, punishment, nagging and disapproval regarding the child's schoolwork, with higher scores suggestive of more behavioural and psychological control related to learning (i.e., less effective involvement). In the current study sample, coefficient alpha was .88 for instrumental involvement and .65 for controlling involvement. See Appendix H for pre-test/post-test PSLS correlations for the current study.

**Child welfare worker background information form.** This questionnaire was developed by the study research team. Once the children had been referred to the project by their child welfare workers, the latter were asked to complete this questionnaire, which consisted of background information about the children in care (e.g., age of entry into care, maltreatment history; see Appendix B).

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

**Foster parent questionnaire.** This questionnaire was developed by the study research team and administered at the pre- and post-test (Appendices C & F). Foster parents were asked to provide background information (e.g., number of children in the home, length of time as a foster parent), as well as updates on the children's medication, Individualized Education Plans (IEPs), etc.

**Tutoring experiences questionnaire (TEQ).** The TEQ was developed by the study research team and was administered to all children in the Tutorbright group at the post-assessment (see Appendix G). The children were asked about the quality of their tutoring sessions, the amount learned, as well as what they liked most and least about the program.

### **Training of the Assessors**

Training on all of the assessment measures (i.e., on administration of the questionnaires and the WJ-III) was provided by the primary investigator. The primary investigator held a 4-day training event in which she provided the assessors with a general overview of the research project and a review of the questionnaires for caregivers and children in care. Most of the training focused on learning the WJ-III. The assessors practiced test administration with the primary investigator and were given a "mock" child to test (a university graduate research assistant). Following this, all of the assessors were observed by the primary investigator while conducting three "live" assessments with study participants, with corrective feedback provided in the moment. Next, to help ensure the fidelity of data collection, following the completion of approximately 10 assessments, these assessments were sent to the primary investigator for scoring review. The raw scores were calculated and then entered into the computer scoring software. If any scoring errors were found, the assessors were contacted immediately, and the scoring was reviewed with them.

### **Experimental and Waitlist Control Conditions**

**TutorBright tutoring program.** The TutorBright program was developed in 2007 in Toronto, Ontario, Canada. The program is based on direct-instruction, an educational approach that uses a well-organized instructional methodology and clearly structured teaching materials. Its aim is to accelerate the learning of students in reading, language, and math, as well as to create confidence via mentor relationships (S. Verma, personal communication, June 7, 2017).

The TutorBright program is a one-on-one, in-home tutoring method that uses detailed instructor's manuals and customized student workbooks (S. Verma, personal communication, June 7, 2017). Both the math and reading curricula have 10 progressive levels. Students move on to the next level as mastery of the previous level is demonstrated by meeting accuracy requirements. TutorBright also incorporates “homework help”, in which the tutor provides aid in any academic subject of need (e.g., math, reading, science, geography etc.). Criteria to be a TutorBright tutor are as follows: an undergraduate or masters degree either in progress or completed, experience with either mentoring or teaching, own method of transportation, and very strong communication skills and positivity. Each TutorBright tutor is matched to a child in need of tutoring, based on the academic needs of the child, geographic location, as well as mutual interests. Based on program materials and interviews with program staff, the use of a one-to-one model was intended to support the development of a mentoring relationship between tutors and children. In addition to facilitating the task of tutoring per se, this relationship was posited to provide the children with the skills and experience to develop other healthy relationships with adults. The creator of the TutorBright program provided trained TutorBright tutors and ongoing consultation for the present research project as well as monitoring of student progress over the years 2014-2016.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

In the current study, after a child had been matched with a tutor, the tutor conducted a series of home visits to assess the child's reading, math, and writing to determine the curriculum levels to use with the child. The tutor then met individually with the child twice per week in the child's home for one-hour sessions, for a maximum of 50 hours of tutoring. On average, the youths in care received a total of 47.56 tutoring sessions ( $SD = 4.23$ , range = 35 - 56) over the course of 9 months. The tutors recorded the length of each session in minutes, which we then converted to hours. The children in the experimental group received, on average, 48.66 hours of tutoring ( $SD = 4.06$ ), which included a mean of 14.10 hours of reading ( $SD = 4.48$ ), 13.97 hours of math tutoring ( $SD = 8.11$ ), 10.94 hours of homework help ( $SD = 9.78$ ), and 8.13 hours ( $SD = 3.80$ ) of other tutoring (e.g., relationship building, managing behaviour) during the study.

### *Training of TutorBright Tutors*

The TutorBright tutors were trained by a senior TutorBright staff member and supervisor (J. Judgey). Over the course of training, the tutors were provided strategies on how best to engage students, behavioural management techniques (primarily positive reinforcement), how best to facilitate learning (e.g., by asking the student to take the lead on tasks and helping them problem-solve answers). A large portion of the training time was also spent on teaching the tutors about the TutorBright lessons, which serve as an adjunct to homework help. Once the information was reviewed, the tutors were given the opportunity to practice teaching lessons on one another and were provided with potential problematic scenarios to work through (e.g., a disengaged student). The TutorBright supervisor provided corrective feedback to each tutor, as needed.

**Wait-list control condition.** Children randomly assigned to the wait-list control condition were asked to continue 'as usual' and not to seek additional tutoring or academic

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

support throughout the academic year. They were offered the tutoring intervention following the end of the academic school year. Participants in both the tutoring and wait-list control groups had their academic abilities assessed with the WJ-III on two occasions, at the pre-test and post-test. For participants in the tutoring group, the post-test was triggered by one of the following events: either having received 50 hours of tutoring, or having reached the first week in September of the following school year without having reached the 50 hours of tutoring. This latter criterion was imposed to ensure that no child would benefit from more schooling than the other children in the tutoring condition. Each time that a child in the tutoring group was scheduled for his or her post-test, a child in the waitlist control group was randomly selected to be post-tested. The purpose of this was to ensure that the length of time between the pre-test and post-test was equal for the two groups. Indeed, the time (days) between the pre-test and post-test was equivalent between the two groups,  $t(68) = -.57, p = .57$  (control group:  $M = 290.72$  days,  $SD = 74.56$ ; experimental group:  $M = 299.06$  days,  $SD = 42.96$ ).

**Assessment of level of treatment fidelity and tutoring dosage.** The level of fidelity of implementation of each of the tutoring components (reading, math, and homework help) by the experimental-group tutors was assessed weekly by the project coordinator (AJH) and the TutorBright coordinator. The assessment of fidelity was based on the weekly performance data that the tutors had sent to the project coordinator and the TutorBright coordinator. This information included the lessons covered during the week, the number of weeks of actual tutoring, the average number of hours per week that had been dedicated to tutoring, the number of minutes each week spent on math and reading tutoring (based on the TutorBright lessons) and the number of minutes spent on homework help (see Appendix J). Participants completed an

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

average of 47.56 sessions ( $SD = 4.23$ , range = 35 - 56) over a 9-month period, and were judged to have received a high level of implementation.

### **Data Analysis**

All statistical analyses were conducted using SPSS Version 24. Prior to testing the hypotheses, the data were screened for missing data and univariate outliers in accordance with guidelines presented by Tabachnick and Fidell (2007). Data were assessed for skewness and kurtosis. A few variables were negatively skewed, namely, at the pre-test: Broad Reading, Letter-Word Identification, Passage Comprehension, and Applied Problems. At the post-test: Letter-Word Identification, Passage Comprehension, and Broad Reading were negatively skewed (see Table 1). This is not unexpected, as many children in care, compared to children in the general population, are performing below average in math and reading.

### **Missing Data**

All variables had less than 10% of missing data, with the majority having less than 5% missing data. Due to the relatively small amount of missing data, the expectation maximization (EM) algorithm in SPSS was used to impute data that were missing at the item level (Schafer & Graham, 2002).

### **Primary Data Analyses**

**ANCOVA.** ANCOVA via multiple regression was used to analyze the impact of tutoring on math and reading skills, with baseline math and reading skills serving as the covariates (primary research question). ANCOVA via multiple regression was chosen because it is the most powerful approach for analyzing pre-test/post-test comparison group designs (Gliner, Morgan, & Harmon, 2003). The ANCOVA approach takes account of any differences in the pre-test scores of the experimental and control groups, reducing error variance by adjusting the post-test scores

(Dimitrov & Rumrill, 2003)<sup>3</sup>. Follow up scores (i.e., adjusted post test scores) were calculated via a single regression equation as per Vickers and Altman (2001) and was as follows:

$$\text{Constant} + a*\text{baseline score} + b*\text{group}$$

Where  $a$  and  $b$  are estimated coefficients and group is a binary variable (coded 1 for tutoring and 0 for control). The coefficient  $b$  is the effect of interest – the estimated difference between the two treatment groups.

The children’s pretest scores on each of the WJ-III subtests served as the covariate in each analysis. We tested the directional hypothesis (with a 1-tailed test) that the children in care who had received tutoring would have higher adjusted mean scores at the post-test on the WJ-III sub-tests than would the children in care in the wait-list control group.

**Dose-response.** Correlational analyses were conducted to explore the relationship between the number of tutoring sessions completed and the total number of tutoring minutes (in math, reading, and in homework help) with the unadjusted post-WJ-III math and reading scores.

### Secondary Data Analyses

**ANCOVA.** ANCOVA via hierarchical multiple regression was also used to explore whether age, gender, executive functioning, behavioural difficulties, symptoms of Post-Traumatic Stress Disorder, or caregiver involvement in academic activities in the home, moderated the impact of tutoring on academic for children in care. The children’s pretest scores on the WJ-III served as a covariate (entered at step 1), followed by group (entered at step 2), and, one by one, the following variables were entered at step 3: age, gender, pre-test scores on executive functioning (as measured by the CEFI), total behavioural difficulties (as measured by

---

<sup>3</sup> “With randomized designs...the main purpose of ANCOVA is to reduce error variance...with nonrandomized designs...the main purpose of ANCOVA is to adjust the posttest means for differences among groups on the pretest, because such differences are likely to occur” (Dimitov & Rumrill, 2003). Thus, the purpose of using ANCOVA in the current study was to reduce error variance.

the SDQ), degree of PSTS (as measured by the total score on the TSCC or TSCYC), or the degree of instrumental and controlling caregiver involvement in academic activities in the home (as measured by the PSLS). Next, a multiplicative term, between group and each moderator, was entered at step 4. Separate ANCOVAs were conducted for age, gender, and each of the 4 educationally relevant domains (executive functioning, behaviour, symptoms of PTSD, caregiver involvement in academics in the home), as well as for each of the WJ-III subtests. Given the two different measures of PTSD that were utilized in the current study, (TSCC for children 10 years and older and the TSCYC for children ages 5-9), separate ANCOVAs were conducted for the separate PTSD measures.

ANCOVA via multiple regression was also conducted to explore the extent to which tutoring may produce “spillover effects” in educationally relevant domains for children in care, specifically, executive functioning, behavioural difficulties, and caregiver involvement in academic activities in the home. The pre-test score on each of the educationally relevant domains were entered at step 1, group (tutoring or waitlist control) was entered at step 2, and the post-test score on each of the educationally relevant domains was the dependent variable. (See Table 2 for the Pearson correlations between all of the moderators and WJ-III subtests).

### **Effect Size Index**

As recommended by the What Works Clearinghouse (WWC) Procedures and Standards Handbook (WWC; 2008, pp/ 35-37), Hedges’ *g*, which corrects for bias due to small sample size, was used as the index of effect size to determine the magnitude of the treatment effect of the tutoring intervention. Hedges’ *g* is very similar in magnitude to, but slightly more conservative than, Cohen’s *d*. As recommended by the WWC (2008, p. 37) for the calculation of Hedges’ *g* when used with ANCOVA, the difference between the adjusted post-test means of the

tutoring and control groups is divided by the *unadjusted* pooled within-group standard deviation.

The formula we used was the following:

$$g = \frac{X'_1 - X'_2}{\sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{(n_1 + n_2 - 2)}}}$$

“where  $X'_1$  and  $X'_2$  are adjusted post-test means,  $n_1$  and  $n_2$  are the student sample sizes, and  $S_1$  and  $S_2$  are the student-level unadjusted post-test *SD* for the intervention group and the comparison group, respectively” (WWC, 2008, p. 37).

According to the WWC Procedures and Standards Handbook (WWC; 2008), an effect size equal to or greater than 0.25 should be deemed “substantively important”, even though the effect size may not have reached statistical significance, because it reflects a minimum of a 10-percentile point difference between the means of the control and intervention groups on a normal distribution. As such, the current study applied the recommended criterion to denote any effects that could be considered substantively important<sup>4</sup>.

---

<sup>4</sup> Lipsey and colleagues (2012) suggest that in “intervention areas that involve hard to change low base rate outcomes, [...], the most impressively large effect sizes found to date fall well below the .20 that Cohen characterized as small” (p.4). According to Lipsey and colleagues (2012), educational research is included in the areas that are “hard to change”, and as such, the magnitude of effect sizes, when compared to those within other “easier to move” domains, may lead to inappropriate and misleading interpretations of results. In a recent compilation of effect sizes from randomized studies of educational interventions, Lipsey et al. (2012) found that among the effect sizes for one-to-one interventions, the median effect size was 0.29, only slightly larger than the WWC (2008) benchmark of 0.25. This supports Lipsey et al.’s (2012) suggestion that the traditional criteria put forth by Cohen (1988) of 0.20 (small), 0.50 (medium), and 0.80 (large) are inappropriate when applied to educational research. As such, the current thesis will adopt the median effect size of 0.29 from Lipsey et al. (2012), which is equivalent to a “medium” effect size.

### **Equivalence of Groups at Pre-Test**

Independent samples  $t$  tests and chi square analyses were conducted to assess the equivalence of the tutoring and waitlist control groups at the pre-test. There were no statistically significant differences ( $p < .05$ ) between the tutoring and wait-list control groups at the pre-intervention assessment in terms of gender, age, school grade, total behavioural difficulties, symptoms of trauma, and the subtests of the WJ-III, indicating that randomization was effective (see Table 2 and 3). However, a significant difference between groups was found for the experience of abandonment, with significantly higher rates in the control group than in the experimental group ( $\chi^2 (1, N = 70) = 5.90, p < .05$ ). Similarly, a significant group difference was found for the degree of controlling caregiver involvement in academics, with higher levels for participants in the control group than in the experimental group ( $t(68) = 2.46, p < .05$ ) (see Table 3).

### **Attrition**

From pre to post intervention, three children from the tutoring group (8.11%) and two from the waitlist control group (5.26%) withdrew from the study. The overall rate of attrition was 6.67%. The reasons for attrition can be classified as *exogenous* to the study (i.e., due to circumstances unrelated to either condition, such as, a foster parent or child falling ill or a change in the child's placement), as *endogenous* (i.e., related directly to either the intervention or control conditions, such as, the tutoring took too much time or it was a source of conflict between the tutor and child), or as *mixed* (i.e., a combination of both endogenous and exogenous factors). Over the course of the study, most of the attrition was attributed to exogenous reasons. More specifically, from the tutoring group: 1 child dropped out due to mental health problems, 1 child dropped out due to a change in caregiver and subsequent move, and 1 child dropped out as she

was no longer taking math in school and, as such, did not see value in continuing with the tutoring (this latter reason can be classified as “mixed”). From the control group: 1 child was reunited with her biological parents and not interested in returning for the post assessment and 1 child refused to return for the post assessment.

### **Improvement Index**

To show more clearly the practical implications of the tutoring intervention, Hedges’  $g$  was translated into an “improvement index” (see WWC, 2008, p. 24). This was calculated as the difference between the percentile rank corresponding to the tutoring group mean and the percentile rank corresponding to the control group mean (by definition, the 50<sup>th</sup> percentile).

### **Effects of the TutorBright Tutoring Intervention**

Table 4 shows the means on the pre-test scores and on the unadjusted and adjusted post-test scores for the experimental (tutoring) and wait-list control groups, on the 7 WJ-III subtests and overall Broad Math and Broad Reading composite scores.

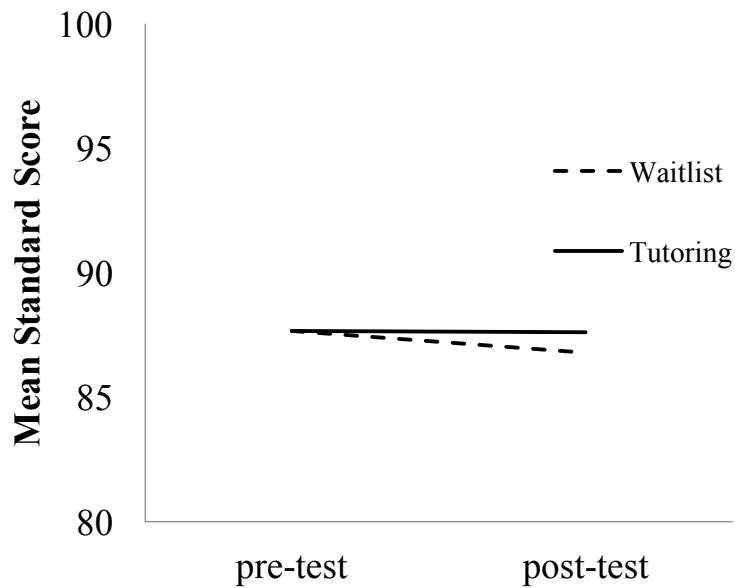
## **Results**

**Primary Research Question #1:** *Does TutorBright tutoring improve math and reading skills for children in care?*

**Letter-Word Identification.** On Letter Word Identification, which assesses the decoding of letters and words through identification and word recognition, the difference between the adjusted post-test group means was not statistically significant ( $B = .35$ ,  $t[68] = 0.25$ ,  $p = .81$ , 1-tailed), and the size of the effect (Hedges’  $g = 0.05$ ) was below the 0.25 threshold that WWC (2008) considers “substantively important” (see Figure 2 and Appendix I). The improvement index was a mere 2% (i.e., 52.0<sup>th</sup> – 50.0<sup>th</sup> percentile), such that the average child in care in the

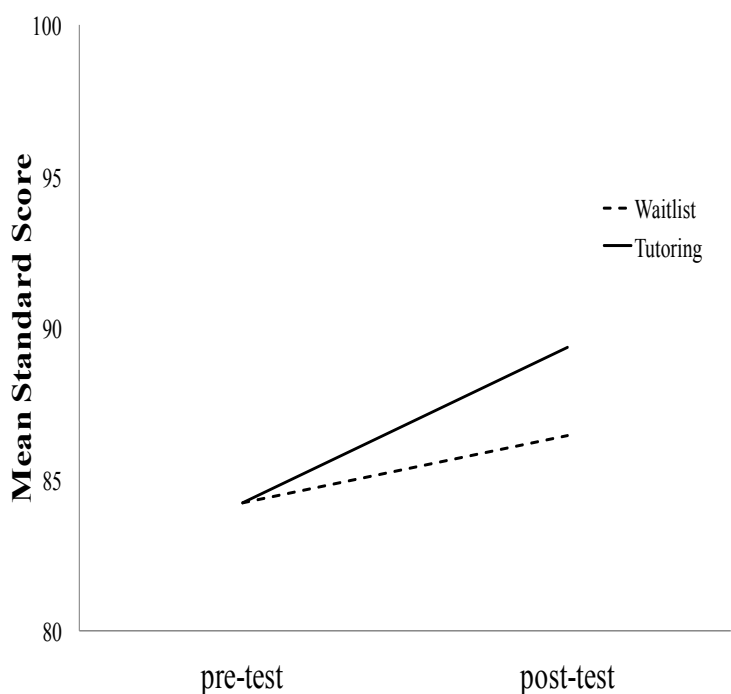
## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

tutoring group was at the 52<sup>nd</sup> percentile of the control group, whose average child in care was, by definition, at the 50<sup>th</sup> percentile.



*Figure 2.* Experimental and Control Groups' WJ-III Letter Word Identification Pre-test and Adjusted Post-test Mean Standard Scores.

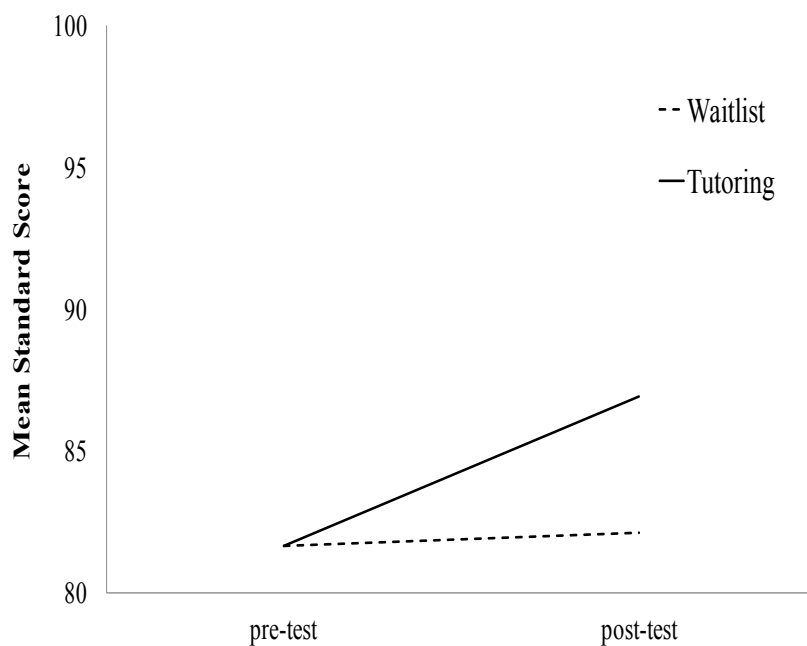
**Reading Fluency.** On Reading Fluency, measuring reading speed and ability to accurately answer true/false questions about what was read, the difference between the adjusted post-test group means was statistically significant, in the hypothesized direction ( $B = 4.50$ ,  $t[68] = 2.21$ ,  $p = .03$ , 1-tailed) (see Figure 3, Table 4 and Appendix I). The effect size ( $g$ ) was 0.16 and the improvement index was 6.4% ( $56.4^{\text{th}} - 50.0^{\text{th}}$ ).



*Figure 3.* Experimental and control groups' WJ-III Reading Fluency pre-test and adjusted post-test mean standard scores.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

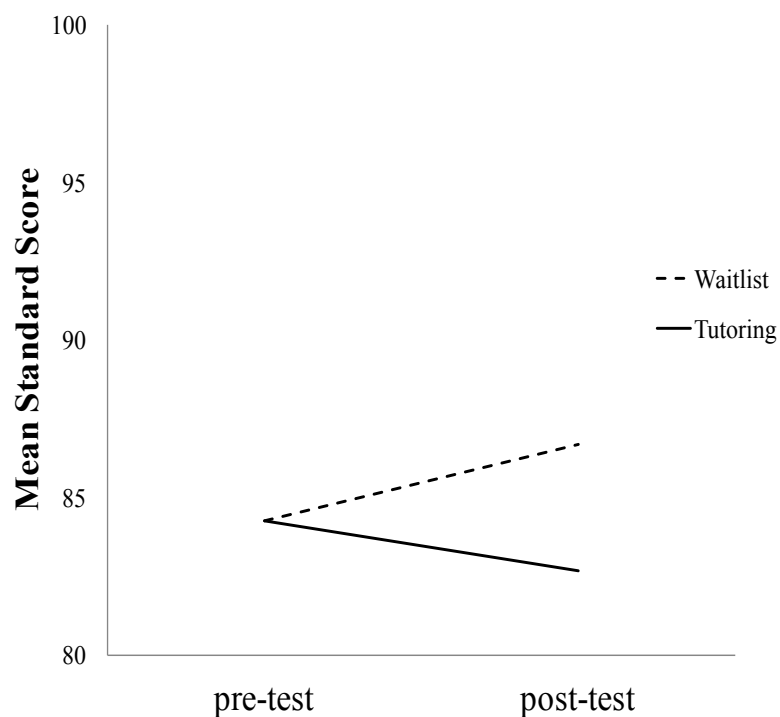
**Passage Comprehension.** On Passage Comprehension, measuring the ability to gain meaning from words and comprehend ideas and information contained in sentences, the difference between the adjusted post-test group means was statistically significant, in the hypothesized direction ( $B = 3.52$ ,  $t[68] = 2.03$ ,  $p = .05$ , 1-tailed) (see Figure 4, Table 4, and Appendix I). The effect size ( $g$ ) was 0.34 and the improvement index was 13.3% ( $63.3^{\text{th}} - 50.0^{\text{th}}$ ).



*Figure 4.* Experimental and control groups' WJ-III Passage Comprehension pre-test and adjusted post-test mean standard scores.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

**Spelling.** On Spelling, which assesses the ability to spell orally presented words, the difference between the adjusted post-test group means was not statistically significant and, in fact, was in the direction opposite that hypothesized ( $B = -1.42$ ,  $t[68] = -0.81$ ,  $p = .42$ , 2-tailed) (see Figure 5, Table 4, and Appendix I). The effect size ( $g$ ) and improvement index were negative ( $-0.20$ ;  $-8.0\% = 42.0^{\text{th}} - 50.0^{\text{th}}$ , respectively).



*Figure 5.* Experimental and control groups' WJ-III Spelling pre-test and adjusted post-test mean standard scores.

**Broad Reading Composite.** On Broad Reading Composite, obtained by combining the standard scores for Letter/Word Identification, Passage Comprehension, and Reading Fluency, the statistical significance of the difference between the adjusted post-test group means was close to significant, at the level of a trend, ( $B = 2.35$ ,  $t[68] = 1.95$ ,  $p = .06$ , 1-tailed); however, the effect size ( $g$ ) was 0.14 and below the WCC (2008) threshold of 0.25 (see Figure 6, Table 4, and Appendix I). The improvement index was 5.6% ( $55.6^{\text{th}} - 50.0^{\text{th}}$ ).

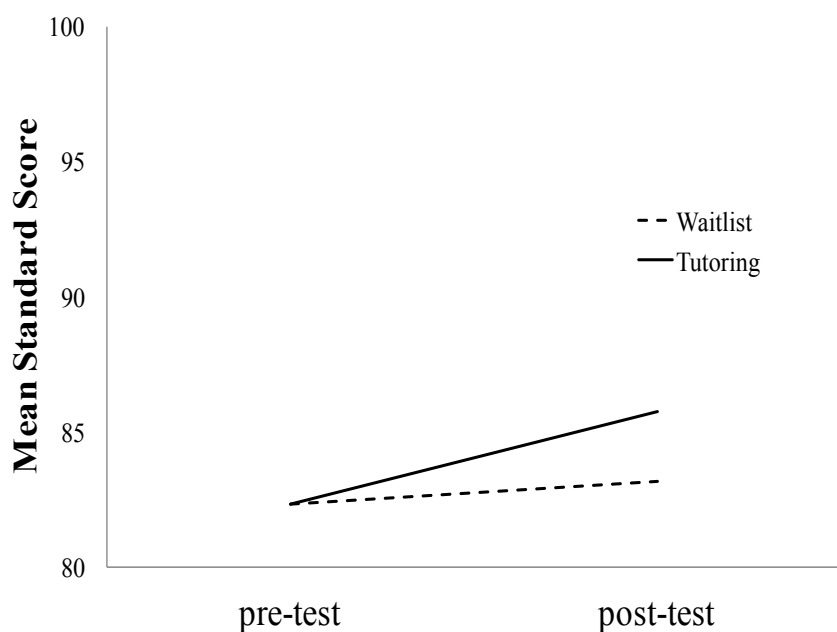


Figure 6. Experimental and control groups' WJ-III Broad Reading Composite pre-test and adjusted post-test mean standard scores.

**Math Calculation.** On Math Calculation, measuring the ability to perform basic mathematical computations through counting and calculating written math problems, the difference between the adjusted post-test means was statistically significant, in the hypothesized direction ( $B = 4.74$ ,  $t[68] = 2.03$ ,  $p = .05$ , 1-tailed) (see Figure 7, Table 4, and Appendix I). The effect ( $g$ ) of tutoring was 0.39 and the improvement index was 15.2% ( $65.2^{\text{th}} - 50.0^{\text{th}}$ ).

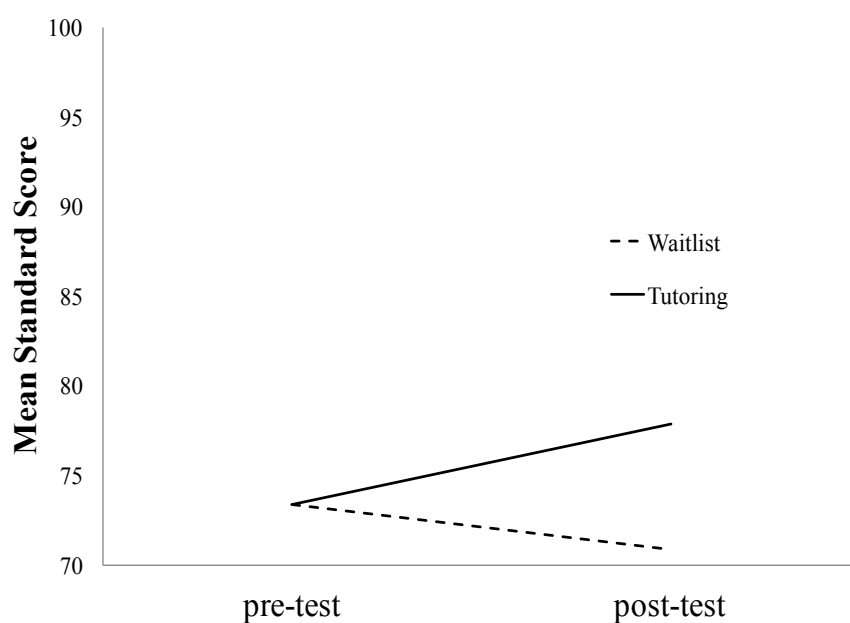


Figure 7. Experimental and control groups' WJ-III Math Calculation pre-test and adjusted post-test mean standard scores.

**Math Fluency.** On Math Fluency, measuring the ability to rapidly perform basic addition, subtraction, multiplication, and division, the difference between the adjusted post-test group means was not statistically significant, ( $B = .78$ ,  $t[68] = .51$ ,  $p = .61$ , 1-tailed) (see Figure 8, Table 4, and Appendix I). The effect size ( $g$ ) was 0.27, however, the improvement index was 10.6% ( $60.6^{\text{th}}$  -  $50.0^{\text{th}}$ ).

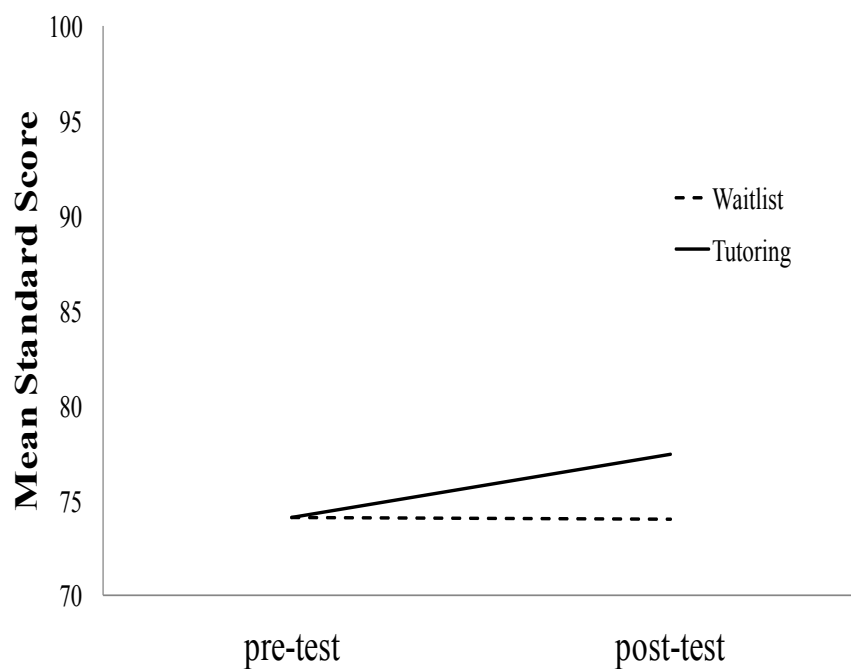
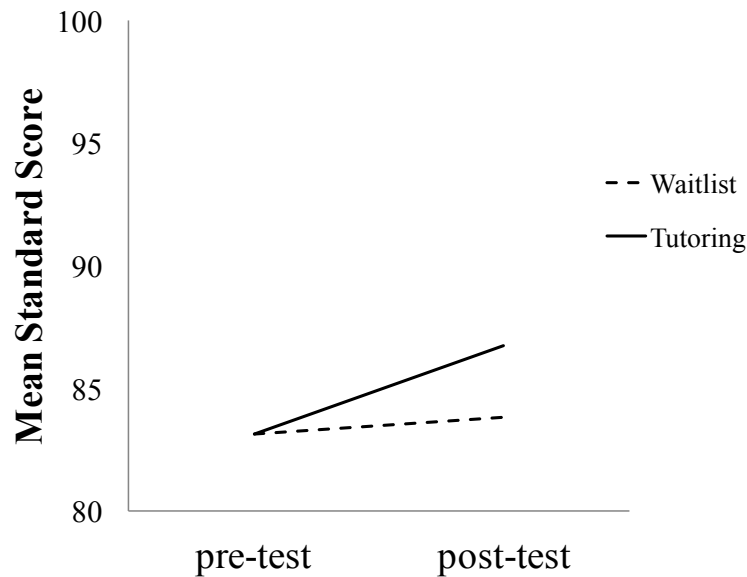


Figure 8. Experimental and control groups' WJ-III Math Fluency pre-test and adjusted post-test mean standard scores.

**Applied Problems.** On Applied Problems, measuring quantitative reasoning and the ability to solve orally presented math problems, the difference between the adjusted post-test group means was not statistically significant, ( $B = .13$ ,  $t[68] = .06$ ,  $p = .95$ , 1-tailed) (see Figure 9, Table 4, and Appendix I). The effect size ( $g$ ) was 0.21 and the improvement index was (8.4% = 58.4<sup>th</sup>-50.0<sup>th</sup>).



*Figure 9.* Experimental and control groups' WJ-III Applied Problems pre-test and adjusted post-test mean standard scores.

**Broad Math Composite.** On Broad Math Composite, obtained by combining the standard scores for Math Calculation, Applied Problems, and Math Fluency, the statistical significance of the difference between the adjusted post-test group means was not significant, ( $B = 2.21$ ,  $t[68] = 1.29$ ,  $p = .20$ , 1-tailed) (see Figure 10, Table 4, and Appendix I). The effect size ( $g$ ) was 0.32 and the improvement index was 12.7% ( $62.7^{\text{th}} - 50.0^{\text{th}}$ ).

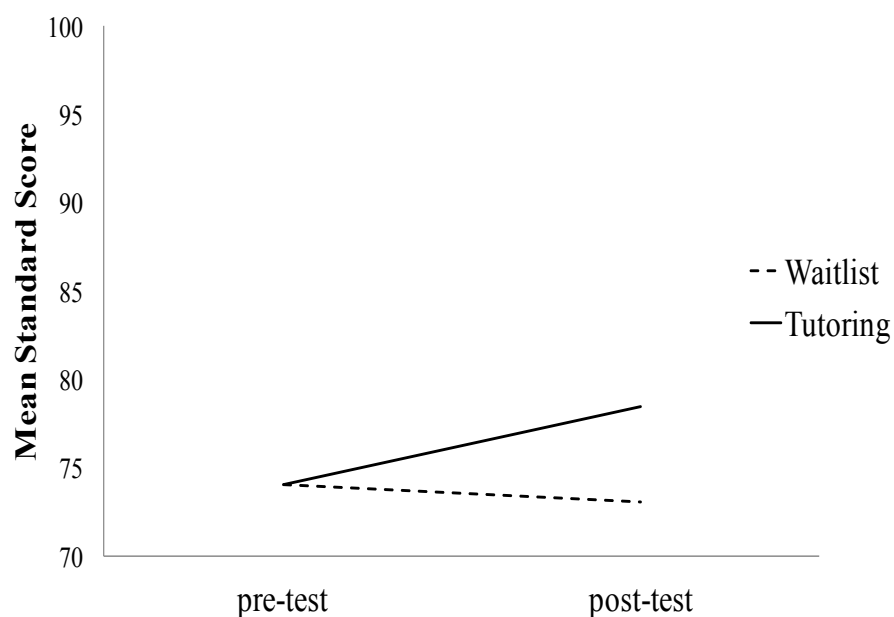


Figure 10. Experimental and control groups' WJ-III Broad Math Composite pre-test and adjusted post-test mean standard scores.

### Discrepancy Analyses

ANCOVA via multiple regression was also used to assess whether the TutorBright program reduced the discrepancy between the actual and predicted Broad math or Broad reading scores. A decrease in the discrepancy would be suggestive of an increase in ability/achievement

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

(Woodcock, McGrew, & Mather, 2001). A pre and post test “difference” score was first calculated by subtracting the predicted Broad Reading and Broad Math scores (based on each participant’s Oral Language score) from the actual Broad Reading and Broad Math scores.

**Broad Reading Discrepancy.** For Broad Reading, the difference between the adjusted post-test group means was not significant, ( $B = 1.13$ ,  $t[68] = .62$ ,  $p = .54$ , 1-tailed).

**Broad Math Discrepancy.** For Broad Math, the statistical significance of the difference between the adjusted post-test group means was not significant, ( $B = 1.23$ ,  $t[67] = .72$ ,  $p = .48$ , 1-tailed).

**Primary Research Question #2:** *Do the children in care in the experimental group who received a greater number of tutoring sessions, or tutoring minutes, experience greater gains in reading and math skills?*

Bivariate correlations assessing the relationship between tutoring “dose” and WJ-III outcome measures revealed a positive relationship, at the level of a trend between Letter-Word Identification and the total number of tutoring sessions,  $r(34) = .30$ ,  $p = .08$ . Moreover, moderate negative correlations, significant at the trend level, were found between Broad Reading, Reading Fluency, and Math Fluency, and the number of minutes spent on “other” activities during the tutoring sessions (i.e., behavioural management, relationship building), (Broad Reading:  $r(34) = -.30$ ,  $p = .09$ ; Reading Fluency:  $r(34) = -.32$ ,  $p = .06$ ; Math Fluency:  $r(34) = -.32$ ,  $p = .07$ ). No other significant correlations were found.

### **Exploratory Research Results**

Given the exploratory nature of these research questions, two-tailed tests were conducted.

**Exploratory Research Question #1:** *Do age, gender, executive functioning, behavioural difficulties, symptoms of Post-Traumatic Stress Disorder, or caregiver involvement in academic activities in the home moderate the impact of tutoring on academic outcomes for children in care?*

**Age.** Age was found to negatively moderate the effect of tutoring, at the level of a trend, for Broad Math and accounted for an increment of 0.8% in the variance explained in Broad Math scores,  $B = -1.04$ ,  $t(68) = -1.80$ ,  $p = .08$ ;  $R^2$  change = .008. More specifically, younger children in the tutoring group performed better on Broad Math at post test than older children.

**Gender.** Gender was not a significant moderator of tutoring, all  $ps > .20$ . However, the hierarchical regression revealed a main effect of gender, at the level of a trend, for Spelling,  $B = -3.04$ ,  $t(68) = -1.75$ ,  $p = .09$ , such that boys improved more than girls over time. Gender accounted for an increment of 0.6% in the variance explained in Spelling.

**Executive functioning.** The ANCOVA via multiple regression revealed a significant group x CEFI total score interaction on Letter Word Identification and accounted for an increment of 0.9% in the variance explained in Letter Word Identification scores,  $B = -.26$ ,  $t(68) = -2.29$ ,  $p = .03$ . More specifically, children in the control group, with higher executive functioning at the pre-test performed better on Letter Word Identification. The CEFI total score did not moderate the effects of tutoring for any other WJ-III subtest,  $ps > .20$ . The hierarchical

regressions did not reveal any significant main effects of CEFI total score on any of the WJ-III subtests,  $ps > .10$

**Total behavioural difficulties.** Total behavioural difficulties (as measured by the SDQ) was not a significant moderator for any of the WJ-III subtests, all  $ps > .20$ . The hierarchical regression also did not reveal any main effects of SDQ on any of the WJ-III subtests, all  $ps > .20$ .

**Parental support for learning.**

*Instrumental Involvement.* Instrumental involvement was not a significant moderator for any of the WJ-III subtests, all  $ps > .10$ . Moreover, no significant main effects of instrumental involvement were found for any of the WJ-III subtests, all  $ps > .20$

*Controlling Involvement.* Controlling involvement was found to moderate the impact of tutoring, at the level of a trend, for Reading Fluency, such that children in the waitlist control group with higher rates of controlling involvement had better performance,  $B = -.82, t(68) = -1.70, p = .09$ . Controlling involvement accounted for an increment of 0.9% in the variance explained in Reading Fluency.

Furthermore, the hierarchical regression revealed a significant and positive main effect (rather than a moderating effect) of controlling involvement for Applied Problems ( $B = .65, t(68) = 2.38, p = .02; R^2 \text{ change} = .04$ ), Passage Comprehension ( $B = .65, t(68) = 3.14, p < .01; R^2 \text{ change} = .03$ ), Reading Fluency ( $B = .68, t(68) = 2.78, p = .01; R^2 \text{ change} = .02$ ), and Broad Reading ( $B = .53, t(68) = 3.02, p < .01; R^2 \text{ change} = .01$ ), such that higher levels of controlling involvement were related to better performance. No significant difference between the adjusted

post-test group means were found for Spelling, Math Fluency, Calculation, or Letter-Word Identification, all  $ps > .10$ .

### **Symptoms of PTSD.**

*TSCYC*. For younger children (i.e., ages 5-9 years,  $n = 28$ ), total PTSD symptoms, as rated by caregivers, was not found to be a significant moderator of tutoring, all  $ps > .15$ . However, a significant main effect of total PTSD symptoms was found for Spelling, such that young children with higher total PTSD symptoms performed more poorly on Spelling, as compared to young children with lower total PTSD symptoms,  $B = -.21$ ,  $t(26) = -2.08$ ,  $p = .05$ ;  $R^2$  change = .02.

*TSCC*. For older children (i.e., 10 years and older,  $n = 42$ ), total self-reported symptoms of PTSD significantly and negatively moderated the impact of tutoring on Math Fluency, such that children aged 10 and older in the tutoring group with higher total PTSD symptoms performed more poorly than those aged 10 and older in the waitlist control group with higher total PTSD symptoms,  $B = -.36$ ,  $t(40) = -2.15$ ,  $p = .04$ ;  $R^2$  change = .02. Moreover, total self-reported symptoms of PTSD negatively moderated the impact of tutoring on Calculation at the level of a trend, such that children with higher total PTSD symptoms performed more poorly than older children with lower total PTSD scores,  $B = -.35$ ,  $t(40) = -1.72$ ,  $p = .09$ ;  $R^2$  change = .01. A significant main effect of total PTSD symptoms was also found for Calculation,  $B = -.34$ ,  $t(40) = -3.32$ ,  $p < .01$ ;  $R^2$  change = .05, such that higher levels of PTSD was related to poorer performance on Calculation.

A total of 72 ANCOVAs were conducted to answer exploratory research question #1: 8 significant findings (i.e.,  $p < .05$ ), and 4 findings at the level of a trend (i.e.,  $p < .10$ ) were found (3 moderations and 1 main effect). Thus, given the number of ANCOVAs conducted, there were minimal significant results for exploratory research question #1.

***Exploratory Research Question #2:*** *To what extent does tutoring produce “spillover effects” in educationally relevant domains for children in care, specifically, executive functioning, behavioural difficulties, and caregiver involvement in academic activities in the home?*

ANCOVA via multiple regression revealed no significant differences between the adjusted post-test group means and any of the educationally relevant domains, all  $ps > .10$ . These results therefore suggest that academic tutoring may not produce spillover effects into other educationally relevant domains.

### **Discussion**

This study investigated the effectiveness of a one-on-one tutoring program, TutorBright, on academic achievement among children in care. Moreover, this study sought to explore potential variables that may moderate the impact of tutoring on academic outcomes (namely: age, gender, executive functioning, behavioural difficulties, symptoms of PTSD, and caregiver involvement in academic activities in the home). The study also aimed to explore the extent to which tutoring may produce “spillover effects” in educationally relevant domains for children in care, specifically, executive functioning, behavioural difficulties, and caregiver involvement in academic activities in the home.

Overall, the children in care who participated in the study possessed academic skills that were well below those of children from the general population. More specifically, at the pre-test, the children in care in the current study were performing approximately 1 standard deviation below the population mean on reading and 2 standard deviations below the population mean on math. Moreover, the children in care had significantly lower performance in math skills, compared to reading or spelling skills (see Table 4). This is consistent with previous reviews on the academic status of children in care, noting that children in care tend to perform below grade

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

level and in the low-to-low average range on academic achievement measures (Trout et al., 2008). However, the current study sample was particularly weak in both math and reading, and performed even below the average level of that found in previous literature (Trout et al., 2008). The TutorBright program had statistically significant and positive effects on reading fluency ( $g = .16$ ), reading comprehension ( $g = .34$ ), and math calculation ( $g = .39$ ), which exceeded those attained from the normal course of development and schooling by the children in care in the waitlist control group. Moreover, according to the WWC (2008) guidelines, even though the gains were not statistically significant the children in the tutoring group also made ‘substantively important’ gains in math fluency ( $g = .27$ ) and broad math ( $g = .32$ ). Together, these findings suggest that the TutorBright program was somewhat effective in improving both math and reading, with relatively stronger improvements in math. However, the discrepancy analysis indicated that the TutorBright program did not significantly close the ‘intra-achievement gap’ in math or reading, suggesting that there continues to be much room for these children to improve academically. Moreover, despite the gains made in math and reading for the children in the tutoring group, at the post-test, many continued to perform below average in both reading and math, with most scores approximately 1.0 - 1.5 standard deviations below the population mean (see Table 4).

The effects of tutoring in the current study are consistent with the review and meta-analysis by Ritter et al. (2009) on randomized studies of tutoring in children of primary school age in the general population. More specifically, Ritter et al. (2009) found small to moderate effect sizes for one-to-one tutoring with adult volunteers, using Hedge’s  $g$ , ranging from 0.18 (Reading Comprehension) to 0.41 (Reading Words and Letters). However, the statistically significant and strongest effect on Math Calculation in the current study ( $g = .39$ ), was larger

than Ritters' non-significant mean effect ( $g = .26$ ). This may be attributed to the fact that the mean effect for math in Ritter et al. (2009) was based on only 5 studies, and yet, despite this, it was still above the WWC (2008) threshold of  $g = 0.25$  for being considered substantively important. The primary findings from the current study are also consistent with previous academic tutoring studies for children in care. For example, in an individualized direct-instruction tutoring intervention by foster parents, Flynn and colleagues (2012) found that the children in the tutoring group made significant gains in sentence comprehension ( $g = .38$ ), reading composite ( $g = .29$ ), and math computation ( $g = .46$ ), but not on word reading ( $g = .19$ ), or spelling ( $g = -.08$ ). Moreover, using a direct-instruction small-group tutoring program for children in care, Harper and Schmidt (2016) found that the children in care in the tutoring group made significant gains in word reading ( $g = .40$ ), spelling ( $g = .25$ ), and math ( $g = .34$ ), but not in sentence comprehension ( $g = .15$ ). Together, these findings suggest that tutoring can be a relatively effective method of improving math and reading skills for children in care.

Interestingly, no significant 'dose-response' was found for the number of tutoring sessions (i.e., duration), nor for the number of tutoring minutes (i.e., intensity) and math and reading outcomes (although a trend towards significance was found for the relationship between the total number of tutoring sessions and letter-word identification). This finding is consistent with previous meta-analyses that have indicated that tutoring length is seldom a significant predictor of intervention effect size (Elbaum, Vaughn, Tejero Hughes, & Watson Moody, 2000; Suggate, 2010). One possibility for this finding is that the TutorBright program may have too narrow a focus and may not be able to produce further benefit beyond a certain point of saturation. Interestingly, a negative relationship (at the trend level) was found between the number of minutes spent on 'other activities' (e.g., behaviour management, relationship

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

building) and Reading Fluency, Math Fluency, and Broad Reading Composite, suggesting that ‘off task’ behaviours may be related to less improvement in math and reading. However, the current study did not differentiate time spent on relationship building activities versus behaviour management. As such, future studies should assess the relative impact of relationship building vs. behaviour management on the effectiveness of tutoring.

The secondary objective of the current study was to explore potential moderating variables that may impact the effectiveness of tutoring (age, gender, executive functioning, caregiver involvement in academics, and symptoms of PTSD). Two significant ( $p < .05$ ) moderators were found, namely, executive functioning and symptoms of PTSD. Although executive functioning and symptoms of PTSD did not significantly moderate the effectiveness of tutoring on the majority of the WJ-III, they did significantly moderate the effectiveness of tutoring on Letter-Word Identification, and Math Fluency, respectively. More specifically, for children in the control group, those with higher executive functioning skills at pre-test performed better on Letter Word Identification, and, for older children, higher PTSD scores were related to lower performance in Math Fluency. At the trend level, symptoms of PTSD also negatively moderated the impact of tutoring on math Calculation, and controlling caregiver involvement negatively moderated the impact of tutoring on Reading Fluency. To date, there is very little existing research that has examined the role of potential moderating variables on the effectiveness of tutoring. In a follow-up analysis of Flynn et al.’s (2012) direct instruction tutoring study with children in care, Marquis (2013) found that gender moderated the effectiveness of the caregiver delivered tutoring program, such that girls benefited slightly more from tutoring than boys. This finding, together with the results from the current study, provides initial support suggesting that the effectiveness of tutoring may be influenced by both individual

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

(e.g., executive functioning, PTSD symptoms) and contextual (e.g., caregiver involvement) variables. However, the impact of these moderators on tutoring was very small, as they accounted for less than 3% of the variance explained in the hierarchical regression. As such, future research should assess other potential moderators that may have a greater impact on the effectiveness of tutoring (e.g., academic self-efficacy). The current results also suggest that greater levels of controlling caregiver involvement in academic activities and lower levels of PTSD, are related to better academic outcomes. These findings are consistent with previous literature that demonstrates a link between parental involvement in academics and positive mental health, with increased academic success in children in both the general and in care population (Jeynes, 2007; Cheung, Lwin, & Jenkins, 2012; Tessier et al. 2017). However, previous research also suggests that instrumental, or supportive, involvement is related to better academic outcomes for children with ADHD, when compared to more controlling involvement (Rogers, Wiener, Marton, & Tannock, 2009). This discrepancy with the current findings may be due to the often significant behavioural and learning difficulties experienced by children in care, such that children in care benefit more from more controlling involvement than children in the general population. To gain a better understanding of this relationship, future research should assess the relative impact of various types of caregiver academic involvement (e.g., school involvement vs. home involvement), as well as the frequency and quality of the involvement. Moreover, the perceptions of caregiver involvement by the child should also be assessed.

The current study found no significant ‘spillover’ effects, suggesting that the TutorBright program alone does not alter executive functioning, behavioural difficulties, or caregiver involvement in academic activities in the home. These findings are consistent with those documented by Marquis (2013), Harper (2012), and Tideman et al. (2011), in which there was

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

very little gain in children in cares' mental health after having received tutoring or an individualized academic plan. However, for children in the general population, tutoring has been found to positively impact 'non-academic' outcomes such as disruptive behaviour and social skills (Bowman-Perrott, Burke, Zhang, & Zaini, 2014). Thus, the limited research assessing possible 'spill-over' effects suggests that tutoring alone is not sufficient to improve behaviour or mental health for children in care. However, it is also possible that the measures selected for use in the current study were not sensitive enough to detect meaningful 'real-life' improvements within the educationally relevant domains assessed. Future studies should include a qualitative component whereby caregivers and children in care are interviewed about their functioning in educationally relevant domains (i.e., behavior and caregiver involvement in academics), to better assess whether improvement in basic academic skills can improve functioning in these areas.

Implementation of the TutorBright program was relatively straightforward, as it was packaged as a 'turn-key' program. That is, trained tutors were provided by the TutorBright organization and matched to students, without involvement by the CAS. Moreover, the tutoring occurred within the child's foster home, thereby removing the potential barriers of travel and also aimed to leverage the support of caregivers (Gordon, 2009). Moreover, TutorBright's emphasis on the relationship between tutor and tutee is believed to be a relative strength of the program, particularly given that 'care-experienced' young people report preferring academic interventions with a clear relational component (Evans et al. 2016). Despite the relative ease of deploying the TutorBright program, there was a challenge in enrolling eligible participants. Indeed, 40.48% of eligible participants declined to participate for a variety of reasons, including: disinterest, belief that the child was not in need of tutoring, and not wanting to be randomized to the waitlist control group. As such, future studies should first aim to increase engagement (of

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

both children and caregivers), which is a necessary precursor to impact (Zinn & Courtney, 2014). While the implementation of the TutorBright program was relatively straightforward, to better assess the effectiveness of the program, future studies should include a more rigorous fidelity measure (e.g., audio and/or video recording of randomly selected tutoring sessions). A more rigorous fidelity measure would better assess the degree to which the TutorBright program was adhered to by the tutors.

Despite the promising findings of the current study, which suggest that TutorBright, in its current format, is somewhat effective in improving reading and math calculation skills, in order to boost the effectiveness of the TutorBright program, the following recommendations should be considered. First, the TutorBright program should enhance the academic involvement by caregivers. Previous researchers have found that parental involvement in academics is an important predictor of academic success, across grade levels (for meta-analyses see Hill & Tyson, 2009; Nye, Turner, & Schwartz, 2006). Moreover, for children in care, higher rates of academic support at home (e.g., providing homework help) and increased caregiver academic aspirations have been found to predict academic success in their children (Tessier et al. 2017; Cheung et al. 2012). Interestingly, previous researchers have found that ‘care-experienced’ young people report having a preference for interventions delivered by caregivers (Evans et al. 2016), which is consistent with Jackson’s (2007) strong advocacy in favour of a much greater role for foster parents in the academic education of their foster children. As such, the TutorBright program may enhance its effectiveness by involving caregivers (e.g., having their child in care read with them, have the child discuss what was learnt in the tutoring sessions). Secondly, the TutorBright program may also benefit from greater emphasis on Direct Instruction. Direct Instruction has been found to be one of the most effective models for improving educational

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

outcomes in low-performance urban schools (Borman, Hewes, Overman, & Brown, 2003). Moreover, when combined with contingency management, direct instruction has been found to be effective in improving academic outcomes for children at risk of school failure (Dolezal, Weber, Evavold, Wylie, & McLaughlin, 2007). Although Direct Instruction is reported to be a component of the TutorBright program (S. Verma, personal communication, June, 2017), it does not seem to be its primary component. Indeed, the TutorBright program emphasizes ‘homework help’ to ameliorate in-class performance (S. Verma, personal communication, June 2017). However, little research has been conducted on the effectiveness of homework help, both on the performance on standardized academic assessments and in-class performance. As such, future research should assess the relative effectiveness of homework help in improving academic outcomes for children in care. Moreover, given the often significant behavioural and learning difficulties of children in care, TutorBright tutors may benefit from training in these areas to better serve these children academically.

With regard to future intervention studies on tutoring for children in care, it would be desirable to recruit a larger number of local child welfare organizations, as well as a larger sample of children in care. Moreover, to further assess the effectiveness and generalizability of the TutorBright program, future studies should obtain teacher ratings of academic performance in the classroom (i.e., perhaps the homework help component helps to boost ‘in class’ achievement/performance, but does not boost performance on standardized math and reading assessments). Moreover, to our knowledge, little no research has assessed whether gains made in math and reading from tutoring are maintained in the longer term for children in care. It would thus be of interest for future studies to assess whether gains made from tutoring are indeed maintained following the completion of the program.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Given that academic tutoring appears to be a relatively effective method of improving academic skills for children in care (Flynn et al., 2012; Harper & Schmidt, 2016), future research should assess the following: 1) whether the academic gains made by tutoring are maintained following the completion of the program, 2) the amount of tutoring that is necessary to enhance academic skills (i.e., how much tutoring is enough, and does more tutoring lead to better outcomes?), 3) which are the essential components of the academic intervention (i.e., the mechanisms of change), and 4) how to increase the potency of academic interventions (e.g., greater intensity, greater number of sessions, longer duration of tutoring), and finally, 5) how best to prevent or mitigate academic difficulties from occurring for this population.

In summary, our findings are consistent with the conclusions reached by Forsman and Vinnerljung (2012), which suggested that educational interventions for children in care appear in many cases to produce positive results. However, despite the gains made in math and reading skills from tutoring, children in care remain at risk of continued poor academic functioning. Future research should be conducted to better identify the academic interventions that work best, and for whom, and also assess potential variables that may moderate the effectiveness of such interventions, in order to improve the short and long term academic outcomes for children in care.

**References**

- Berlin, M., Vinnerljung, B. & Hjern, A. (2011) School performance in primary school and psychosocial problems in young adulthood among care leavers from long term foster care, *Children and Youth Services Review*, 33, 2489–2497.
- Bowman-Perrott, L., Burke, M. D., Zhang, N., & Zaini, S. (2014). Direct and collateral effects of peer tutoring on social and behavioral outcomes: A meta-analysis of single-case research. *School Psychology Review*, 43(3), 260-285.
- Briere, J. (1996). Trauma symptom checklist for children. *Odessa, FL: Psychological Assessment Resources*, 00253-8.
- Briere, J., Johnson, K., Bissada, A., Damon, L., Crouch, J., Gil, E., ... & Ernst, V. (2001). The Trauma Symptom Checklist for Young Children (TSCYC): Reliability and association with abuse exposure in a multi-site study. *Child Abuse & Neglect*, 25, 1001-1014.
- Borman, G.D., Hewes, G.M., Overman, L.T., & Brown, S. (2003). Comprehensive school reform and achievement: A meta-analysis. *Review of Educational Research*, 73, 125-230.
- Cheung, C., Lewin, K., & Jenkins, J. M. (2012). Helping youth in care succeed: Influence of caregiver involvement on academic achievement. *Children and Youth Services Review*, 34, 1092–1100.
- Cheung, A. C., & Slavin, R. E. (2016). How methodological features affect effect sizes in education. *Educational Researcher*, 45(5), 283-292.
- Cosden, M., Morrison, G., Albanese, A. L., & Macias, S. (2001). When homework is not home work: After-school programs for homework assistance. *Educational Psychologist*, 36, 211-221.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Courtney, M. E., Dworsky, A., Lee, J. S. & Raap, M. (2010). *Midwest evaluation of the adult functioning of former foster youth: Outcomes at ages 23 and 24*. Chapin Hall at the University of Chicago: Chicago.
- Coyne, J. C., Thombs, B. D., & Hagedoorn, M. (2010). Ain't necessarily so: Review and critique of recent meta-analyses of behavioral medicine interventions in health psychology. *Health Psychology, 29*(2), 107.
- DeGregorio, L. J., & McLean, S. (2013). The cognitive profiles of maltreated children in care and their educational needs: Supporting good outcomes. *Children Australia, 38*(1), 28-35.
- Dietrichson, J., Bøg, M., Filges, T., & Klint Jørgensen, A. M. (2017). Academic interventions for elementary and middle school students with low socioeconomic status: A systematic review and meta-analysis. *Review of Educational Research, 87*(2), 243-282.
- Dimitrov, D. M., & Rumrill, J. D. (2003). Pretest-posttest designs and measurement of change. *Work, 20*(2), 159.
- Dolezal, D.N., Weber, K.P., Evavold, J.J., Wylie, J., & McLaughlin, T.F. (2007). The effects of a reinforcement package for on-task and reading behavior with at-risk and middle school students with disabilities. *Child & Family Behavior Therapy, 29*, 9-25
- Elbaum, B., Vaughn, S., Tejero Hughes, M., & Watson Moody, S. (2000). How effective are one-to-one tutoring programs in reading for elementary students at risk for reading failure? A meta-analysis of the intervention research.
- Evans, R., Brown, R., Rees, G., & Smith, P. (2017). Systematic review of educational interventions for looked- after children and young people: Recommendations for intervention development and evaluation. *British Educational Research Journal, 43*(1), 68-94.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Finnie, R., Afshar, K., Bozkurt, E., Mivairi, M., & Pavlic, D. (2016, July). Barista or better? New evidence on the earnings of post-secondary education graduates: A tax linkage approach. Ottawa, ON: Educational Policy Research Initiative (EPRI), University of Ottawa. Retrieved from [http://static1.squarespace.com/static/5557eaf0e4b0384b6c9b0172/t/57a3595eb8a79b06bc686cbf/1470323048183/EPRI-ESDC+Tax+linkage\\_Report.pdf](http://static1.squarespace.com/static/5557eaf0e4b0384b6c9b0172/t/57a3595eb8a79b06bc686cbf/1470323048183/EPRI-ESDC+Tax+linkage_Report.pdf)
- Flynn, R. J., Marquis, R. A., Paquet, M. P., Peeke, L. M., & Aubry, T. D. (2012). Effects of individual direct-instruction tutoring on foster children's academic skills: A randomized trial. *Children and Youth Services Review, 34*, 1183-1189.
- Forsman, H., Brännström, L., Vinnerljung, B., & Hjern, A. (2016). Does poor school performance cause later psychosocial problems among children in foster care? Evidence from national longitudinal registry data. *Child Abuse & Neglect, 57*, 61-71.
- Forsman, H., & Vinnerljung, B. (2012). Interventions aiming to improve school achievements of children in out-of-home care: A scoping review. *Children and Youth Services Review, 34*(6), 1084-1091.
- Franzen, E. & Vinnerljung, B. (2006) Foster children as young adults: Many motherless, fatherless or orphans. A Swedish national cohort study, *Child & Family Social Work, 11*, 254–263.
- Gliner, J. A., Morgan, G. A., & Harmon, R. J. (2003). Pretest-posttest comparison group designs: Analysis and interpretation. *Journal of the American Academy of Child & Adolescent Psychiatry, 42*, 500-503.
- Goodman, R. (1997). The Strengths and Difficulties Questionnaire: a research note. *Journal of Child Psychology and Psychiatry, 38*(5), 581-586.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Goodman, A., & Goodman, R. (2009). Strengths and difficulties questionnaire as a dimensional measure of child mental health. *Journal of the American Academy of Child & Adolescent Psychiatry, 48*(4), 400-403.
- Goodman, A., & Goodman, R. (2011). Population mean scores predict child mental disorder rates: validating SDQ prevalence estimators in Britain. *Journal of Child Psychology and Psychiatry, 52*(1), 100-108.
- Gordon, E. E. (2009). 5 ways to improve tutoring programs. *Phi Delta Kappan, 90*(6), 440-445.
- Harper, J., & Schmidt, F. (2016). Effectiveness of a group-based academic tutoring program for children in foster care: A randomized controlled trial. *Children and Youth Services Review, 67*, 238-246.
- Hill, N. E., & Tyson, D. F. (2009). Parental involvement in middle school: a meta-analytic assessment of the strategies that promote achievement. *Developmental Psychology, 45*(3), 740.
- Hinshaw, S. P. (1992). Academic underachievement, attention deficits, and aggression: Comorbidity and implications for intervention. *Journal of Consulting and Clinical Psychology, 60*, 893-903.
- Jackson, S. (1994). Educating children in residential and foster care. *Oxford Review of Education, 20*, 267-279.
- Jackson, S., & Ajayi, S. (2007). Foster care and higher education. *Adoption & Fostering, 31*(1), 62-72.
- Jeynes, W. H. (2007). The relationship between parental involvement and urban secondary school student academic achievement: A meta-analysis. *Urban Education, 42*(1), 82-110.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Kavanaugh, B. C., Dupont-Frechette, J. A., Jerskey, B. A., & Holler, K. A. (2016).

Neurocognitive deficits in children and adolescents following maltreatment: Neurodevelopmental consequences and neuropsychological implications of traumatic stress. *Applied Neuropsychology: Child*, 1-15.

Kufeldt, K., Simard, M., & Vachon, J. (2000). *Looking after children in Canada: Final report*.

Fredericton, NB: Human Resources Development Canada. Retrieved from

[http://www.unb.ca/fredericton/arts/centres/mmfc/\\_resources/pdfs/team2000a.pdf](http://www.unb.ca/fredericton/arts/centres/mmfc/_resources/pdfs/team2000a.pdf)

Lauer, P. A., Akiba, M., Wilkerson, S. B., Aphorp, H. S., Snow, D., & Martin-Glenn, M. L.

(2006). Out-of-school-time programs: A meta-analysis of effects for at-risk students. *Review of Educational Research*, 76(2), 275-313.

Lipsey, M. W., Puzio, K., Yun, C., Hebert, M. A., Steinka-Fry, K., Cole, M. W., ... & Busick, M.

D. (2012). Translating the statistical representation of the effects of education interventions into more readily interpretable forms. *National Center for Special Education Research*. Washington, DC: National Center for Special Education Research, Institute of Education Sciences, U.S. Department of Education.

Lightfoot, E., Hill, K., & LaLiberte, T. (2011). Prevalence of children with disabilities in the

child welfare system and out of home placement: An examination of administrative records. *Children and Youth Services Review*, 33(11), 2069-2075.

Maloney, M. (1998). *Teach your children well: A solution to some of North America's*

*educational problems*. Belleville, ON: QLC Educational Services.

Marquis, R. (2013). *The gender effects of a foster parent-delivered tutoring program on foster*

*children's academic skills and mental health: A randomized field trial*. Retrieved from ProQuest Digital Dissertations.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Naglieri, & Goldstein. (2012). *Comprehensive executive function inventory*. Toronto: Multi Health Systems.
- Nilsson, D. K., Gustafsson, P. E., & Svedin, C. G. (2012). Polytraumatization and trauma symptoms in adolescent boys and girls: Interpersonal and noninterpersonal events and moderating effects of adverse family circumstances. *Journal of Interpersonal Violence*, 27(13), 2645-2664.
- Nilsson, D., Wadsby, M., & Svedin, C. G. (2008). The psychometric properties of the Trauma Symptom Checklist for Children (TSCC) in a sample of Swedish children. *Child Abuse & Neglect*, 32(6), 627-636.
- Nye, C., Turner, H., & Schwartz, J. (2006). Approaches to parent involvement for improving the academic performance. *Campbell Systematic Reviews*, 4.
- O'Higgins, A., Sebba, J., & Gardner, J. (2014). What are the factors associated with educational achievement for children in kinship or foster care: A systematic review. *Children and Youth Services Review*, 79, 198-220.
- O'Higgins, A., Sebba, J., & Luke, N. (2015). *What is the relationship between being in care and the educational outcomes of children. An International Systematic Review*. Oxford: Rees Centre.
- Ontario Ministry of Education (2017). *High school graduation rate climbs to all-time high*. Retrieved from [https://news.ontario.ca/edu/en/2017/05/high-school-graduation-rate-climbs-to-all-time-high.html?\\_ga=2.258555401.2099054610.1495500161-1922161080.1495500064](https://news.ontario.ca/edu/en/2017/05/high-school-graduation-rate-climbs-to-all-time-high.html?_ga=2.258555401.2099054610.1495500161-1922161080.1495500064).

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Pears, K. C., Fisher, P. A., Bruce, J., Kim, H. K., & Yoerger, K. (2010). Early elementary school adjustment of maltreated children in foster care: The roles of inhibitory control and caregiver involvement. *Child Development, 81*(5), 1550-1564.
- Pecora, P. J. (2012). Maximizing educational achievement of youth in foster care and alumni: Factors associated with success. *Children and Youth Services Review, 34*(6), 1121-1129.
- Ritter, G. W., Barnett, J. H., Denny, G. S., & Albin, G. R. (2009). The effectiveness of volunteer tutoring programs for elementary and middle school students: A meta-analysis. *Review of Educational Research, 79*(1), 3-38.
- Rogers, M., Markel, C., Midgett, J. D., Ryan, B. A., & Tannock, R. (2014). Measuring children's perceptions of parental involvement in conjoint behavioral consultation: Factor structure and reliability of the Parental Support for Learning Scale. *Assessment for Effective Intervention, 39*, 170-181.
- Rogers, M. A., Wiener, J., Marton, I., & Tannock, R. (2009). Supportive and controlling parental involvement as predictors of children's academic achievement: Relations to children's ADHD symptoms and parenting stress. *School Mental Health, 1*(2), 89-102.
- Romano, E., Babchishin, L., Marquis, R., & Fréchette, S. (2015). Childhood maltreatment and educational outcomes. *Trauma, Violence, & Abuse, 16*(4), 418-437.
- Rutman, D., Hubberstey, C., Feduniw, A., & Brown, E. (2007). *When youth age out of care—Where to from there*. Final Report, Victoria, BC, Research Initiatives for Social Change Unit, 20.
- Sadowski, C. M., & Friedrich, W. N. (2000). Psychometric properties of the Trauma Symptom Checklist for Children (TSCC) with psychiatrically hospitalized adolescents. *Child Maltreatment, 5*(4), 364-372.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Schafer, J. L., & Graham, J. W. (2002). Missing data: our view of the state of the art. *Psychological Methods*, 7, 147.
- Schelble, J. L., Franks, B. A., & Miller, M. D. (2010). Emotion dysregulation and academic resilience in maltreated children. In *Child & Youth Care Forum* (Vol. 39, No. 4, pp. 289-303).
- Sebba, J., Berridge, D., Luke, N., Fletcher, J., Bell, K., Strand, S., Thomas, S., Sinclair, I. & O'Higgins, A. (2015) *The educational progress of looked after children in England: Linking care and educational data*. University of Oxford, Rees Centre for Research in Fostering and Education, and University of Bristol).
- Singal, A. G., Higgins, P. D., & Waljee, A.K. (2014). A primer on effectiveness and efficacy trials. *Clinical and Translational Gastroenterology*, 5, e45.
- Slavin, R. E., Cheung, A., Groff, C., & Lake, C. (2008). Effective reading programs for middle and high schools: A best- evidence synthesis. *Reading Research Quarterly*, 43(3), 290-322.
- Slavin, R. E., & Lake, C. (2008). Effective programs in elementary mathematics: A best-evidence synthesis. *Review of Educational Research*, 78(3), 427-515.
- Snow, K. (2009). The case for enhanced educational supports for children in public care: An integrative literature review of the educational pathway of children in care. *Vulnerable Children and Youth Studies*, 4(4), 300-311.
- Stone, S. (2007) Child maltreatment, out-of-home placement, and academic vulnerability: A fifteen-year review of evidence and future directions, *Children & Youth Services Review*, 29, 139–161.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Suggate, S. P. (2010). Why what we teach depends on when: Grade and reading intervention modality moderate effect size. *Developmental Psychology, 46*(6), 1556-1579.

Sylva, K., Melhuish, E., Sammons, P., Siraj, I., Taggart, B., Smees, R., ... Hollingworth, K. (2014). Students' educational and developmental outcomes at age 16 Effective Pre-school, Primary and Secondary Education (EPPSE 3-16) Project. London: Department for Education. Retrieved from [https:// www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/351496/RR354\\_\\_Students\\_\\_educational\\_and\\_developmental\\_outcomes\\_at\\_age\\_16.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/351496/RR354__Students__educational_and_developmental_outcomes_at_age_16.pdf)

Tabachnick, B.G., & Fidell, L.S. (2007). *Using multivariate statistics* (6<sup>th</sup> ed.). Boston, MA: Pearson Education.

Thompson, T., & Massat, C. R. (2005). Experiences of violence, post-traumatic stress, academic achievement and behavior problems of urban African-American children. *Child and Adolescent Social Work Journal, 22*(5-6), 367-393.

Tideman, E., Vinnerljung, B., Hintze, K. & Aldenius Isaksson, A. (2011). Improving foster children's school achievements: Promising results from a Swedish intensive study. *Adoption & Fostering, 35*(1), 44-56

Trout, A. L., Hagaman, J., Casey, K., Reid, R., & Epstein, M. H. (2008). The academic status of children and youth in out-of-home care: A review of the literature. *Children and Youth Services Review, 30*(9), 979-994.

Trout, A. L., Nordness, P. D., Pierce, C. D., & Epstein, M. H. (2003). Research on the academic status of students with emotional and behavioral disorders: A review of the literature from 1961-2000. *Journal of Emotional and Behavioral Disorders, 11*, 198-210.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Viner, R. M. & Taylor, B. (2005) Adult health and social outcomes of children who have been in public care: Population-based study, *Paediatrics*, 115, 894–899.
- Vinnerljung, B., Tideman, E., Sallnäs, M., & Forsman, H. (2014). Paired Reading for foster children: Results from a Swedish replication of an English literacy intervention. *Adoption & Fostering*, 38(4), 361-373.
- What Works Clearinghouse (2008). *Procedures and standards handbook (version 2.0)*. Washington, DC: Institute of Educational Sciences.
- Woodcock, R., McGrew, K., & Mather, N. (2001). Examiner's Manual. *Woodcock-Johnson III Tests of Achievement*. Rolling Meadows, IL: Riverside.
- Zetlin, A. G., Weinberg, L. A. & Shea, N. M. (2006) Seeing the whole picture: Views from diverse participants on barriers to educating foster youths, *Children and Schools*, 28, 165–173.
- Zinn, A., & Courtney, M. E. (2014). Context matters: Experimental evaluation of home-based tutoring for youth in foster care. *Children and Youth Services Review*, 47, 198-204.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Table 1.

*Means (or percentages), standard deviations, Cronbach's alphas, theoretical range, and skewness statistics for study variables, after attrition, at the pre and post-test (N = 70).*

Variable	Pre-test (N = 70)					Post-test (N = 70)				
	Mean (or %)	SD	Cronbach's alpha	Theoretical Range	Skew	Mean (or %)	SD	Cronbach's alpha	Theoretical Range	Skew
<i>Outcome</i>										
Broad Reading	82.33	19.43	---	50-150	-1.00	84.43	18.50	---	50-150	-1.25
Letter-Word Identification	87.66	17.54	---	50-150	-.91	87.20	17.35	---	50-150	-1.07
Passage Comprehension	81.63	17.15	---	50-150	-1.16	84.43	14.20	---	50-150	-1.89
Reading Fluency	84.22	18.03	---	50-150	-.25	88.04	17.52	---	50-150	-.29
Spelling	84.27	19.10	---	50-150	-.58	84.73	19.61	---	50-150	-.52
Broad Math	74.01	18.97	---	50-150	-.59	75.67	16.81	---	50-150	-1.25
Calculation	73.34	22.10	---	50-150	-.28	74.24	19.02	---	50-150	-.43
Applied Problems	83.16	15.28	---	50-150	-.97	85.20	13.88	---	50-150	-.53
Math Fluency	74.10	13.15	---	50-150	-.05	75.67	13.10	---	50-150	-.19
<i>Covariates</i>										
Executive Functioning (CEFI total score)	81.89	13.12	0.92	50-150	-.05	83.63	13.05	0.90	50-150	.61
Behaviour (SDQ total behavioural difficulties)	16.19	6.59	0.81	0-40	-.11	15.54	7.20	0.75	0-40	-.09
PSLS caregiver involvement										
Instrumental involvement	32.30	6.41	0.88	0-44	-.06	31.86	5.38	0.81	0-44	-.44
Controlling involvement	10.77	18.97	0.65	0-32	-.17	12.09	4.90	0.74	0-32	-.13
Symptoms of PTSD										
TSCC (n = 42)	48.45	11.01	0.97	---	.72	---	---	---	---	---
TSCYC (n = 28)	60.43	13.42	0.93	---	.63	---	---	---	---	---
Age	10.41	2.94	---	5-16	.07	11.27	2.89	---	5-16	.12
Gender (male: female %)	54.3:45.7	---	---	---	---	54.3:45.7	---	---	---	---

*Notes.* The skewed variables were initially transformed with reflection and square root transformations. Analyses with the untransformed variables, however, provided a greater number of statistically significant results and thus were retained.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Table 2.

*Inter-correlation matrix for variables in the study at the pre-test (N = 70) \* p < .05; \*\* p < .01*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Broad Reading	---															
2 Letter-Word Identification	.97**	---														
3 Reading Fluency	.85**	.77**	---													
4 Passage Comprehension	.94**	.86**	.74**	---												
5 Spelling	.85**	.82**	.76**	.77**	---											
6 Broad Math	.76**	.74**	.65**	.76**	.63**	---										
7 Calculation	.67**	.67**	.53**	.70**	.56**	.91**	---									
8 Math Fluency	.68**	.62**	.69**	.61**	.59**	.81**	.69**	---								
9 Applied Problems	.74**	.69**	.63**	.72**	.63**	.89**	.66**	.70**	---							
10 CEFI Total Score	.27*	.24*	.29*	.28*	.21	.22	.17	.28*	.19	---						
11 SDQ Total Difficulties	-.20	-.20	-.21	-.20	-.19	-.23	-.14	-.27*	-.24*	-.77**	---					
12 PSLS: Instrumental Involvement	.09	.12	.14	.07	-.06	.12	.17	.20	-.02	.07	.00	---				
13 PSLS: Controlling Involvement	.03	.00	.11	-.06	.11	-.02	-.01	.07	-.02	.16	-.08	-.01	---			
14 Age	-.03	-.08	.06	-.13	.07	-.21	-.35**	-.07	.03	.10	-.06	-.23	.45**	---		
15 Gender (0 = male; 1 = female)	.10	.06	.19	.09	.15	.00	.04	.06	-.05	.02	.06	.00	-.19	-.27*	---	
16 Group (0 = control; 1 = tutoring)	.01	.01	-.05	.06	-.07	.10	.04	.12	.13	-.21	.11	.22	-.29*	-.03	-.03	---

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Table 3.

*Sample descriptives at pre-test, post attrition (Means, SDs, or Percentages)*

	WL control group (n = 36)	Experimental group (n = 34)
	Pre-test	Pre-test
Sex (M:F)	19:17	19:15
Age	10.50 (2.91)	10.32 (3.01)
School grade	5.69 (3.03)	5.35 (2.80)
Age of first placement	5.68 (3.91)	5.24 (3.69)
Number of previous placements	1.85 (2.13)	1.94 (1.69)
Number of unplanned school changes	2.70 (2.18)	1.96 (1.62)
Does the child have an IEP at school	Yes: 24 (66.7%)	Yes: 22 (64.7%)
Long term health conditions		
ADHD	13 (36.1%)	14 (41.2%)
Learning Disability	8 (22.2%)	13 (38.2%)
Developmental Disability	6 (16.7%)	3(8.8%)
Autism Spectrum Disorder	3 (8.3%)	3(8.8%)
Reason for entry into care <sup>5</sup>		
Neglect	30 (42.9%)	22 (25.3%)
Sexual Abuse	4 (5.7%)	6 (8.6%)
Domestic Violence	15 (21.4%)	10 (14.3%)
Emotional Harm	21 (30.0%)	22 (31.4%)
Abandonment	10 (14.3%)*	2 (2.9%)*
Problem Behaviour	7 (10.0%)	3 (4.3%)
Other: Parental Mental Illness	0 (0.0%)	2 (2.9%)
Trauma Symptoms (total PTSD T score)		
TSCYC	60.00 (11.75)	60.86 (15.36)
TSCC	46.95 (11.49)	50.10 (10.49)
SDQ Total Difficulties	15.50 (6.56)	16.91 (6.65)
CEFI Total Standard Score†	84.56 (11.47)	79.06 (14.29)
PSLS		
Instrumental†	30.94 (5.18)	33.74 (7.31)
Controlling	11.92 (4.11)*	9.56 (3.89)*

\* significant difference between groups,  $p < .05$

† trend towards significant difference between groups,  $p < .10$

<sup>5</sup> To note, these totals add up to more than 100% as children may have had exposure to several types of maltreatment

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Table 4

*Means and standard deviations on the pre-test and the unadjusted and adjusted post-test scores on the 7 WJ-III subtests and overall broad math and broad reading scores.*

WJ-III sub-test	WL control group (n = 36)			Experimental group (n = 34)		
	Pre-test	Unadjusted post-test	Adjusted post-test	Pre-test	Unadjusted post-test	Adjusted post- test
Letter word identification	87.42 (16.78)	86.81 (17.57)	86.80 (15.60)	87.91 (18.57)	87.62 (17.37)	87.61 (17.27)
Reading fluency	85.18 (16.08)	86.74 (17.70)	86.48 (13.88)	83.29 (19.95)	89.35 (17.51)	89.35 (17.21)
Passage comprehension	80.72 (18.80)	82.08 (16.18)	82.11 (13.22)	82.59 (15.44)	86.91 (11.46)	86.94 (10.86)
Spelling	85.58 (19.92)	86.67 (20.58)	86.66 (18.97)	82.88 (18.38)	82.68 (18.61)	82.67 (17.50)
Broad Reading	82.19 (19.72)	83.17 (19.91)	83.17 (17.71)	82.47 (19.42)	85.76 (17.08)	85.77 (17.44)
Calculation	71.86 (21.63)	70.86 (19.65)	70.85 (15.73)	74.91 (22.81)	77.82 (17.93)	77.81 (16.58)
Math fluency	72.58 (12.72)	73.97 (13.61)	73.96 (11.07)	75.71 (13.59)	77.47 (12.48)	77.46 (11.82)
Applied problems	81.19 (14.79)	83.81 (13.80)	83.84 (10.03)	85.24 (15.74)	86.68 (14.02)	86.71 (10.67)
Broad Math	72.11 (18.81)	73.08 (16.80)	73.09 (15.00)	76.03 (19.20)	78.41 (16.62)	78.42 (15.30)

How much tutoring is enough? A randomized trial of 15 vs. 25 weeks of Direct Instruction one-to-one tutoring for children in care

Andrea Hickey & Robert J. Flynn

University of Ottawa

### Abstract

It has been well documented that children in out of home care (e.g., foster care) lag behind their peers in educational achievement. As a result, there have been increased efforts on trying to improve the academic success of these children through intervention (e.g., academic tutoring). Previous research has found that 25 weeks of The Teach Your Children Well (TYCW) direct instruction tutoring program can ameliorate math and reading skills for children in care. However, an important question for policy makers, child welfare workers, foster parents and children is that of quantity: how much tutoring is enough to accelerate learning? To date, no published research has assessed whether a shorter version of the TYCW method (i.e., 15 weeks) would be as effective as a longer version for children in care (i.e., 25 weeks). After random assignment and attrition, the current study sample consisted of 72 children in foster or kinship care, or adoption probation, from two local Children's Aid Societies in Ontario, Canada. At the pre-test, the children in care were aged 5 to 16 years ( $M = 11.23$ ,  $SD = 3.02$ ), and were in school grades 1-12 ( $M = 6.44$ ,  $SD = 3.00$ ). Thirty-six children were randomly assigned to the 15-week TYCW math and reading tutoring, and 36 to the 25 weeks of TYCW math and reading tutoring. The tutoring was one-on-one and conducted by paid adult tutors in the children's homes. With one exception, ANCOVAs via multiple hierarchical regression revealed no significant differences between the 15 and 25 week tutoring groups on the WJ-III math and reading subtests. Follow-up paired  $t$ -tests, collapsed across group, revealed significant improvement from pre-to-post testing on Letter-Word Identification, Reading Fluency, Broad Reading composite, Calculation, Math Fluency, Applied Problems, and Broad Math composite. An attribute-treatment interaction was also conducted to assess potential moderating variables on the effectiveness of the 15 and 25 week tutoring group. ANCOVA via regression revealed that

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

children with higher executive functioning benefited more from the 15 weeks of tutoring. The implications of the results for improving the often poor academic outcomes for children in care were discussed.

*Keywords:* foster care, Direct Instruction, math, reading, tutoring dose

### **How much tutoring is enough? A randomized trial of 15 vs. 25 weeks of Direct Instruction one-to-one tutoring for children in care**

It has been well documented that children in out-of-home care (hereafter, in care), are at risk of low academic attainment. Indeed, relative to children in the general population, children in care have been found to have below-grade academic performance, higher rates of grade retention, and lower scores on standardized tests of academic achievement in reading, writing, and mathematics (Berger, Cancian, Han, Noyes, & Rios-Salas, 2015; Pecora, 2012). As a result of such challenges, children in care are approximately three times as likely as their peers in the general population to be involved in special education (Trout, Hagaman, Casey, Reid, & Epstein, 2008). This academic disparity can be attributed to factors such as pre-care experiences of abuse and neglect, as well as in-care events such as disruptive changes in placements or schools (O'Higgins, Sebba, & Luke, 2015). Moreover, previous researchers have found that children with a history of maltreatment are at risk of developing emotional and behavioural difficulties (e.g., post traumatic stress disorder (PTSD), conduct disorder) and poor cognitive development (e.g., executive functioning), both of which can negatively impact academic functioning (for a review see, Romano et al., 2015; DeGregorio & McLean, 2013). Caregiver involvement and expectations about academics have also been found to influence academic success for children in care. For example, Cheung, Lewin, and Jenkins (2012) found that caregiver involvement in school-related activities, the home literacy environment, and expectations about the value and use of education are significantly associated with the academic success of children in care.

The research on the long-term academic outcomes of children in care raises significant concerns about their future well-being. Poor academic outcomes have been found to be associated with increased rates of teenage pregnancy, substance abuse, incarceration, and

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

homelessness (Fergusson, & Woodward, 2000; Townsend, Flisher, & King, 2007; Katsiyannis, Ryan, Zhang, & Spann, 2008; Dworsky, Napolitano, Courtney, 2013; Forsman, Brännström, Vinnerljung, & Hjern, 2016). Mastering basic academic skills and increasing educational achievement can be a protective factor associated with improved outcomes, such as completing high school. This, in turn, can lead to significant positive outcomes, such as improved future employment and quality of life (Katsiyannis et al., 2008; Trout et al., 2008, Forsman et al., 2016). Therefore, interventions aimed at improving the academic outcomes of children in care may improve their overall future and well-being.

Although the educational achievement of many children in foster care is relatively poor, very few well validated educational interventions exist to help them achieve at a level that reflects their academic potential (for reviews see Evans et al. 2016; Forsman et al., 2012; Liabo et al., 2013). Of the academic interventions that have been conducted, next to classroom teaching, tutoring appears to be the most effective academic intervention to help children in care to catch-up academically (Slavin et al., 2008, 2011). While the mechanisms underlying effective tutoring for children in care have not yet been elucidated, tutoring interventions that utilize Direct Instruction (DI) appear to be relatively effective in improving math and reading skills for this population (Flynn et al., 2012; Harper & Schmidt, 2016) and for children in the general population (Borman, Hewes, Overman, & Brown, 2003; Flores & Ganz, 2009). The DI model explicitly teaches reading mastery and mathematical skills needed to achieve academically, through the use of scripted lesson plans that are highly interactive. The lessons are designed to help students achieve mastery as quickly as possible, while frequently assessing their skills to monitor their own progress (Ryder, Burton, & Silberg, 2006). Moreover, DI reinforces the achievement of target behaviours with a contingency-management approach (Dolezal, Weber,

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Evavold, Wylie, & McLaughlin, 2007; Ryder, Burton, & Silberg, 2006). Several tutoring programs have been developed based upon the principles of DI; one such program is the *Teach Your Children Well* method (TYCW; Maloney, 1998). This Canadian tutoring program utilizes the well-organized and structured methodology that is characteristic of DI programs and has been implemented within both the general population and child welfare settings to enhance the reading, language and arithmetic skills of educationally-disadvantaged children.

To date, there have been two previous controlled trials assessing the Maloney *TYCW* method (Flynn et al., 2012; Harper & Schmidt, 2016). Flynn and colleagues (2012) assessed the impact of the TYCW direct instruction tutoring intervention delivered by foster parents, compared to a waitlist control group. The sample was comprised of 77 children in care, aged 6 to 13 ( $M = 10.7$  years) and in school grades 2 through 7. Thirty-five children were randomly assigned to a waitlist control group and 42 to the tutoring group. The children in the tutoring group received an average of 3 hours/week of math and reading tutoring for approximately 25 weeks. The results indicated that children in the tutoring group, as compared to the waitlist control group, made significant improvements in sentence comprehension and math computation, but not word reading or spelling (as measured by the Wide Range Achievement Test – 4<sup>th</sup> edition). In a constructive replication of the Flynn et al. (2012) study, Harper and Schmidt (2016) conducted a randomized trial of the TYCW, delivered in a small-group format to children in foster care that were of primarily Aboriginal origins. In this study, 91 children between the ages of 6 to 13 ( $M = 9.93$  years) were randomized to either a waitlist control group or a small tutoring group that was comprised of 3 to 4 students, with two volunteer tutors per group. The tutoring groups ran over a 25-week period, for 2 hours/week. The results indicated that compared to children in the waitlist control group, children that received tutoring

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

significantly improved on word reading, spelling, and mathematics however; in contrast to the findings from Flynn et al. (2012), there was no significant improvement in sentence comprehension. The discrepant finding may be accounted for by the use of a different instruction model (i.e., individual vs. group format), different samples of children in care (i.e., Harper and Schmidt (2012) used a sample of primarily Aboriginal children in care), or may be related to some additional factors unknown at present. However, despite the discrepant results, together, the findings from these two studies suggest that approximately 25 weeks of TYCW tutoring can contribute to accelerated learning, as compared to a waitlist control group. To date, however, no published study has assessed whether a shorter version of TYCW (i.e., 15 weeks) would be as effective as 25 weeks for children in care. If the two tutoring groups are found to be equivalent in terms of improving math and reading skills, the shorter TYCW tutoring program could be a more feasible and cost effective intervention for agencies or schools to implement.

### **Duration of Tutoring Interventions**

To our knowledge, very little published research has been conducted that systematically assesses the effectiveness of various tutoring durations on the ability to improve math and reading skills. Findings from non-experimental research suggest that reaching a minimum threshold of tutoring hours (i.e., approximately 40 or more hours) may be critical to producing measurable effects on students' achievement (Heinrich et al., 2014). Moreover, previous meta-analyses suggest that high-dosage tutoring (i.e., approximately 200 hours per year or more) produces effects on student math and reading achievement that are about four to five times the effect sizes typically reported for academic tutoring (Fryer, 2014). Consistent with this finding, Al Otaiba, Schatschneider and Silverman (2005) randomly assigned young children to one of two tutoring groups: either 4 days/week or 2 days/week of tutoring in reading. Results indicated

that the children in the 4 days/week group made significantly greater gains in reading skills than the children in the 2 days/week group. However, previous researchers have also found no relationship between quantity of tutoring and achievement (Elbaum et al., 2000; Kitano & Lewis, 2007). Given the inconsistent findings on the impact of tutoring duration on math and research skills, as well as the limited systematic investigation of tutoring duration, it is of interest to examine the relationship between hours of academic tutoring and effects on student achievement to assess the possibility that there are growing or diminishing returns to tutoring as the number of hours of tutoring increases.

### **Current Study**

The findings from previous academic intervention studies highlight the ability of such interventions to begin to reduce the academic disparity for children in care. However, an important question for policy makers, researchers, children in care, and foster carers is that of duration: how much of an academic intervention is necessary in order to improve math and reading skills? The present study aimed to begin to explore this question by assessing the relative impact of 15 vs. 25 weeks of the TYCW math and reading direct instruction tutoring for children in care. To our knowledge, no previous research has systematically assessed the impact of tutoring duration on math and reading skills for children in care. The present study also had two secondary objectives. There is a paucity of research examining the variables that may influence the effectiveness of tutoring. Thus, one of the secondary aims of this study was to establish whether age, gender, behavioural difficulties, executive functioning, symptoms of PTSD, or caregiver academic involvement moderate the impact of tutoring duration (i.e., do children with particular characteristics benefit more from the 15 or 25 weeks of TYCW tutoring?). Moreover, it currently remains unclear whether academic tutoring can produce “spill-over” effects in

educationally relevant domains (i.e., behavior, executive functioning, caregiver academic involvement), as very limited research has explored such potential effects. Thus, in order to elucidate such potential relationships, another secondary aim of the current study was to assess whether the TYCW can enhance functioning in these educationally relevant domains.

### **Methods**

The project was an effectiveness trial, conducted under real-world conditions, rather than an efficacy trial carried out under near-ideal, laboratory conditions (Singal, Higgins, & Waljee, 2014). The study was approved by the Social Sciences and Humanities Research Ethics Board of the University of Ottawa.

### **Participants**

Two local Children's Aid Societies (CASs) in Ontario agreed to collaborate in the study (one in Northern Ontario, the other in Central Ontario). Within each collaborating CAS, direct-service staff members (i.e., child welfare workers and their supervisors) nominated foster children who would be suitable to participate in the tutoring intervention. The nominated children were required to meet several eligibility criteria. They needed to be enrolled in school grades 1 - 12, fluent in English (the TYCW program existed only in English), living in a family-style placement (foster or kinship care placement or adoption probation), and assessed as stable by the child welfare worker (such that the child was likely to remain in their current placement for the duration of the study). Foster children were excluded from the study if they were living in a group home or if, in the judgment of the child welfare worker, they were either very strong students (and thus not likely to need the intervention) or else intellectually disabled or very behaviourally disturbed (and thus not likely to complete or benefit from the intervention). Recruitment for the project occurred over two years (year 1, May 2014-September 2014; year 2,

May 2015-September 2015). A priori power analysis was conducted to determine the sample size required to find a medium effect (G\*Power; Buchner, Erdfelder, & Faul, 1996). A total sample of 55 was deemed adequate to find a medium effect of  $f^2 = 0.15$  with 80% power and an alpha level of .05. However, Coyne, Thombs, and Hagedoom, (2010) suggest that a minimum of 35 participants per group, after attrition, is necessary for an adequate sample size in order to find a moderate effect size.

### **Foster Children and Foster Parents Participants (Prior to Attrition)**

375 children in foster or kinship care, or adoption probation, met the inclusion criteria to participate in the project ( $N = 101$  from Agency 1;  $N = 274$  from Agency 2). A total of 83 children in foster care and their foster parents within the collaborating CASs assented and consented, respectively, to participate in the study (see Appendix A for assent and consent forms). Reasons for not participating in the project included: foster home instability, too many behavioural difficulties, and geographic location (i.e., too remote to find a tutor to meet with the student). At the pre-assessment (i.e., in August/September 2014/2015), the 83 foster children were between the ages of 5 and 17 ( $M = 11.45$  years,  $SD = 2.98$ ), and were in primary or secondary school grades 1 through 12 ( $M = 6.67$ ,  $SD = 2.95$ ). Foster parents (4 males; 75 females) on average, had been providing care to the participating child for 3.77 years ( $SD = 3.34$ ). Forty-two children were randomly assigned to the 15-week intervention (57.1% male; 42.9% female) and 41 to the 25-week intervention group (56.1% male; 43.9 % female). See Figure 1 for CONSORT diagram.

### **Research Design and Randomization**

The current study used a pre-test/post-test control group design. Several weeks prior to the pre-test, in preparation for the random assignment of participants to each treatment condition,

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

a permuted-blocks randomization procedure (Beller, Gebiski, & Keech, 2002) was used to ensure that there would be a relatively equal division of the different types of foster children between the experimental and control groups. More specifically, the sample of participants was divided into 7 categories, or strata, of foster children: (a) one girl, (b) one boy, (c) 1 girl and 1 boy (from the same foster home), (d) 2 girls (from the same foster home), (e) 2 boys (from the same foster home), (f) three boys (from the same foster home), and (g) three girls (from the same foster home). For each foster child, an envelope was prepared and then, within each stratum, a table of random numbers was used to randomly assign each envelope to the 15-week or the 25-week group. A slip of paper was inserted into the envelope to indicate to which group the eventual recipient child would be assigned, and the envelope was then sealed, only to be opened at the pre-test immediately after the foster parents and foster children had signed their respective consent forms. This randomization procedure ensured that the number of children in the two experimental conditions (15 and 25 week groups) would be as equal as possible and allowed for cases in which two or more children in the foster home participating in the study to be assigned to the same condition. This, in turn, made the tutoring logistically feasible and eliminated the risk, within any given foster home, of leakage from one condition to the other.

### **Intervention: Tutoring Using the Teach Your Children Well Program.**

All foster children received the Teach Your Children Well (TYCW; Maloney, 1998) tutoring intervention for either 15 or 25-weeks. The TYCW tutoring program was intended to provide three hours a week of individual tutoring to each foster child. The three hours consisted of two 1.5 hour sessions (each of which was divided into 30 minutes of one-to-one direct instruction in reading, 30 minutes of one-to-one direct instruction in math, and the remaining 30 minutes in either math or reading (whichever was the greatest area of weakness of the child)).

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

For participants in the 15 week group, the target total number of tutoring sessions was 30 (or 45 hours of TYCW tutoring), while for participants in the 25 week group, the target total number of tutoring sessions was 50 (or 75 hours of TYCW tutoring). Both the reading and math tutoring consisted of a four-level learn-to-read/learn-to-do-math series of books. For each level of the reading and math series, there was a detailed instructor's manual and a student reader, and for some levels, there was a student workbook. As part of the TYCW program, after the children learn the basic skills associated with their reading and math lesson, they complete a fluency test in which they are required to accurately pronounce a certain number of written words within one minute (for reading), or to accurately calculate a certain number of math problems within one minute (for math). If the child was able to achieve the target number of words and math problems, she/he would be considered to have achieved "mastery"; if they did not, they would need to repeat the lesson until mastery was achieved.

For the current study, to determine at which level of the TYCW program the foster child should begin, his or her current reading level was determined by means of an assessment package, which was conducted by the TYCW coordinator. The foster children began by reading the Level 1 passage aloud. If they made four or more mistakes, they started the program at Level 1. If they made fewer than four mistakes, they read aloud the assessment passage for Level 2, and so on, until their reading level had been identified. Similarly, placement into the math program was also determined by an initial math assessment. The foster children began by completing addition and subtraction math problems. If they scored greater than 80%, they would complete the next level of math problems (multiplication and division problems), and so on, until their math level had been identified.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

To teach and promote behavioural self-regulation, the TYCW program also incorporated a behaviour-management component, to help motivate the foster children to maintain appropriate behaviour during each lesson to optimize learning. The behaviour management component used a reward system, in which the child was to be awarded points for positive behaviour in a given tutoring session. The child could collect a predetermined number of points, agreed upon with the tutor, which could be redeemed for a reward (e.g., playing on the computer). At one CAS, all children also received a reward for every two weeks of tutoring completed (a \$15.00 gift card to a bookstore).

The children in care were assigned to a trained TYCW tutor, based on geographic location and scheduling match (i.e., both tutor and child were available at the same time each week). The TYCW tutors were all adults with a completed, or in progress, undergraduate degree and were paid approximately \$14.00/hour, with mileage. The creator of the TYCW program provided ongoing consultation for the present research project as well as monitoring of student progress over the years 2014-2016.

### *Training of TYCW Tutors*

The TYCW tutors (and the primary investigator) were trained over two full days by the creator of the TYCW program, Michael Maloney. During the training, the tutors were provided with an overview of Direct Instruction and behavioural management techniques (e.g., positive reinforcement). The majority of the training was focused on teaching the tutors how to use the detailed TYCW training manuals. Once taught, the tutors were asked to practice with a fellow trainee while Michael Maloney observed the practice and provided feedback.

### **Measures**

**Woodcock-Johnson-Third Edition (WJ-III; Woodcock, McGrew, and Mather, 2001).** The WJ-III is a norm-referenced, standardized test that assesses basic reading and math skills. It was developed for use with individuals between the ages of 2 years and 90+ years, or in Grades kindergarten through graduate school. For the current study, the following subtests were administered: Letter-Word Identification, Reading Fluency, Story Recall, Understanding Directions, Calculation, Math Fluency, Spelling, Passage Comprehension, Applied Problems, and Story Recall-Delayed, Picture Vocabulary, and Oral Comprehension. These subtests were selected because their administration allows for the calculation of an “intra-achievement” discrepancy score. More specifically, an Oral Language score (derived from the following subtests: Understanding Directions, Picture Vocabulary, and Oral Comprehension) can be used to predict the level of math and reading achievement based upon the individuals’ level of oral language development. A significant discrepancy between Oral Language ability and academic performance (i.e., math and reading) may be used to help substantiate the existence of a specific math or reading learning disability (Woodcock, McGrew, & Mather, 2001).

Scoring of the WJ-III provides an indication of how the individual compares to others of his/her age or grade. For each subtest, corresponding standard scores ( $M = 100$ ,  $SD = 15$ ) are computed from raw scores. A Reading Composite score (i.e., Broad Reading) is obtained by combining the Letter-Word Identification, Reading Fluency, and Passage Comprehension subtests. A Math Composite score (i.e., Broad Math) is obtained by combining the scores for Calculation, Math Fluency, and Applied Problems. The WJ-III demonstrates excellent internal reliability and concurrent validity (Woodcock, McGrew, & Mather, 2001)

**Comprehensive Executive Function Inventory—Parent Version (CEFI; Naglieri & Goldsetin, 2012).** The CEFI (Naglieri & Goldstein, 2012) is a norm-referenced standardized

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

measure of executive functioning in children ages 5 to 18 years. The CEFI is completed by the child or youth's primary caregiver and requires approximately 15-20 minutes to complete. Items are rated on a six-point Likert scale, with end points labeled N (Never) and A (Always). Scoring of the CEFI provides a total standardized score ( $M = 100$ ,  $SD = 15$ ), based on all 100 items. Subscales are also computed for the following: Attention, Emotion Regulation, Flexibility, Inhibitory Control, Initiation, Organization, Planning, Self-monitoring, and Working Memory. For the current study, the total CEFI score was used. Lower total standardized scores indicate a greater likelihood that the child would have difficulty with executive functioning. Internal consistency and test-retest reliability (over 1-4 weeks) are excellent (Naglieri & Goldstein, 2012). In the current sample, coefficient alpha was .89 for the total score.

**Parental Support for Learning Scale – Caretaker version (PSLS, Rogers et al., 2014).** The PSLS was used to assess the extent of caregiver support for educational activities in the home. The PSLS is comprised of 48 items rated on a 5-point scale (1 = I strongly disagree to 5 = I strongly agree), and was completed by the caregiver. Two subscales are computed: instrumental parental involvement and controlling parental involvement. Instrumental parental involvement measures the degree of warmth, patience, and independence regarding school-related choices, with higher scores suggesting more effective involvement. Controlling parental involvement measures the use of commands, punishment, nagging and disapproval regarding the child's schoolwork, with higher scores suggestive of more behavioural and psychological control related to learning (i.e., less effective involvement). In the current study sample, coefficient alpha was .87 for instrumental involvement and .69 for controlling involvement.

**Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997).** The SDQ uses parent or caregiver ratings to assess mental health problems in children and youth aged 4-17,

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

over the past 6-months (Goodman & Goodman, 2011; Goodman & Goodman, 2009). The scale is comprised of 25-items, with five items assessing conduct problems (e.g., often fights with other children or bullies them), five items assessing emotional problems (e.g., often unhappy, depressed, or tearful), five items assessing hyperactivity (e.g., cannot stay still for long, restless), five assessing peer relations (e.g., would rather be alone than with other youth), and five assessing prosocial behaviour (e.g., shares readily with other children). Each of the 25-items are scored on a 3-point Likert scale, ranging from 0 (Not True) to 2 (True). The Total Difficulties score, an amalgamation of the 4 negative behaviour scales (the prosocial subscale is excluded), ranges from 0 to 40, with a higher score demonstrating greater behavioural problems. For males, total difficulties scores between 18 and 40 are in the severe range, scores from 14 to 17 are in the borderline range, and scores from 0 to 13 are in the normal range. For females, total difficulties scores between 16 and 40 are in the severe range, scores from 13 to 15 are in the borderline range, and scores from 0 to 12 are in the normal range. In the current study, coefficient alpha was 0.82 for the 20-item Total Difficulties scale.

**Trauma Symptom Checklist for Children. (TSCC; Briere 1996).** The TSCC (Briere, 1996) is a self-report instrument designed to identify a broad range of symptoms of traumatic experiences in children and adolescents, ages 8–17. This 54-item questionnaire takes approximately 15 minutes to administer. The scale is comprised of two validity scales (indicating over- and under-reporting of symptoms) and six clinical scales (Anxiety, Depression, Posttraumatic Stress, Sexual Concerns, Dissociation, and Anger). Each item is rated on a 4-point Likert scale, with endpoints ranging from 0 (Never) to 3 (Almost all of the time). T-scores can then be calculated, with elevated T-scores indicating greater symptom severity. For the purposes of this study, the alternate form of the TSCC was used (TSCC-A), as it makes no reference to

sexual issues<sup>6</sup>. The TSCC-A is comprised of a total of 44-items and is comprised of the same two validity scales and clinical scales (with the exception of the scale for sexual concerns).

Moreover, given the reading level required to complete this questionnaire, this measure was administered to children aged 10 years and older. The total Posttraumatic Stress score was used in the current study. Convergent and discriminant validity has been established (Briere, 1996; Sadowski & Friedrich, 2000) as well as adequate test-retest reliability (Nilsson, Wadsby, Svedin, 2008). In the current study sample, coefficient alpha was 0.96.

**Trauma Symptom Checklist for Young Children (TSCYC; Briere, 2001).** The TSCYC is a parent-reported measure that is used to identify a broad range of symptoms of traumatic experiences in young children, ages 3-12; in the current project, the TSCYC was administered to caregivers of children aged 5-9 years. The TSCYC is comprised of 90 items rated on a 4-point scale (1 = Not at all to 4 = Very Often). Subscales are computed for the following: Anxiety, Depression, Anger/Aggression, Posttraumatic Stress-Intrusion, Posttraumatic Stress-Avoidance, Posttraumatic Stress-Arousal, Dissociation, and Sexual Concerns. A total Posttraumatic Stress scale (which was used in the current study) is obtained by summing the raw scores for Posttraumatic Stress-Intrusion, Posttraumatic Stress-Avoidance, and Posttraumatic Stress-Arousal. T-scores can then be calculated, with elevated T-scores indicating greater symptoms of posttraumatic stress. More specifically, a T-score that is greater than 69 is considered to be “clinically significant”, a T-score between 65-69 is considered to be “potentially problematic”, and T-scores below 65 are considered “normal”. The TSCYC has been found to have adequate validity and test-retest reliability (Briere, 2001; Nilsson, Gustafsson, & Svedin, 2012). Coefficient alpha for the current study sample was 0.96.

---

<sup>6</sup> This was at the request of the collaborating agencies.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

**Foster parent questionnaire.** This questionnaire was developed by the study research team and administered at the pre- and post-tests (see Appendices C & F). Foster parents were asked to provide background information (e.g., number of children in the home, length of time as a foster parent), as well as updates on the children's medication, Individualized Education Plans (IEPs), etc.

**Child welfare worker background information form.** This questionnaire was developed by the study research team. Once the children had been referred to the project by their child welfare workers, the latter were asked to complete this questionnaire, which consisted of background information about the children in care (e.g., age of entry into care, maltreatment history; see Appendix B).

**Tutoring experiences questionnaire (TEQ).** The TEQ was developed by the study research team and was administered to all children at the post-assessment (see Appendix G). The children were asked about the quality of their tutoring sessions, the amount learned, as well as what they liked most and least about the program.

### **Training of Assessors**

Training on all of the assessment measures (i.e., on administration of the questionnaires and the WJ-III) was provided by the primary investigator. At each participating agency, the primary investigator held a 4-day training event in which the assessors were provided a general overview of the research project and a review of the questionnaires for caregivers and children in care. Most of the training focused on learning the WJ-III. The assessors practiced test administration with the primary investigator and were given a “mock” child to test (a university graduate research assistant). Following this, all of the assessors were observed while conducting three “live” assessments with study participants, with corrective feedback provided in the

moment. Next, to help ensure the fidelity of data collection, following the completion of approximately 10 assessments, these assessments were sent to the primary investigator for scoring review. The raw scores were calculated and then entered into the computer scoring software. If any scoring errors were found, the assessors were contacted immediately and the scoring was reviewed with them.

### **Performance Monitoring**

All tutors were asked to complete a weekly data monitoring form in which they were asked to measure sound fluency (i.e., the number of sounds read from a list of sounds per 30 s), word fluency (i.e., the number of words read from a word list per 30 s), and story fluency (i.e., the number of words read from a story in 1 min). The tutors also recorded the number of lessons completed during the week and the amount of time spent on reading tutoring and math tutoring (see Appendix J). Once submitted to the primary investigator (AJH), these data were placed onto weekly spreadsheets and sent to the TYCW coordinator for monitoring. If the primary investigator did not receive the weekly data, she would follow up with email reminders and phone calls, as needed. These data served to assess the degree of fidelity with which the tutors were implementing the tutoring intervention.

### **Data Analysis**

All statistical analyses were conducted using SPSS Version 24. Prior to testing the hypotheses, the data were screened for missing data and outliers in accordance with guidelines presented by Tabachnick and Fidell (2007)<sup>7</sup>. Data were assessed for skewness and kurtosis. At pre-test, symptoms of PTSD for younger and older children (as measured by the TSCC and

---

<sup>7</sup> Outlying cases (as determined via a residual analysis, Tabachnick & Fidell, 2013) were initially retained and the data were analyzed twice: with and without the univariate outliers; if the results were not significantly different, the complete dataset (i.e., containing outliers) was retained and reported. Moreover, outliers were left in the dataset as they did not correlate with the outcome variables. As such, they were not deemed to be “influential” outliers.

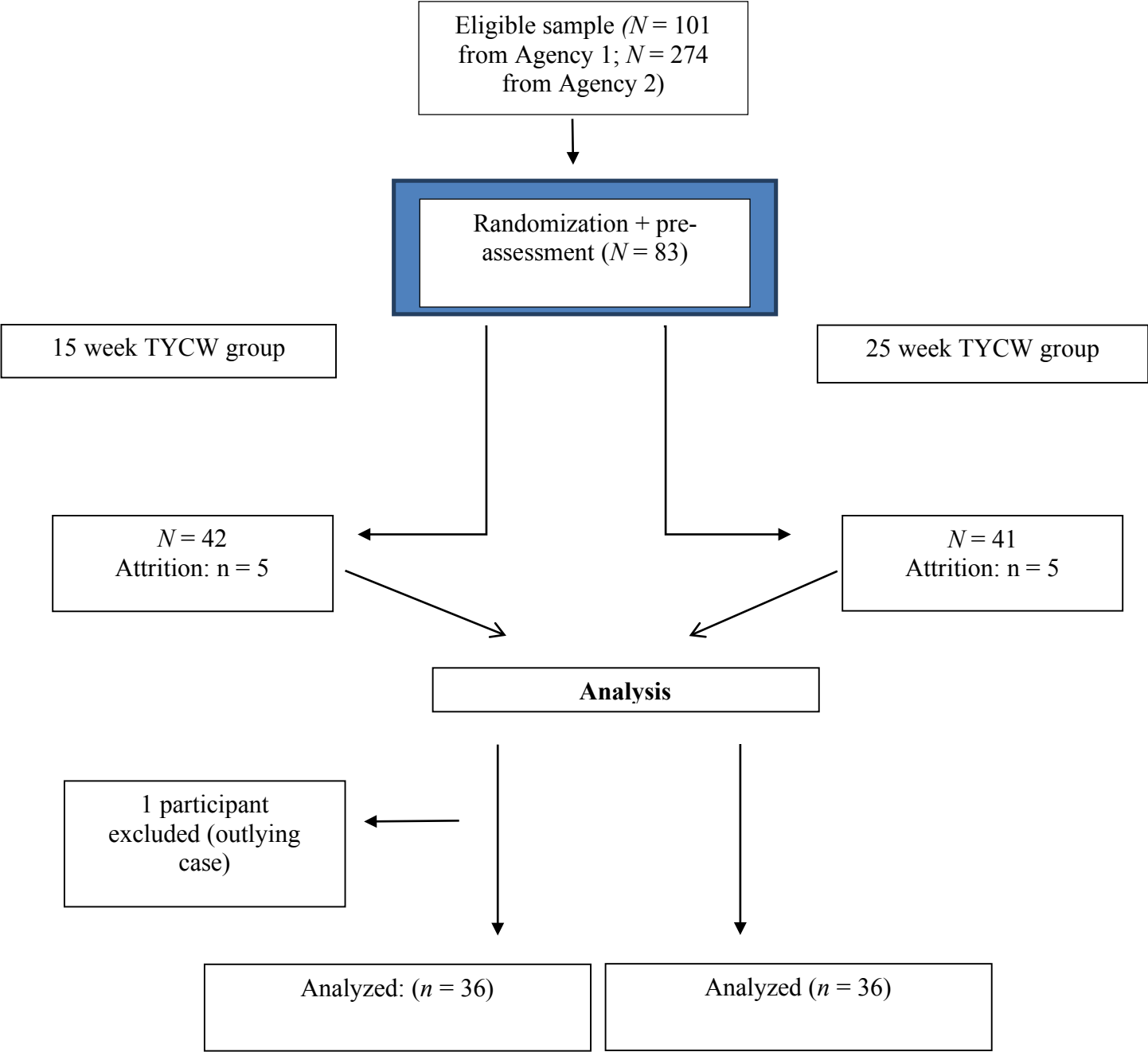
## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

TSCYC respectively) were positively skewed. At post-test, Broad Reading, Spelling, and Calculation were negatively skewed, while executive functioning (as measured by the CEFI) was positively skewed (see Table 1). Skewed variables were not transformed for ease of interpretation (Tabachnick & Fidell, 2013). One extreme univariate outlier was found from the 15-week group (i.e., z score > 4.0 on one WJ-III subtest and > 3.3 on multiple other WJ-III subtest scores); as such, that individual was removed from the data analysis.

### **Missing Data**

All variables had less than 10% of missing data, with the majority having less than 5% missing data. Due to the relatively small amount of missing data, the expectation maximization (EM) algorithm in SPSS was used to address the missing data at the item level, rather than mean substitution or multiple imputation (Schafer & Graham, 2002).

Figure 1. CONSORT diagram (Schulz, Altman, & Moher, 2010)



### **Primary Data Analysis**

ANCOVA via hierarchical multiple regression was used to assess whether the 15 weeks of tutoring was as effective as the 25 weeks of tutoring in terms of improving math and reading skills for the children in care. Baseline math and reading skills served as the covariates and were entered at step 1. Next, group (15 or 25 weeks of TYCW) was entered at step 2. ANCOVA via regression was also used to assess whether the 15 or 25 weeks of TYCW tutoring was effective in closing the “intra-achievement” gap, as measured by the WJ-III. Descriptive analyses were conducted to assess children’s experience with the TYCW program.

### **Secondary Data Analyses**

ANCOVA via hierarchical multiple regression was also used to conduct an attribute-treatment interaction analysis (Cronbach & Snow, 1977). This was done in order to explore whether age, gender, executive functioning, behavioural difficulties, symptoms of Post-Traumatic Stress Disorder, or caregiver involvement in academic activities in the home, moderated the effectiveness of the 15 or 25 weeks of TYCW tutoring; that is, did certain characteristics make a child more or less likely to benefit from the 15 or 25 week group? The children’s pretest scores on the WJ-III served as a covariate (entered at step 1), followed by group (entered at step 2). At step 3, and one at a time, age, gender, pre-test scores on executive functioning (as measured by the CEFI), total behavioural difficulties (as measured by the SDQ), degree of PTSD (as measured by the total score on the TSCC or TSCYC), or the degree of instrumental and controlling caregiver involvement in academic activities in the home (as measured by the PSLs), were entered. Finally, at step 4, the multiplicative formed terms, between group and each moderator were entered. Separate ANCOVAs were conducted for age, gender, and each of the 4 educationally relevant measures (executive functioning, behaviour,

symptoms of PTSD, caregiver involvement in academics in the home), as well as for each of the WJ-III subtests. Given the two different measures of PTSD that were utilized in the current study (TSCC for children 10 years and older and the TSCYC for children ages 5-9), separate ANCOVAs were conducted for the separate PTSD measures.

ANCOVA via multiple regression was also conducted to explore the extent to which tutoring may produce “spillover effects” in educationally relevant domains for children in care, specifically: executive functioning, behavioural difficulties, and caregiver involvement in academic activities in the home. The pre-test scores on each of the educationally relevant measures were entered at step 1, group was entered at step 2, and the post-test score on each of the educationally relevant domains was the dependent variable. (See Table 3 for correlations between all moderators and WJ-III subtests).

### **Effect Size Index**

Cohen’s  $d$  was used as the measure of effect size, to determine the magnitude of the treatment effect of the tutoring interventions (i.e., between 15 and 25 weeks of TYCW tutoring). These effect sizes were conservative, as we took into account the correlation between pre and post math and reading scores by using the formula for dependent groups,  $d = t_c[2(1-r/n)]^{1/2}$  (from Dunlap, Cortina, Vaslow, & Burke, 1996).

According to the WWC Procedures and Standards Handbook (WWC; 2008), an effect size equal to or greater than 0.25 should be deemed “substantively important”, even though the effect size may not have reached statistical significance, because it reflects a minimum of a 10-percentile point difference between the means of the control and intervention groups on a normal

distribution. As such, the current study applied the recommended criterion to denote any effects that could be considered substantively important.<sup>8</sup>

### Results

#### Equivalence of Intervention and Control Groups at Pre-Intervention

There were no statistically significant differences ( $p > 0.05$ ) between the two tutoring groups at pre-intervention in terms of gender, age of first placement, behavioural difficulties, executive functioning, symptoms of PTSD, controlling caregiver involvement, and any of the WJ-III subtest scores. A significant difference between groups was found, however, for age (15 week group:  $M = 10.28$ ,  $SD = 2.78$ ; 25-week group:  $M = 12.18$ ,  $SD = 2.97$ ), grade (15 week group:  $M = 5.44$ ,  $SD = 2.72$ ; 25 week group:  $M = 7.77$ ;  $SD = 2.96$ ) and instrumental caregiver involvement (15 week group:  $M = 34.97$ ,  $SD = 7.00$ ; 25 week group:  $M = 31.36$ ,  $SD = 5.18$ ), see Table 4. However, these variables were not correlated with any of the outcome variables, and as such were not controlled for in the data analyses (see Table 3).

#### Attrition

From pre to post intervention, five children from the 15 week group (11.9%) and five from the 25 week group (12.2%) withdrew from the study. The overall rate of attrition was 12.0%. A drop out was defined as a child who completed less than 10 tutoring sessions and/or declined to participate in a post assessment. Reasons for attrition from the 15 week tutoring

---

<sup>8</sup> Lipsey and colleagues (2012) suggest that in “intervention areas that involve hard to change low baserate outcomes, [...], the most impressively large effect sizes found to date fall well below the .20 that Cohen characterized as small” (p.4). According to Lipsey and colleagues (2012), educational research is included in the areas that are “hard to change”, and as such, the magnitude of effect sizes, when compared to those within other “easier to move” domains, may lead to inappropriate and misleading interpretations of results. In a recent compilation of effect sizes from randomized studies of educational interventions, Lipsey et al. (2012) found that among the effect sizes for one-to-one interventions, the median effect size was 0.29, only slightly larger than the WWC (2008) benchmark of 0.25. This supports Lipsey et al.’s (2012) suggestion that the traditional criteria put forth by Cohen (1988) of 0.20 (small), 0.50 (medium), and 0.80 (large) are inappropriate when applied to educational research. As such, the current thesis will adopt the median effect size of 0.29 from Lipsey et al. (2012), which is equivalent to a “medium” effect size.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

group were as follows: 1 child was reunited with his biological parents and did not want to continue, 1 child dropped out due to mental health problems, 1 child dropped out after 1 session of tutoring as he was no longer interested in participating, and 2 children dropped out as their foster mother was ill. For the 25 week tutoring group, the reasons for drop out were as follows: 1 child moved foster homes, 1 child demonstrated increasing behavioural issues, 1 child's tutor was not reliability attending sessions and the child dropped out due to reported frustration, 1 child's tutor left the project to pursue another career and the child did not want to continue with a new tutor. In terms of number of tutoring sessions completed, for participants in the 15 week group (30 sessions), the majority reached the target number of sessions ( $M = 30.22$  sessions,  $SD = 2.70$ , range = 25-43). Similarly, for participants in the 25 week group (50 sessions), the majority completed close to the target number of sessions ( $M = 46.19$ ,  $SD = 9.56$ , range = 18-56). Moreover, for participants in the 15 week group, the children received on average 43.30 hours of tutoring, which was comprised of 23.29 hours of tutoring in reading ( $SD = 4.54$ ) and 19.53 hours of tutoring in math ( $SD = 4.85$ ); for participants in the 25 week group, the children received on average of 67.28 hours of tutoring, with 35.98 hours of tutoring in reading ( $SD = 11.86$ ) and 30.58 hours of tutoring in math ( $SD = 10.10$ ). No association was found between dropping out and the variables of gender, age, grade, behavioural difficulties (as measured by the SDQ), executive functioning (as measured by the CEFI), caregiver involvement in academic activities (as measured by the PSLS) or any of the WJ-III subtest scores.

### **Effectiveness of 15 vs. 25 weeks of TYCW Tutoring**

Using ANCOVA via multiple hierarchical regression with the WJ-III subtest scores and Broad Reading and Broad Math composite scores as the dependent variables, we found no significant differences between-group effects on any of the WJ-III subtest scores. However, a

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

trend towards significance was found for Math Fluency,  $B = -3.94$ ,  $t(71) = -1.87$ ,  $p = .07$ ,  $R^2$  change = .02. Moreover, with the removal of 1 univariate outlier, the trend became significant,  $B = -4.89$ ,  $t(70) = -2.53$ ,  $p < .05$ ,  $R^2$  change = .04, with children in the 15 week group performing better on Math Fluency at post test, compared to children in the 25 week TYCW group. Another trend towards significance was found for Applied Problems,  $B = -3.07$ ,  $t(71) = -1.86$ ,  $p = .07$ ,  $R^2$  change = .02, with children in the 15 week tutoring group performing better on Applied Problems post-test, compared to children in the 25 week group.

Given the relative lack of statistically significant effects between the 15 and 25 week TYCW interventions, we examined whether the pooled sample as a whole made gains from pretest to posttest on the WJ-III subtests. Thus, we computed a series of paired  $t$ -tests between the pretest and posttest WJ-III subtest scores and Broad Reading and Broad Math composite scores for the pooled sample of 73 participants. A Bonferroni correction was used to control the overall alpha level, given the multiple comparisons conducted (the per-comparison criterion used was  $0.05/9 = 0.006$ ). Table 2 displays these results. Except for Spelling and Reading Comprehension, the participants made large and statistically significant ( $p < 0.001$ ) gains on all of the WJ-III subtests and Broad Math and Broad Reading composite scores (see Table 2). Of the significant findings, the effect sizes (Cohen's  $d$ ) for the subscales and the two composite scores were mainly of medium size, ranging in size from 0.22 to 0.47. With the exception of Letter Word Identification, the remaining statistically significant findings were all well above the threshold of 0.25 that the WWC (2008) considers to demarcate substantively important effects.

### **Discrepancy Analyses**

ANCOVA via multiple regression was also used to assess whether the 15 or 25 weeks of TYCW tutoring reduced the discrepancy between actual and predicted Broad Math or Broad

Reading scores. A decrease in the discrepancy would be suggestive of an increase in ability/achievement (Woodcock, McGrew, & Mather, 2001). A pre and post-test “difference” score was first calculated by subtracting the predicted Broad Reading and Broad Math scores (based on each participant’s Oral Language score) from the actual Broad Reading and Broad Math scores. Next, the pre test “difference” score was entered at step 1, followed by group (15 or 25 weeks of TYCW) at step 2. The post test “difference” score was entered as the dependent variable. Separate ANCOVAs were conducted for Broad Math and Broad Reading discrepancy scores.

**Broad Reading Discrepancy.** For Broad Reading, no significant group effect was found, ( $B = -.83$ ,  $t[68] = -.51$ ,  $p = .61$ ). Given the lack of a significant group effect, a paired samples  $t$ -test (collapsed across groups) was subsequently conducted. The paired samples  $t$ -test revealed a significant difference in Broad Reading discrepancy scores from pre to post test, with a significant decrease in the difference score at post test,  $t(68) = 2.60$ ,  $p = .01$ , ( $M$  at pre test = 10.51,  $SD = 10.95$ ;  $M$  at post test = 8.01,  $SD = 10.95$ ).

**Broad Math Discrepancy.** For Broad Math, no significant group effect was found, ( $B = 2.21$ ,  $t[68] = 1.14$ ,  $p = .26$ ). A subsequent paired samples  $t$ -test (collapsed across groups), revealed a significant difference in Broad Math discrepancy scores from pre to post test, with a significant decrease in the difference score at post test,  $t(68) = 3.87$ ,  $p = .00$ , ( $M$  at pre test = 21.12,  $SD = 12.74$ ;  $M$  at post test = 16.94,  $SD = 12.74$ ).

### **Children’s Experience with the TYCW Program**

Descriptive statistics revealed that children in both tutoring groups generally found the intervention helpful in improving their math and reading skills and overall in school

performance. Moreover, the majority of children reported that getting more of the TYCW tutoring would be helpful, see Table 5.

### **Moderation Analysis**

We conducted an ‘attribute-treatment interaction’ analysis (Cronbach & Snow, 1977), with ANCOVA via hierarchical multiple regression, to explore whether tutoring duration was as effective, to the same degree, for children with different characteristics. More specifically, we explored whether age, gender, behavioural difficulties, executive functioning, symptoms of PTSD, and caregiver academic involvement moderated the effectiveness of the 15 or 25 week tutoring group. No significant main effects or interactions were found between group and gender, behavioural difficulties, symptoms of PTSD (for younger children), or controlling caregiver academic involvement.

The hierarchical regression revealed a group X age interaction, however, at the level of a trend, for Passage Comprehension,  $B = 1.45$ ,  $t[71] = 1.87$ ,  $p = .07$ ,  $R^2$  change = 0.03. Follow-up simple slopes analysis revealed that younger children benefited more from the 15 week program than from the 25 week program. The hierarchical regression also revealed a main effect (at the level of a trend) for executive functioning, such that children with higher executive functioning performed worse on Letter Word Identification,  $B = -.09$ ,  $t[71] = -1.72$ ,  $p = .09$ ,  $R^2$  change = .01. The hierarchical regression revealed a significant group X CEFI interaction for Calculation,  $B = -.47$ ,  $t[71] = -2.34$ ,  $p < .05$ ,  $R^2$  change = .04. Follow-up simple slopes analysis revealed that children with high executive functioning at pre-test, benefited more from 15 weeks of tutoring, compared with 25 weeks of tutoring.

The hierarchical regression revealed a group X symptoms of PTSD (for older children; ages 10+) interaction, at the trend level, for Letter Word Identification,  $B = .25$ ,  $t[48] = 1.85$ ,  $p =$

.07,  $R^2$  change = .01. Moreover, the regression revealed another interaction between group X symptoms of PTSD (for older children) for Math Fluency at the trend level,  $B = .27$ ,  $t[48] = 1.74$ ,  $p = .09$ ,  $R^2$  change = .02. Follow-up simple slopes analysis revealed that older children in the 25 week group with greater symptoms of PTSD performed better than children with greater symptoms of PTSD in the 15 week group.

The hierarchical regression also revealed a group X instrumental involvement interaction (at the level of a trend) for Spelling ( $B = .74$ ,  $t(71) = 1.73$ ,  $p = .09$ ;  $R^2$  change = .01), Letter-Word Identification ( $B = .45$ ,  $t(71) = 1.71$ ,  $p = .09$ ;  $R^2$  change = .01), and Broad Math ( $B = .58$ ,  $t(71) = 1.75$ ,  $p = .09$ ;  $R^2$  change = .01), such that children in the 15 week group made greater improvements in these WJ-III subtests with greater levels of instrumental caregiver involvement.

### **“Spillover Effects” of Tutoring onto Educationally Relevant Domains**

ANCOVA via multiple hierarchical regression was conducted to assess whether the receipt of TYCW tutoring was associated with any change in the performance in educationally relevant areas (namely: executive functioning, behavior, or caregiver academic involvement). Pre test scores on each of the educationally relevant domains were entered at step 1 followed by group (15 or 25 weeks of TYCW) at step 2. The post test score on each of the domains was the dependent variable. Separate ANCOVAs were conducted for each of the three domains. The ANCOVA via regression revealed no significant differences between the adjusted post test group means and executive functioning, behavior, or controlling caregiver involvement in academic activities,  $ps > .10$ . A trend towards significance was found for instrumental caregiver involvement in academic activities,  $B = 2.00$ ,  $t(71) = 1.71$ ,  $p = .09$ ,  $R^2$  change = .02, such that instrumental caregiver involvement increased as the amount of tutoring increased.

### **Discussion**

The aim of the current study was to examine whether a shorter version (i.e., 15 weeks and 30 sessions) of the TYCW math and reading tutoring was as effective as a longer version (i.e., 25 weeks and 50 sessions) in improving math and reading skills for children in care. This is the first published study to systematically assess the relative effectiveness of two tutoring “dosages” on improving the math and reading skills of children in care. The aim of the current study was also to explore the degree to which educationally relevant variables moderated the effectiveness of the two tutoring groups (i.e., to explore whether certain characteristics made a child more or less likely to benefit from the 15 or 25 weeks of tutoring) and also to explore the degree to which tutoring produced “spillover” effects onto educationally relevant domains (i.e., age, gender, executive functioning, behavior, and caregiver academic involvement).

#### **Effectiveness of the TYCW Program**

The results indicated that the 15 weeks of TYCW tutoring was generally as effective as the 25 weeks of TYCW tutoring in improving Letter-Word Identification, Reading Fluency, Broad Reading composite, Calculation, Applied Problems, and Broad Math composite. Moreover, the results suggested that the 15 weeks of TYCW tutoring was significantly more effective than the 25 weeks of tutoring in improving Math Fluency. However, neither tutoring group was effective in improving Spelling or Passage Comprehension (after correcting for multiple comparisons). Moreover, the findings from the current study also suggest that the TYCW tutoring program, as a whole, significantly decreased the “intra-achievement” oral language and academic gap, that is the difference between estimated academic skill performance (based on oral language ability) and actual academic skill performance, providing additional support that the intervention was somewhat effective in producing accelerated learning across

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

both groups. Descriptive statistics revealed that children in both tutoring groups reported benefiting from the program in terms of improving math and reading skills. Moreover, caregivers reported similar levels of improvement in the math and reading skills as well as the self-esteem and behavior of their child in care (see Table 6).

The current findings are consistent with previous research suggesting that higher tutoring dosages do not necessarily accelerate learning more than shorter dosages (Elbaum et al., 2000; Kitano & Lewis, 2007). Some researchers have hypothesized that one potential contributing factor to this finding is that children lose motivation to achieve with longer interventions (Steenbergen-Hu & Cooper, 2013). However, the current findings stand in contrast to other research which suggests that increased tutoring duration does produce larger effect sizes (i.e., a linear dose-response relationship) for children at risk academically, particularly for math (Heinrich et al., 2014), with tutoring dosages beyond 200 hours being the most effective in helping academically at-risk children improve in both math and reading (Fryer, 2014). The inconsistent results may be attributed to the majority of previous research being quasi-experimental (i.e., lacking random assignment). Interestingly, tutoring intensity (i.e., frequency of tutoring) has been suggested to be more powerful than tutoring duration (i.e., length of tutoring) in producing accelerated learning (Elbaum et al., 2000). Thus, given that the intensity was the same for both groups in the current study (i.e., approximately 3 hours/week), future research should assess varying degrees of intensity to disentangle the impact of intensity versus duration. Moreover, perhaps the core components of one-to-one DI instruction tutoring (e.g., error correction procedures, repetition) are sufficient to make an impact on academic outcomes with as few as 30 sessions or as many as 50. Taken together, the primary research findings suggest that 15 weeks of TYCW tutoring is as effective as 25 weeks in improving math and

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

reading skills for children in care. However, it is essential to consider that the lack of a group difference may or may not be attributed solely to the TYCW program. Firstly, the lack of significant group differences may be in part due to the relatively small sample size, and thus low power, in the current study. Indeed, Coyne, Thombs, and Hagedoom, (2010) suggest that a minimum of 35 participants per group, after attrition, is necessary for an adequate sample size in order to find a moderate effect size. While the current study consisted of 36 children in each experimental group (despite two years of recruitment), this is arguably minimally powered and may thus not be strong enough to detect significant group differences. As such, future studies should try to include a larger sample size. Secondly, given the lack of a control group in the current study, it is difficult to disentangle the degree to which the observed improvements in math and reading are attributable to the TYCW program, environmental characteristics (e.g., lack of motivation), or to additional schooling. However, previous literature can help to clarify. Flynn and colleagues (2012) assessed the effectiveness of a caregiver delivered one-to-one TYCW program over 25 weeks. In this study, it was reported that for children in the waitlist control group, an additional year of school did not significantly improve children's performance in word reading, sentence comprehension, spelling, or math computation. Moreover, in a constructive replication of the Flynn et al. (2012) study, Harper and Schmidt (2016) utilized the same TYCW program and assessed the effectiveness of the program, delivered in a small group format for improving math and reading skills of a sample of primarily Aboriginal children in care. The results of the study by Harper and Schmidt (2016) suggested that the receipt of TYCW tutoring, collapsed across groups, was significantly more effective than an additional year of schooling in improving Word Reading, Spelling, and Math. Together, these initial studies provide support for the effectiveness of the TYCW program in being able to accelerate learning, beyond what an

additional year of schooling can produce. Indeed, previous research suggests that an additional year of classroom teaching typically only produces a median effect size of 0.08, compared with 0.29 for individual intervention (including one-to-one tutoring) (Lipsey et al., 2012). Thus, given that the effect sizes in the current study ranged in size from 0.22 to 0.47, it is quite possible that these effects are mainly due to the effects of the TYCW program, rather than to an additional year of schooling. Interestingly, previous research suggests that programs of moderate duration (i.e., 44 to 84 hours) tend to show positive and significant effect sizes for both math and reading (Lauer et al., 2006). Thus, given that all of the children in the current study received a minimum of about 44 hours of tutoring, it may be that the lack of significant group differences is due in part, to both groups having received a “sufficient” dose of tutoring. Future studies should vary the tutoring dosage outside of the moderate duration range, (i.e., less than 44 hours) to assess the true impact of a low-duration tutoring program on academic achievement and also to determine whether there is a minimum number of hours needed for children to gain the most benefit from the TYCW program.

### **Treatment Interaction Analysis**

The results of the current study suggested that children with high executive functioning benefited more from the shorter tutoring intervention. However, caution should be used in interpreting this finding, given the significant age difference between the two groups (approximately 2 years), which may be a confound. As such, the impact of executive functioning on tutoring for children in care should be explored further and replicated in future studies. The current findings also demonstrated that age, symptoms of PTSD (for older children), and the degree of instrumental caregiver involvement in academics also moderated the effectiveness of

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

the two programs, at the level of a trend. However, the relatively small amount of variance explained by these variables suggests that their impact on tutoring was quite small.

Very few existing studies have assessed variables that may moderate the impact of tutoring. Of the limited research with children in the general population, the majority have utilized age or grade as moderating variables, with findings indicating that younger children tend to benefit more from tutoring than older children (Cohen, 1982; Rohrbeck, Ginsburg-Block, Fantuzzo, & Miller, 2003). Interestingly, in a meta-analysis of peer tutoring for children in the general population, Bowman-Perrott, Davis, Vannest, and Williams (2013) found that the use of rewards positively moderated the effectiveness of tutoring, particularly for students in secondary school. For children in care, virtually no published research has assessed potential moderating variables on the effectiveness of tutoring. In a follow-up analysis of Flynn et al.'s (2012) direct instruction tutoring study with children in care, Marquis (2013) found that gender moderated the effectiveness of the caregiver delivered tutoring program, such that girls benefited slightly more from tutoring than boys. The current study findings provide preliminary evidence that educationally relevant characteristics of children in care may influence the effectiveness of tutoring. However, more research is needed to better understand how particular characteristics (e.g., within the child or environment) impact the effectiveness of tutoring in order to enhance the effectiveness of tutoring. For example, does the presence of a learning disability affect outcomes? Do children that have been in the same foster home for a prolonged period of time gain more or less from tutoring than children that are new to a home? Indeed, as suggested by Steenbergen-Hu and Cooper (2013), when addressing the effectiveness of academic interventions, one ought to ask the questions: for whom, compared with what, and in what circumstances.

### **Spillover Effects**

A secondary aim of the current study was to assess whether the receipt of tutoring would alter functioning in educationally relevant domains (i.e., executive functioning, behavior, or level of caregiver academic involvement). The current study did not find any significant “spillover” effects, but a trend towards significance was found for instrumental caregiver involvement. That is, after controlling for baseline levels of instrumental caregiver involvement, the amount of instrumental caregiver involvement increased as the amount of tutoring increased; suggesting that instrumental caregiver involvement in academics may grow as tutoring duration grows. This finding is of particular interest, given the link between parental involvement in academics and positive academic outcomes for their children (Hill & Tyson, 2009; Monti, Pomerantz, & Roisman, 2014; Rogers, Hickey, Wiener, Heath, & Noble, in press). Despite this finding, the relative lack of spillover effects is consistent with those documented by Marquis (2013), Harper (2012), and Tideman et al. (2011), in which there was very little gain in the mental health of children in care after having received tutoring or an individualized academic plan. However, the limited power in the current study may not have been sufficient to find significant spillover effects.

### **Implications for Research and Implementation**

The findings from the current study provide preliminary evidence for use of a shorter TYCW tutoring program to help improve math and reading skills for children in care. Several recommendations can be made, however, to improve the effectiveness of the program.

The children in care in the present study ranged in age from 5-17 years. Previous research has found that academic tutoring is often more successful in improving academic skills for children when administered at an earlier age (Rohrbeck, Ginsburg-Block, Fantuzzo, & Miller,

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

2003). Moreover, Finnie (2012) has argued that critical educational decisions (e.g., deciding to obtain post secondary education (PSE)) are influenced especially by parental messages early in life, rather than at or near the end of high school. Thus, if an intervention comes too late, the children may not benefit as greatly and may have already dismissed PSE as a future option. It would be of benefit for agencies to administer both cognitive and academic testing to all children upon entry into care. This would allow for earlier and more targeted academic intervention. Moreover, given the relationship between parental academic involvement and better academic success of their children (Hill & Tyson, 2009), future academic intervention research should also promote caregiver engagement. Indeed, previous research has found that children in care describe their caregivers as being highly influential of their educational aspirations (Weegar, Hickey, Shewchuk, Fall, & Flynn, 2017). Thus, academic interventions for children in care should tap into this valuable resource by continuing to engage caregivers in program-related (e.g, tutoring) and school-related activities. Historically, there has been a tendency for intervention research and practice to treat mental health separately from academics. However, given the high prevalence of mental health problems among children in care (Ford, Vostanis, Meltzer, & Goodman, 2007; Pilowsky & Wu, 2006), and the known link between good mental health and academic success (Romano et al., 2014), future research should better assess whether academic tutoring (e.g., TYCW), paired with mental health intervention, can improve functioning in both domains. Moreover, it is uncertain the degree to which improvements in academic skills made from tutoring are sustained over the longer term for children in care. Previous research suggests that the effects of tutoring may decrease 1-2 years following the end of a tutoring program for children in the general population (Suggate, 2010). It would thus be of interest to assess the sustainability of academic interventions for children in care.

### **Limitations and Future Directions**

The results of the current study should be interpreted within the context of the following limitations. First, this study had a relatively small sample. Despite recruiting participants over a two-year period, it was quite challenging to enroll children in the project. Many caregivers reported not having the time to dedicate to the project. A larger sample size would better allow for the effectiveness of the intervention to be tested across additional variables of interest, such as executive functioning subscale scores (e.g., working memory, attention). This type of in-depth analysis would help to determine the tutoring dose that would be most beneficial and appropriate for different groups of children. Moreover, the sample included participants who met strict inclusion criteria (i.e., few behavioural difficulties, stable foster/kinship home or on adoption probation, English speaking). As such, the participants may not be representative of all children in care; future studies should include a larger and broader sample. As previously discussed, another limitation was the lack of a true control group (e.g., a third group). While previous literature can be used to guide the interpretation of the findings (i.e., to help disentangle the true impact of the TYCW program versus additional schooling; Flynn et al., 2012; Harper & Schmidt, 2016), future research should include a waitlist control group, if possible. While tutors completed a fidelity measure of their tutoring sessions, the measure is limited in that it is self-report and historical in nature (i.e., tutors completed the forms at the end of the tutoring sessions). To better assess the fidelity of the TYCW method, future research should utilize audio or video recording of randomly selected tutoring sessions in order to determine the extent to which tutors adhered to the TYCW program. Furthermore, it would be of interest for future studies to include an economic evaluation (i.e., cost-benefit analysis) to understand the economic advantages of new academic interventions (Evans et al., 2017).

### **Conclusions**

The current study examined whether 15 weeks of TYCW math and reading tutoring was as effective as 25 weeks of TYCW math and reading tutoring in being able to improve the academic skills of children in care. To our knowledge, this was the first study to systematically examine the impact of different tutoring doses on math and reading skills for children in care. After collapsing across groups, the results provided preliminary support that the shorter version of the program was as effective as the longer version in being able to improve Letter Word Identification, Reading Fluency, Calculation, Math Fluency, and Applied Problems. Results also indicate that particular educationally relevant constructs (i.e., age, gender, executive functioning, symptoms of PTSD, and caregiver academic involvement) may influence the effectiveness of the shorter and longer TYCW programs. Furthermore, there was a trend for instrumental caregiver involvement to increase as the amount of tutoring increased.

The findings of the present study contribute to the emerging body of research focused on the identification of interventions that can contribute to reducing the academic disparity for children in care. Experts have called for increased empirical evidence in this area to improve our understanding of what governments, educational institutions, and community partners can do to improve academic outcomes for these children (Evans et al., 2017; Forsman et al., 2012)

**References**

- Al Otaiba, S., Schatschneider, C., & Silverman, E. (2005). Tutor-assisted intensive learning strategies in kindergarten: How much is enough?. *Exceptionality, 13*(4), 195-208.
- Beller, E. M., Gebski, V., & Keech, A. C. (2002). Randomisation in clinical trials. *Medical Journal of Australia, 177*(10), 565-567.
- Berger, L. M., Cancian, M., Han, E., Noyes, J., & Rios-Salas, V. (2015). Children's academic achievement and foster care. *Pediatrics, 135*, 109-116.
- Borman, G.D., Hewes, G.M., Overman, L.T., & Brown, S. (2003). Comprehensive school reform and achievement: A meta-analysis. *Review of Educational Research, 73*, 125-230.
- Briere, J. (1996). Trauma symptom checklist for children. *Odessa, FL: Psychological Assessment Resources, 00253-8*.
- Briere, J., Johnson, K., Bissada, A., Damon, L., Crouch, J., Gil, E., ... & Ernst, V. (2001). The Trauma Symptom Checklist for Young Children (TSCYC): Reliability and association with abuse exposure in a multi-site study. *Child Abuse & Neglect, 25*, 1001-1014.
- Cheung, C., Lewin, K., & Jenkins, J. M. (2012). Helping youth in care succeed: Influence of caregiver involvement on academic achievement. *Children and Youth Services Review, 34*, 1092–1100.
- Coyne, J. C., Thombs, B. D., & Hagedoorn, M. (2010). Ain't necessarily so: Review and critique of recent meta-analyses of behavioral medicine interventions in health psychology. *Health Psychology, 29*(2), 107.
- Cronbach, L. J., & Snow, R. E. (1977). *Aptitudes and instructional methods: A handbook for research on interactions*. Irvington.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- DeGregorio, L. J., & McLean, S. (2013). The cognitive profiles of maltreated children in care and their educational needs: Supporting good outcomes. *Children Australia*, 38(1), 28-35.
- Dolezal, D.N., Weber, K.P., Evavold, J.J., Wylie, J., & McLaughlin, T.F. (2007). The effects of a reinforcement package for on-task and reading behavior with at-risk and middle school students with disabilities. *Child & Family Behavior Therapy*, 29, 9-25
- Dunlap, W. P., Cortina, J. M., Vaslow, J. B., & Burke, M. J. (1996). Meta-analysis of experiments with matched groups or repeated measures designs. *Psychological Methods*, 1, 170-177.
- Dworsky, A., Napolitano, L., & Courtney, M. (2013). Homelessness during the transition from foster care to adulthood. *American Journal of Public Health*, 103(S2), S318-S323.
- Elbaum, B., Vaughn, S., Tejero Hughes, M., & Watson Moody, S. (2000). How effective are one-to-one tutoring programs in reading for elementary students at risk for reading failure? A meta-analysis of the intervention research. *Journal of Educational Psychology*, 92(4), 605-619.
- Evans, R., Brown, R., Rees, G., & Smith, P. (2017). Systematic review of educational interventions for looked-after children and young people: Recommendations for intervention development and evaluation. *British Educational Research Journal*, 43(1), 68-94.
- Fergusson, D. M., & Woodward, L. J. (2000). Teenage pregnancy and female educational underachievement: A prospective study of a New Zealand birth cohort. *Journal of Marriage and Family*, 62(1), 147-161.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Flores, M. M., & Ganz, J. B. (2009). Effects of direct instruction on the reading comprehension of students with autism and developmental disabilities. *Education and Training in Developmental Disabilities, 39*-53.
- Flynn, R. J., Marquis, R. A., Paquet, M. P., Peeke, L. M., & Aubry, T. D. (2012). Effects of individual direct-instruction tutoring on foster children's academic skills: A randomized trial. *Children and Youth Services Review, 34*(6), 1183-1189.
- Ford, T., Vostanis, P., Meltzer, H., & Goodman, R. (2007). Psychiatric disorder among British children looked after by local authorities: Comparison with children living in private households. *The British Journal of Psychiatry, 190*(4), 319-325.
- Forsman, H., Brännström, L., Vinnerljung, B., & Hjern, A. (2016). Does poor school performance cause later psychosocial problems among children in foster care? Evidence from national longitudinal registry data. *Child Abuse & Neglect, 57*, 61-71.
- Forsman, H., & Vinnerljung, B. (2012). Interventions aiming to improve school achievements of children in out-of-home care: A scoping review. *Children and Youth Services Review, 34*(6), 1084-1091.
- Fryer Jr, R. G. (2014). Injecting charter school best practices into traditional public schools: Evidence from field experiments. *The Quarterly Journal of Economics, 129*(3), 1355-1407.
- Goodman, R. (1997). The Strengths and Difficulties Questionnaire: A research note. *Journal of Child Psychology and Psychiatry, 38*(5), 581-586.
- Goodman, A., & Goodman, R. (2009). Strengths and difficulties questionnaire as a dimensional measure of child mental health. *Journal of the American Academy of Child & Adolescent Psychiatry, 48*(4), 400-403.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Goodman, A., & Goodman, R. (2011). Population mean scores predict child mental disorder rates: Validating SDQ prevalence estimators in Britain. *Journal of Child Psychology and Psychiatry*, 52(1), 100-108.
- Harper, J., & Schmidt, F. (2016). Effectiveness of a group-based academic tutoring program for children in foster care: A randomized controlled trial. *Children and Youth Services Review*, 67, 238-246.
- Heinrich, C. J., Burch, P., Good, A., Acosta, R., Cheng, H., Dillender, M., ... & Stewart, M. (2014). Improving the implementation and effectiveness of out-of-school-time tutoring. *Journal of Policy Analysis and Management*, 33(2), 471-494.
- Hill, N. E., & Tyson, D. F. (2009). Parental involvement in middle school: A meta-analytic assessment of the strategies that promote achievement. *Developmental Psychology*, 45(3), 740.
- Katsiyannis, A., Ryan, J. B., Zhang, D., & Spann, A. (2008). Juvenile delinquency and recidivism: The impact of academic achievement. *Reading & Writing Quarterly*, 24(2), 177-196.
- Kitano, M. K., & Lewis, R. B. (2007). Examining the relationships between reading achievement and tutoring duration and content for gifted culturally and linguistically diverse students from low-income backgrounds. *Journal for the Education of the Gifted*, 30(3), 295-325.
- Lauer, P. A., Akiba, M., Wilkerson, S. B., Apthorp, H. S., Snow, D., & Martin-Glenn, M. L. (2006). Out-of-school time programs: A meta-analysis of effects for at-risk students. *Review of Educational Research*, 76, 275-313.
- Liabo, K., Gray, K., & Mulcahy, D. (2013). A systematic review of interventions to support looked-after children in school. *Child & Family Social Work*, 18(3), 341-353.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Lipsey, M. W., Puzio, K., Yun, C., Hebert, M. A., Steinka-Fry, K., Cole, M. W., ... & Busick, M. D. (2012). Translating the statistical representation of the effects of education interventions into more readily interpretable forms. *National Center for Special Education Research*. Washington, DC: National Center for Special Education Research, Institute of Education Sciences, U.S. Department of Education.
- Maloney, M. (1998). *Teach your children well: A solution to some of North America's educational problems*. Belleville, ON: QLC Educational Services.
- Marquis, R. (2013). *The gender effects of a foster parent-delivered tutoring program on foster children's academic skills and mental health: A randomized field trial*. Retrieved from ProQuest Digital Dissertations.
- Monti, J. D., Pomerantz, E. M., & Roisman, G. I. (2014). Can parents' involvement in children's education offset the effects of early insensitivity on academic functioning? *Journal of Educational Psychology*, *106*(3), 859-869.
- Naglieri, & Goldstein. (2012). *Comprehensive executive function inventory*. Toronto: Multi Health Systems.
- Nilsson, D. K., Gustafsson, P. E., & Svedin, C. G. (2012). Polytraumatization and trauma symptoms in adolescent boys and girls: Interpersonal and noninterpersonal events and moderating effects of adverse family circumstances. *Journal of Interpersonal Violence*, *27*(13), 2645-2664.
- Nilsson, D., Wadsby, M., & Svedin, C. G. (2008). The psychometric properties of the Trauma Symptom Checklist for Children (TSCC) in a sample of Swedish children. *Child Abuse & Neglect*, *32*(6), 627-636.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- O'Higgins, A., Sebba, J., & Luke, N. (2015). *What is the relationship between being in care and the educational outcomes of children. An international systematic review*. Rees Centre, Department of Education, Oxford University.
- Pecora, P. J. (2012). Maximizing educational achievement of youth in foster care and alumni: Factors associated with success. *Children and Youth Services Review, 34*(6), 1121-1129.
- Pilowsky, D. J., & Wu, L.T. (2006). Psychiatric symptoms and substance use disorders in a nationally representative sample of American adolescents involved with foster care. *The Journal of Adolescent Health : Official Publication of the Society for Adolescent Medicine, 38*(4), 351–358.
- Rogers, M., Hickey, A.J., Wiener, J., Heath, N., & Noble, R. (in press). Factor structure, reliability, and validity of the Parental Support for Learning Scale: Adolescent Short Form (PSLS-AS). *Learning Environments Research*.
- Rogers, M., Markel, C., Midgett, J. D., Ryan, B. A., & Tannock, R. (2014). Measuring children's perceptions of parental involvement in conjoint behavioral consultation: Factor structure and reliability of the Parental Support for Learning Scale. *Assessment for Effective Intervention, 39*, 170-181.
- Romano, E., Babchishin, L., Marquis, R., & Fréchette, S. (2015). Childhood maltreatment and educational outcomes. *Trauma, Violence, & Abuse, 16*(4), 418-437.
- Ryder, R. J., Burton, J. L., & Silberg, A. (2006). Longitudinal study of direct instruction effects from first through third grades. *The Journal of Educational Research, 99*(3), 179-192.
- Sadowski, C. M., & Friedrich, W. N. (2000). Psychometric properties of the Trauma Symptom Checklist for Children (TSCC) with psychiatrically hospitalized adolescents. *Child Maltreatment, 5*(4), 364-372.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Schafer, J. L., & Graham, J. W. (2002). Missing data: Our view of the state of the art. *Psychological methods*, 7(2), 147.
- Singal, A. G., Higgins, P. D., & Waljee, A.K. (2014). A primer on effectiveness and efficacy trials. *Clinical and Translational Gastroenterology*, 5, e45.
- Slavin, R. E., & Lake, C. (2008). Effective programs in elementary mathematics: A best-evidence synthesis. *Review of Educational Research*, 78, 427-515.
- Slavin, R. E., Lake, C., Davis, S., & Madden, N. A. (2011). Effective programs for struggling readers: A best-evidence synthesis. *Educational Research Review*, 6(1), 1-26.
- Steenbergen-Hu, & Cooper, H. (2013). A meta-analysis of the effectiveness of intelligent tutoring systems on K-12 students' mathematical learning. *Journal of Educational Psychology*, 105(4), 970-987.
- Suggate, S. P. (2010). Why what we teach depends on when: Grade and reading intervention modality moderate effect size.
- Tabachnick, B.G., & Fidell, L.S. (2007). *Using multivariate statistics, fifth edition*. Boston, MA: Pearson Education.
- Townsend, L., Flisher, A. J., & King, G. (2007). A systematic review of the relationship between high school dropout and substance use. *Clinical Child and Family Psychology Review*, 10(4), 295-317.
- Trout, A. L., Hagaman, J., Casey, K., Reid, R., & Epstein, M. H. (2008). The academic status of children and youth in out-of-home care: A review of the literature. *Children and Youth Services Review*, 30(9), 979-994.
- Weegar, K., Hickey, A. J., Shewchuk, S., Fall, M. M., & Flynn, R. J. (2017). A formative evaluation of two Crown Ward Education Championship Teams in Ontario.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

What Works Clearinghouse (2008). *Procedures and standards handbook (version 2.0)*.

Washington, DC: Institute of Educational Sciences.

Woodcock, R., McGrew, K., & Mather, N. (2001). Examiner's Manual. *Woodcock-Johnson III Tests of Achievement*. Rolling Meadows, IL: Riverside.

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Table 1.

*Means (or percentages), standard deviations, Cronbach's alphas, theoretical range, and skewness statistics for study variables, post attrition, at the pre and post test (N = 72).*

Variable	Pre-test (N = 72)					Post-test (N = 72)				
	Mean (or %)	SD	Cronbach's alpha	Theoretical Range	Skew	Mean (or %)	SD	Cronbach's alpha	Theoretical Range	Skew
<i>Outcome</i>										
Broad Reading	88.24	16.07	---	50-150	-.34	92.93	14.95	---	50-150	-.98
Letter-Word Identification	92.68	15.13	---	50-150	.10	95.92	13.62	---	50-150	-.59
Passage Comprehension	85.46	13.61	---	50-150	.15	88.40	12.47	---	50-150	-.55
Reading Fluency	89.65	16.99	---	50-150	.24	95.69	16.69	---	50-150	-.29
Spelling	88.07	17.85	---	50-150	.09	89.47	19.42	---	50-150	-.94
Broad Math	78.39	14.98	---	50-150	-.50	84.38	14.94	---	50-150	-.30
Calculation	74.47	17.44	---	50-150	-.60	81.10	16.99	---	50-150	-.72
Applied Problems	89.13	12.94	---	50-150	-.49	92.88	12.05	---	50-150	-.47
Math Fluency	76.51	11.18	---	50-150	.51	82.29	13.15	---	50-150	.53
<i>Covariates</i>										
Executive Functioning (CEFI total score)	83.85	14.27	0.89	50-150	.30	86.28	14.10	0.93	50-150	.81
Behaviour (SDQ total behavioural difficulties)	15.13	7.84	0.82	0-40	.11	14.89	7.76	0.73	0-40	.31
PSLS caregiver involvement										
Instrumental involvement	33.17	6.38	0.87	0-44	.02	31.19	6.38	0.85	0-44	-.04
Controlling involvement	11.43	4.55	0.69	0-32	-.42	10.81	5.20	0.78	0-32	.39
Symptoms of PTSD										
TSCC (n = 49)	47.37	11.15	.96		1.10	---	---	---	---	---
TSCYC (n = 23)	56.35	15.35	.96		1.75	---	---	---	---	---
Age	11.23	3.02	---	5-17	-.13	11.90	3.01		6-17	-.29
Gender (male: female %)	55.6:44.4	---	---	---	---	55.6:44.4	---	---	---	---

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Table 2.

*Means, SDs, paired-t-tests, effect sizes (Cohen's d), and 95% confidence intervals for pretest and posttest WJ-III subtests (N = 72)*

Outcome Variable	Pretest		Posttest		<i>t</i> (71)	<i>p</i>	95% CI		Cohen's <i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			LL	UL	
Letter-Word Identification	92.68	15.13	95.92	13.62	3.82	< .01	-4.92	-1.55	0.22
Reading Fluency	89.65	16.99	95.69	16.69	5.51	< .01	-8.23	-3.86	0.36
Passage Comprehension	85.46	13.61	88.40	12.47	2.35	.02	-5.44	-.45	0.23
Spelling	88.07	17.85	89.47	19.42	1.14	.26	-3.85	1.04	0.07
Broad Reading	88.24	16.07	92.93	14.95	4.78	< .01	-6.65	-2.74	0.30
Calculation	74.47	17.44	81.10	16.99	4.18	< .01	-9.78	-3.47	0.38
Math Fluency	76.51	11.18	82.29	13.15	5.34	< .01	-7.94	-3.62	0.47
Applied Problems	89.13	12.94	92.88	12.05	4.10	< .01	-5.57	-1.93	0.30
Broad Math	78.39	14.98	84.38	14.94	5.97	< .01	-7.99	-3.99	0.40

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Table 3.

*Inter-correlation matrix for variables in the study at the pre-test (N = 72)\* p < .05; \*\* p < .01*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Broad Reading	---															
2 Letter-Word Identification	.92**	---														
3 Reading Fluency	.86**	.64**	---													
4 Passage Comprehension	.90**	.81**	.70**	---												
5 Spelling	.78**	.76**	.68**	.65**	---											
6 Broad Math	.62**	.63**	.47**	.61**	.62**	---										
7 Calculation	.53**	.58**	.40**	.50**	.53**	.90**	---									
8 Math Fluency	.40**	.33**	.42**	.27*	.47**	.71**	.62**	---								
9 Applied Problems	.61**	.57**	.45**	.61**	.57**	.89**	.62**	.55**	---							
10 CEFI Total Score	.08	.06	.11	.04	.15	-.04	-.11	-.08	.04	---						
11 SDQ Total Difficulties	.13	.14	.04	.16	-.02	.01	.04	.01	-.01	-.70**	---					
12 PSLs: Instrumental Involvement	.01	.10	-.08	.03	-.08	.07	.20	.03	-.10	.03	-.15	---				
13 PSLs: Controlling Involvement	.19	.12	.13	.19	.05	-.04	-.14	-.06	.08	-.04	.23	.08	---			
14 Age	.12	-.08	.27*	.00	.09	-.12	-.20	-.00	.08	.05	-.04	-.33**	.23	---		
15 Gender (0 = male; 1 = female)	-.17	-.21	-.04	-.18	.03	-.05	.06	.01	-.14	.25*	-.24*	-.12	-.37**	-.05	---	
16 Group (0 = 15-weeks; 1 = 25-weeks)	-.10	-.18	-.02	-.09	.04	-.04	-.07	.06	.02	-.13	.12	-.29*	-.10	.32*	.00	---

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Table 4.

*Sample descriptives at pre-test, post attrition (Means, SDs, or Percentages).*

	15 weeks ( <i>n</i> = 36)	25 weeks ( <i>n</i> = 36)
	Pre-test	Pre-test
Sex (M:F)	20:16	20:16
Age	10.28 (2.78)*	12.18 (2.97)*
School grade	5.44 (2.72)*	7.44 (2.96)*
Age of first placement	4.99 (3.14)	5.80 (3.86)
Number of previous placements	2.30 (1.74)	2.61 (2.30)
Number of unplanned school changes	1.84 (1.50)	1.61 (1.41)
Does the child have an IEP at school	Yes: 19 (52.8%)	Yes: 17 (47.2%)
Long term health conditions		
ADHD	8 (22.2%)	14 (38.8%)
Learning Disability	7 (19.4%)	8 (22.2%)
Developmental Disability	6 (16.7%)	4 (11.1%)
Autism Spectrum Disorder	3 (8.1%)	0 (0.0%)
Psychiatric	7 (19.4%)	7 (19.4%)
Reason for entry into care <sup>9</sup>		
Neglect	26 (72.2%)	25 (69.4%)
Sexual Abuse	0 (0.0%)	2 (5.6%)
Domestic Violence	8 (22.2%)	10 (27.8%)
Emotional Harm	5 (13.9%)*	14 (38.9%)*
Abandonment	2 (5.6%)	4 (11.1%)
Problem Behaviour	3 (8.3%)	5 (13.9%)
Other: Parental Mental Illness	0 (0.0%)	1 (2.8%)
Trauma Symptoms (total PTSD T score)		
TSCYC	53.20 (10.86)	62.25 (20.82)
TSCC	45.14 (10.40)	49.04 (11.58)
SDQ Total Difficulties	14.17 (7.13)	16.08 (8.49)
CEFI Total Standard Score†	85.72 (14.51)	81.97 (13.97)
PSLS		
Instrumental	34.97 (7.00)*	31.36 (5.18)*
Controlling	11.86 (4.59)	11.00 (4.54)

\* significant difference between groups,  $p < .05$

<sup>9</sup> To note, these totals add up to more than 100% as children may have had exposure to several types of maltreatment

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Table 5.

*Descriptive statistics for the children's feedback post completion of the tutoring programs (%).*

Question	Group	
	15 weeks	25 weeks
Overall, tutoring in reading helped me to become a better reader		
A great deal	69.4	55.6
Some	22.2	30.6
Very little	8.3	8.3
Overall, tutoring in math helped me to become better in math		
A great deal	66.7	66.7
Some	25.0	16.7
Very little	8.3	11.1
Overall, the tutoring I received has helped me do better in school		
A great deal	58.3	58.3
Some	36.1	33.3
Very little	5.6	2.8
Overall, getting more of this tutoring would be helpful for me in school		
A great deal	44.4	38.9
Some	36.1	33.3
Very little	19.4	22.2

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Table 6.  
*Caregiver reported benefits of the TYCW program (%)*

Question	Group	
	15 weeks	25 weeks
<b>Since your child in care started the tutoring program, has there been any improvement, in your opinion, in any of the following areas:</b>		
Child's reading achievement		
A great deal	22.2	36.1
Some	61.1	30.6
Very little	13.9	30.6
Child's math achievement		
A great deal	27.8	33.3
Some	47.2	41.7
Very little	22.2	22.2
Child's overall school work		
A great deal	11.1	19.4
Some	61.1	44.4
Very little	22.2	36.1
Child's overall positive attitude towards school		
A great deal	11.1	25.0
Some	41.7	36.1
Very little	41.7	38.9
Child's self-esteem		
A great deal	22.2	22.2
Some	50.0	47.2
Very little	22.2	27.8
Child's behaviour		
A great deal	5.6	13.9
Some	47.2	44.4
Very little	41.7	38.9
Child's happiness		
A great deal	11.1	16.7
Some	47.2	41.7
Very little	36.1	41.7
Child's relationship with you		
A great deal	22.2	19.4
Some	33.3	38.9
Very little	36.1	41.7

The impact of working memory training on the working memory capacity and academic skills of  
children in foster care: A pilot study

Andrea Hickey & Robert J. Flynn

University of Ottawa

### Abstract

**Background:** Children in care (i.e., foster care) are at risk of poor academic outcomes. Despite these findings, relatively few interventions have been conducted to try to ameliorate the problem. Previous researchers have found that working memory capacity is an important predictor of academic success. Moreover, research suggests that working memory capacity may be improved through working memory training (WMT). To date, no controlled study has assessed whether WMT can enhance working memory capacity and academic performance for children in care. We conducted a pilot randomized placebo-controlled trial to assess whether WMT can enhance working memory capacity of children in foster care (near transfer effect), and whether such training would also enhance math and reading skills as well as caregiver rated executive functioning skills and symptoms of ADHD (far transfer effect). **Methods:** 21 children in foster care (ages 7-13 years) were randomly assigned to either the active (experimental) working memory training program, or to a placebo (control) group. The compliance criterion of 20 or more sessions was met for 15 children ( $n = 8$  control group,  $n = 7$  experimental group). Working memory capacity was assessed before and after completion of the online five-week WMT program (Cogmed), and again at a 6-month post WMT follow-up period. Academic skills were assessed at pre test and at 6-month follow-up. **Results:** A significant experimental effect was found for Verbal Working Memory and for Visual-Spatial Short Term Memory in the shorter term (i.e., from pre-test to post-test); however, these findings were not sustained over the longer term (i.e., at 6-month follow-up). No significant far transfer effects were found. **Conclusions:** WMT was found to demonstrate near-transfer effects on certain aspects of working memory for children in care; however, WMT did not appear to foster treatment generalization to other

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

domains of functioning. The implications of the findings and future research directions were discussed.

*Keywords:* Children in care, foster care, working memory, working memory training, academic skills, math and reading

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

The impact of working memory training on the working memory capacity and academic skills of children in foster care: A pilot study

Annually, across Canada, approximately 65,000 children and adolescents experience out-of-home care (e.g., foster care; Mulcahy & Trocmé, 2010). Although children in out-of-home care (hereafter, “in care”) are at risk of a variety of negative developmental outcomes, of particular concern is their difficulty with academics. For decades, researchers have consistently reported that many children in care perform poorly in school and are at high risk of entering adulthood with relatively low levels of formal education (Cheung & Heath, 1994; Romano, Babchishin, Marquis, & Frechette, 2015). Compared to children in the general population, children in care, on average, have below-grade academic performance, higher rates of grade retention, and lower scores on standardized tests of academic achievement, particularly in mathematics and reading (Jackson, 2007; Mitic & Rimer, 2002; Stone, 2007). As a result of these academic challenges, children in care are approximately three times as likely as their peers in the general population to be involved in special education (Trout, Hagaman, Casey, Reid, & Epstein, 2008).

Previous research has found that children with a history of maltreatment are also at risk of a variety of poor neurocognitive outcomes. In a recent review, Kavanaugh, Dupont-Frechette, Jerskey, and Holler (2016) report that impaired executive functioning is the most frequent and severe reported impairment, although language, visual-spatial skills, and memory are also at serious risk for compromised development following maltreatment. Specific factors such as abuse or neglect duration, severity, type, and timing during development impact the severity of neurocognitive impairment as well as academic outcomes. Children in care are also at a greater risk of neurodevelopmental disorders, particularly, Attention Deficit Hyperactivity Disorder

(ADHD). Indeed, approximately 10-20% of children in care meet diagnostic criteria for ADHD at any given time, versus 5-10% of children in the general population (Froehlich et al., 2007; Garland et al., 2001; Polanczyk & Jensen, 2008). Previous researchers have found that ADHD is an important risk factor for academic difficulties (Kent et al., 2011; Polderman, Boomsma, Bartels, Verhulst, & Huizink, 2010). These academic outcomes, however, are not inevitable. The fact that children in care have been found to have lower school performance compared to age-matched peers of similar cognitive capacity suggests that the poor academic outcomes of at least some children in care are attributable not to cognitive deficits, per se, but rather to their performing below their academic *potential* (Tideman, Vinnerljung, Hintze & Aldenius Isakson 2011).

### **Working Memory**

*Working memory* (WM) is an aspect of executive functioning and refers to the ability to mentally hold, manipulate and use information (Baddeley, 2003). It is critical to several higher-order cognitive abilities, such as planning, problem solving, reasoning, and language comprehension (Baddeley, 2003). According to Baddeley's (1996) model, WM consists of four components: the central executive, the phonological loop, the visuo-spatial sketchpad, and the episodic buffer. The *central executive* is a domain-general component responsible for the control of attention and processing, and is involved in a range of regulatory functions, including the retrieval of information from long-term memory. The *phonological loop* and the *visuo-spatial sketchpad* are domain-specific stores that mediate the temporary storage of verbal and visual-spatial information, respectively (for a review, see Baddeley, 2012). The fourth component, the *episodic buffer*, is responsible for binding information across informational domains and memory subsystems into integrated chunks. This model of working memory has been supported

by evidence from studies of children (e.g., Alloway, Gathercole, & Pickering, 2006; Alloway, Gathercole, Willis, & Adams, 2004) and adults (e.g., Kane et al., 2004).

### **Working Memory and Academic Skills**

It has been argued that WM is crucial for children's general ability to acquire knowledge and new skills (Alloway, Gathercole, Adams, & Willis, 2005; Gathercole, Lamont, & Packiam Alloway, 2006; Gathercole, Pickering, Knight, & Stegmann, 2004). More specifically, there is evidence that WM capacity is directly related to school achievement (Alloway, 2009; Alloway, Gathercole, Kirkwood, & Elliott, 2009). For example, WM capacity has been found to be related to mathematics skills, including one's ability to solve arithmetic word problems (Meyer, Salimpoor, Wu, Geary, & Menon, 2010; Swanson & Sachse-Lee, 2001), and to computational skills (Bull, Espy, & Wiebe, 2008; for a review see Raghobar, Barnes, & Hecht, 2010). Moreover, WM capacity has also been found to be related to reading achievement, including vocabulary (Atkins, & Baddeley, 1998), language comprehension (e.g., Seigneuric, Ehrlich, Oakhill, & Yuill, 2000), and reading ability (e.g., Cain, Oakhill, & Lemmon, 2004; Gathercole, Brown, & Pickering, 2003; Gathercole, Pickering, Knight, & Stegmann, 2004). Indeed, children with reading disabilities show significant and marked deficits on working memory tasks relative to typically developing children (Gathercole, Alloway, Willis, & Adams, 2006; Swanson, & Jerman, 2007). Moreover, children with poor reading and arithmetic abilities score lower on tests of both verbal and visuospatial WM, despite performing within age-appropriate levels on verbal short-term memory (e.g., Wilson & Swanson, 2001). A similar profile has recently been established for children with dyslexia (Pickering & Pickering, 2006) and ADHD (Martinussen & Tannock, 2006; Rogers, Hwang, Toplak, Weiss, & Tannock, 2011), which suggest a selective impairment of WM. Looking beyond specific academic skills, there is evidence that children

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

with low WM capacity need additional classroom support in order to achieve appropriate goals (Alloway, Gathercole, Kirkwood, & Elliott, 2009). Furthermore, these children tend to have low attention spans, are easily distracted, and tend to forget instructions. Therefore, low WM capacity seems to be a high-risk factor for underachievement in the early school years (Alloway & Alloway, 2010). In summary, WM appears to be a critical factor for academic achievement in many domains, including math and reading. Consequently, even modest increases in the efficacy and/or capacity of WM may significantly improve children's performance in the classroom and in their daily lives.

### **Working Memory Training (WMT) and Academic Skills**

Previous researchers have found that WM capacity can be improved through training. Remarkable gains have been reported both in children with ADHD (Klingberg et al., 2005) and in adult neuropsychological patients following strokes (Westerberg, et al., 2007). Neuroimaging studies indicate that training results in increased activation in frontal and parietal areas of the brain that are known to mediate working memory (Olesen, Westerberg & Klingberg, 2004; Westerberg & Klingberg, 2007). Despite the important relationship of WM with scholastic achievement, there are very few studies to date that have examined the effects of WMT on standardized academic achievement tests. Thus, the educational significance of WMT has only recently begun to be investigated, with mixed results.

Holmes, Gathercole, and Dunning (2009) found that WMT can improve the math and reading skills of children aged 8-11 with low WM capacity, 6 months post training. WMT has also been found to improve the reading skills of typically developing children (Loosli, Buschkuehl, Perrig, & Jaeggi, 2012) and children with ADHD (Dahlin, 2011), as well as the spelling and numeracy skills of children with learning difficulties (Alloway, Bibile, Lau, 2013;

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Dahlin, 2013; Kroesbergen, van 't Noordende, & Kolkman, 2012), even up to two years post training (Söderqvist & Nutley, 2015). However, some researchers have found no improvement in academic skills post WMT in children (e.g.; Ang, Lee, Cheam, Poon, & Koh, 2015; Chacko et al., 2014; Dunning, Holmes, & Gathercole, 2013; Gray et al., 2012; Redick, Shipstead, Wiemers, Melby-Lervåg, Hulme, 2015), possibly reflecting the complexity of the many dimensions that underlie academic performance and learning. These studies have differed in the measures used to assess academic performance as well as the age groups and populations studied, which may explain some of the variation in the results. One other possible explanation for this could be the time allowed to pass between the completion of the intervention and the assessment of the academic outcome. Studies that have included a long-term (>7 months) follow up measure have mostly, but not always (Dunning, Holmes, & Gathercole, 2013), reported effect sizes that have been substantially larger (Dahlin, 2011; Dunning, Holmes and Gathercole, 2013; Egeland, Aarlien, & Saunes, 2013) than those merely assessing academic performance immediately or shortly after the completion of the intervention (Gray et al., 2012; Chacko et al., 2014).

Despite the need for more controlled research on the effectiveness of WMT (Shipstead, Redick, & Engle, 2012), it appears that WMT may be a promising candidate as a selective prevention intervention for young children at risk of academic underachievement. To date, there is only one published study that has assessed whether WMT can improve the academic skills of children in foster care. Tordon, Vinnerljung, and Axelsson (2014) found significant improvements in math skills following the implementation of an individualized education plan paired with WMT. However, this study lacked a control group and used a small sample ( $N = 11$ ). Thus, the nature of the impact of WMT on the academic skills of children in care requires further investigation.

### **Objectives of the Current Study**

Given that WMT has not yet been applied to children in care (except for the Tordon et al. (2014) uncontrolled pilot project), the primary objective of the current pilot study was to explore whether WMT could improve WM capacity for children in care in both the shorter term (i.e., immediately following 5 weeks of WMT, from Time 1 to Time 2; a ‘near transfer’ effect) and in the longer term (i.e., approximately 6 months after the completion of WMT; from Time 1 to Time 3). Next, given the relationship between WM capacity and academic skills, the secondary objective was to assess whether WMT could improve the math and reading skills of children in care in the longer term (i.e., 6-months post WMT, from Time 1 to Time 3, a ‘far transfer’ effect). Lastly, given the relationship between poor WM capacity and symptoms of ADHD, the final objective was to assess whether WMT could produce improvements in caregiver reported executive functioning skills, inattention, and hyperactivity, over the short term (i.e., Time 1 to Time 2) or over the longer term (i.e., 6-months post WMT).

### **Method**

#### **Participants**

Two local Children’s Aid Societies (CASs) agreed to participate in the study. In each of the two agencies, child welfare workers nominated foster children as candidates for the study. Eligible children were required to meet several criteria. They needed to be 6-14 years of age, enrolled in grades 1-8, fluent in English (the intervention and assessment tools existed only in English), living in a foster or kinship care placement assessed as stable by the child welfare worker (such that the child was likely to remain in care for the duration of the study), and to have access to a computer with high speed Internet. Foster children were excluded from the study if they were living in a group home or if, in the judgment of the child welfare worker, they were

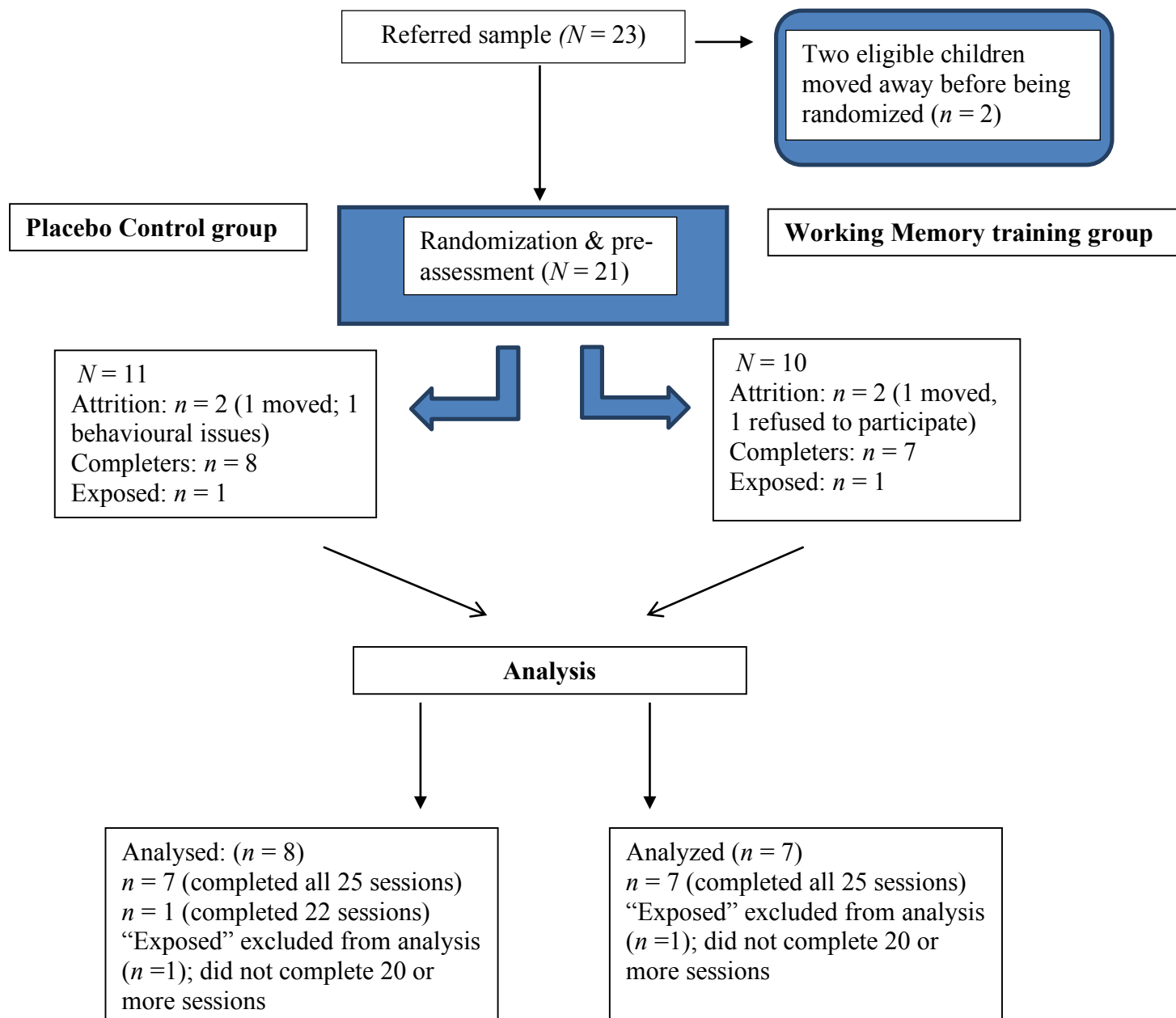
either very strong students (and thus not likely to need the intervention) or else intellectually disabled or very behaviourally disturbed (and thus not likely to complete the intervention). A sample-size calculator (G\*Power; Buchner, Erdfelder, & Faul, 1996) was used to determine the sample size required to find a medium effect. A total sample of 55 was deemed adequate to find a medium effect of  $f^2 = 0.15$  with 80% power and an alpha level of .05.

**Foster children and foster parent participants.** Twenty-three children, residing in family foster care or adoption probation, were nominated to participate in the project. Twenty-one children and foster parents provided assent and consent to participate, were enrolled in the study, and were randomly assigned to the intervention or control groups (see Appendix A for assent and consent forms). At the pre-intervention assessment, the 21 foster children were aged 7-13 years ( $M = 10.19$ ,  $SD = 1.60$ ) and in primary-school grades 2-8 ( $M = 5.05$ ,  $SD = 1.75$ ). Foster parents ( $n = 4$  males,  $n = 11$  females) had a history of fostering for approximately 1 year ( $M = 1.73$ ;  $SD = .96$ ) and had been providing care to the participating child in care for approximately 1 year ( $M = 1.67$ ;  $SD = 1.40$ ). Seven children who had been randomly assigned to the active WM (intervention) group completed the protocol<sup>10</sup> ( $n = 3$  males,  $n = 4$  females), compared with eight who had been randomly assigned to the placebo control group who also completed the protocol ( $n = 5$  males,  $n = 3$  females; see Figure 1 for CONSORT diagram).

---

<sup>10</sup> According to Cogmed, a completed protocol (i.e., having received the full “dose” of WMT) is defined as completing 20 or more WMT sessions over the course of 5 weeks.

**Figure 1.** CONSORT diagram (Schulz, Altman, & Moher, 2010)



### Research Design and Random Assignment

We used a pre-test/post-test double-blind placebo-controlled group design. Random assignment to conditions, based on a table of random numbers, took place at the pre-test, immediately after the foster parents and foster children had signed their consent or assent forms

and had completed their assessments. The children were assessed at three time points: Time 1 (pre-assessment), Time 2 (post-assessment, within 1-week of the completion of the intervention, approximately 6 weeks after Time 1), and Time 3 (6 months following the completion of the intervention; approximately 7.5-months post pre-test). At Time 1 and Time 3, all children were assessed on their math and reading skills as well as their working memory capacity. At Time 2, children were assessed only on their working memory capacity.

### **Cogmed Working Memory Training (WMT) Program**

WMT was conducted using the computerized Cogmed working memory program (Cogmed, 2006), consisting of active (adaptive) and passive (placebo) versions (see the Experimental Conditions section). To date, this software program appears to be the most frequently used software for the training of WM (Klingberg, 2010). Both the active and passive versions of the program consist of 25 sessions of WMT, with each training session lasting, on average, 45 minutes. On each training day, children in both conditions completed 8 tasks; a new task was introduced every 5 to 6 days, for a total of 12 tasks. Each training task involved the temporary storage and manipulation of sequential visuo-spatial or verbal information, or both. An example of a *visuo-spatial* task is “Asteroids”. This task presents a field of several free-floating asteroids, a subset of which light up, one at a time. The child then reproduces the sequence via a mouse-click. An example of a *verbal* task is “Input Module”. In this task, a sequence of auditory digits is displayed. The child then reproduces the sequence in reverse order, using a number-pad that is displayed on a robot's arm. In each session, participants worked on four visuospatial and three verbal WM tasks. Participants trained once a day for five days a week, for a total of five weeks (25 sessions in total). Motivational features included a display of the participant's best scores, the accumulation of ‘energy’ based on performance levels that

could be spent on a racing game that could be completed after training each day, and positive verbal and visual feedback for correct trials.

Training was conducted at the participants' home on a personal computer, which had to have met the minimum requirements to ensure that the program could run appropriately (a PC with a Pentium II processor, 266 Mhz (400 Mhz recommended), containing Windows ME, 2000, or XP software, internal memory of 64 MB (128 recommended), and 150 MB free space on the hard drive). Furthermore, given that Cogmed runs online, all participants needed access to high speed Internet. A "completer" was defined by fulfilment of at least 20 sessions, as per the criterion specified in Klingberg et al. (2005).

### **Experimental Conditions**

**Adaptive working memory training.** In the adaptive (active) WMT program, the participants were expected to complete 25 training sessions. At each session, they completed 8 tasks (out of a total of 12), all of which started at a low difficulty level, namely, remembering two items. As training proceeded, task difficulty was individually adjusted by increasing or decreasing the number of items participants had to remember, such that they reached approximately 60% correct per day for each task (for details about the adaptive training algorithm, see Cogmed QM; [www.cogmed.com](http://www.cogmed.com); Klingberg, Forssberg, & Westerberg, 2002). Each new training session began at the task difficulty level where the participant had ended in the previous session. The participants' performance was continuously recorded while they worked, and these data were automatically saved online.

**Placebo-control memory training.** The participants in the placebo control (passive) group were also expected to complete 25 sessions of the same computerized WMT program as the adaptive training group. The main differences between the two groups were as follows: 1) for

the placebo group, task difficulty remained at the same low initial level, namely, remembering two items; and, 2) to adjust for time differences on tasks due to an increased number of items per task in the adaptive training group, participants in the placebo group worked on 120 trials each day<sup>11</sup>.

**WMT index-improvement.** Trained task effects for participants in the adaptive WMT condition were assessed through a task improvement index (Index-Improvement) provided by Cogmed, upon completion of the training. This index is calculated by subtracting the ‘Start index’ (average performance on days 2, 3, and 4 of the tasks in the program) from the ‘Max index’ (average of the best 2 trials over the course of the 5-week training).

### **Instruments**

Following the recommendation of Trout et al. (2008), standardized measures of academic achievement were used to assess the foster children’s acquisition of basic reading and math skills. Standardized measures were also employed to assess the children’s working memory skills, behaviour, and mental health.

**Automated Working Memory Assessment (AWMA).** The AWMA (Alloway, 2007) is a computer-based assessment of WM skills. All participants completed eight subtests from the AWMA: two tests each of verbal short term memory (STM; word recall, digit recall), visuo-spatial STM (dot matrix, block recall), visuo-spatial WM (odd one out, spatial recall), and verbal WM (counting recall, listening recall).

---

<sup>11</sup> Since we completed this pilot project, Cogmed has decided to phase out the placebo control group condition. citing the following reasons: 1) recent research has found training-related improvements for non-adaptive (placebo) trainees with low baseline WM capacity; 2) non-adaptive trainees spend less time actively engaged with the training than adaptive trainees. Further, because non-adaptive training is less challenging and less intense, it may result in decreased parental involvement and differences in Coach support; and, 3) parental perceptions of non-adaptive trainees’ performance may be more positive than adaptive trainees’, due to the ease with which they progress through training, and this may result in more favorable behavioral ratings for the non-adaptive group.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

The verbal STM tests required the immediate serial recall of verbal information, such as a list of digits or words. For the visuo-spatial STM tests, a series of locations were either tapped out on blocks or presented as dots in a matrix. The participants were required to reproduce each sequence in the correct order. The verbal WM tasks required participants to simultaneously process and store verbal information. More specifically, in Counting Recall, they were required to count the number of red circles on consecutive displays of red circles and blue triangles, while also remembering the count total in each display for serial recall at the end of the trial. For the Listening Recall subtest, participants were presented with a series of spoken sentences, and needed to verify each sentence by stating “true” or “false,” and having to recall the final word for each sentence in sequence. STM is measured in conjunction with WM, as it is assumed that a participant must first be able to recall verbal or visual information prior to being able to manipulate it (i.e., using working memory).

The visuo-spatial WM tasks required the simultaneous processing and storage of visual information. In the Odd one Out task, participants were presented with three shapes and they were asked to first determine what shape was the odd-one-out. Next, participants were asked to recall the location of the odd-one-out shape, in the correct order. In the Spatial Recall task participants were asked to determine whether two shapes were the same or the opposite way around to each other, while remembering the location of a red dot on one of the shapes for later recall.

Composite scores were obtained by averaging the standard scores obtained on the relevant pairs of tests for verbal STM, visuo-spatial STM, visuo-spatial WM and verbal WM, with lower scores indicating greater difficulties. All eight subtests from the AWMA (Alloway, 2007) were completed at the initial assessment (Time 1), immediately following the WM training

(Time 2), and again at a 6-month follow up (Time 3). Test-retest reliability as well as convergent and diagnostic validity for the AWMA have been found to be strong, with test re-test reliability coefficients ranging between .64 and .83 (Alloway et al., 2006; Alloway, Gathercole, Kirkwood, and Elliott, 2008).

**Woodcock-Johnson III Tests of Achievement—Third Edition (WJ-III; Woodcock, McGrew, & Mather, 2001).** The WJ-III is a norm-referenced, standardized series of tests that assess basic reading and math skills. It was developed for use with individuals between the ages of 2 years and 90+ years, or in Grades K through graduate school. The WJ-III is composed of two batteries—Standard and Extended. The Standard Battery, used in the current study, consists of 12 subtests: Letter-Word Identification, Reading Fluency, Story Recall, Understanding Directions, Calculation, Math Fluency, Spelling, Writing Fluency, Passage Comprehension, Applied Problems, Writing Samples and Story Recall-Delayed. With the exception of Writing Fluency and the Writing Samples subtests, all of the subtests from the standard battery were administered for the current study.

Scoring of the WJ-III provides an indication of how the individual compares to others of his/her age or grade. For each subtest, standard scores ( $M = 100$ ,  $SD = 15$ ) are computed from raw scores; a Reading Composite score (“Broad Reading”) is obtained by combining the Letter-Word Identification, Reading Fluency, and Sentence Comprehension standard scores. A Math Composite score (“Broad Math”) is obtained by combining the Calculation, Math Fluency and the Applied Problems subtests. The psychometric properties are excellent; subtest internal consistency reliability coefficients are between .87 and .96 (Wilkinson & Robertson, 2006).

**Conners Parent Rating Scale –Parent Version (3rd Edition; CPRS; Conners, 2008).** The CPRS (Conners, 2008) is a 110-item questionnaire that can be used to help identify and

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

monitor the level of attention and hyperactivity of a young person between the ages of 6 and 18 years. The questionnaire is completed by the child's primary caregiver and requires 15 to 20 minutes to complete. Items are rated on a four-point scale (0 = Not True At All to 3 = Very Much True). An elevated *T*-score indicates a greater likelihood that the child would "probably" meet the DSM-V criteria for a diagnosis of ADHD. Subscales are computed for the following: Inattention, Hyperactivity/Impulsivity, Executive Functioning, Defiance/Aggression, Learning Problems, as well as Peer Relations. For the purposes of the current study, only the Inattention, Hyperactivity/Impulsivity, and Executive Functioning subscales were used, as these were thought to be the most impacted by WMT based on previous research (Klingberb et al., 2005; Salminen, Strobach, & Schubert, 2012). Internal consistency and test-retest reliability (over 2-4 weeks) are excellent, and discriminant validity has also been established (Conners, 2008).

**Child welfare worker background information form.** This questionnaire was developed by the study research team. Once the children were referred to the project by child welfare workers, child welfare workers were asked to complete this questionnaire, which consisted of background information about the children in care (e.g., age of entry into care, maltreatment history; Appendix B).

**Foster parent questionnaire.** This questionnaire was developed by the study research team and administered at the pre- and post-test and 6-month follow up (Appendices C, D and F). Foster parents were asked to provide background information (e.g., number of children in the home, length of time as a foster parent), as well as updates on the children's medication, Individualized Education Plans (IEPs), etc.

**Cogmed experience questionnaires.** These questionnaires were developed by the study research team and asked foster parents as well as children in care about their experience with the Cogmed program (Appendices D and E).

### **Training of Assessors**

Training on all of the assessment measures (i.e., on administration of the questionnaires, WJ-III, and AWMA) was provided by the primary investigator. At each participating agency, the primary investigator held a 4-day training event in which the assessors were provided a general overview of the research project and a review of the questionnaires for caregivers and children in care. Most of the training focused on learning the WJ-III. The assessors practiced test administration with the primary investigator and were given a “mock” child to test (a university graduate research assistant). Following this, all of the assessors were observed while conducting three “live” assessments with study participants, with corrective feedback provided in the moment. Next, to help ensure the fidelity of data collection, following the completion of approximately 10 assessments, these assessments were sent to the primary investigator for scoring review. The raw scores were calculated and then entered into the computer scoring software. If any scoring errors were found, the assessors were contacted immediately and the scoring was reviewed with them.

### **Procedure**

Beginning in 2013, the research team recruited two of what were then 46 Ontario CASs to collaborate and participate in the current study. The CASs that joined the study appointed a lead hand who was responsible for being the liaison with the research team for the duration of the study (i.e., a project manager within each child welfare agency). The lead hands also helped with recruitment of participants and were made available to help with troubleshooting any

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

difficulties that might arise over the course of the study. Furthermore, the lead hands nominated individuals from their agency to serve as the assessors for each of the three assessment periods. Each CAS signed a letter of agreement to confirm their participation in the study. Once the agreement letter had been signed, the lead hand began to actively recruit participants.

At each CAS, the assessor would telephone the nominated foster children and foster parents to explain the purpose of the study. If they were both interested in participating, the initial assessment was booked. Upon arrival for the initial assessment, written assent and consent were obtained from the children and foster parents, respectively (Appendices C and D). Next, the foster parent was provided with an assessment package to complete while the child in care was being assessed. This package consisted of the foster parent questionnaire and the CPRS. All children were initially assessed on their math and reading skills (via the Woodcock-Johnson III), followed by an assessment of their working memory capacity (via the Automated Working Memory Assessment). At the end of the assessment of the child, the assessor met with both the foster parent and the foster child to provide an overview of the Cogmed program<sup>12</sup>. Next, all participants were provided with an envelope that contained the log-in information for the Cogmed program. Both assessors and foster families were masked as to which group they had been assigned to.

The post-test assessment took place within one week of completing the 5-week Cogmed program. The foster parents completed an assessment package, consisting of the foster parent questionnaire (Appendix D) and the CPRS, and the foster children were assessed on their working memory capacity (via the Automated Working Memory Assessment). The children

---

<sup>12</sup> The name “Cogmed” was not used during the assessment in order to prevent participants from the googling and learning about the two conditions (i.e., active WMT and placebo control). As such, the term “attention training” was used, as per the Cogmed protocol.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

were also asked to complete a questionnaire about their experience with the Cogmed program (Appendix E).

The 6-month follow-up assessment took place approximately 6-months following the post-assessment. This final assessment session was identical to the initial assessment; all children were assessed on their math and reading skills (via the WJ-III) as well as their WM capacity (via the AWMA), and all foster parents completed the same questionnaire package (i.e., the foster parent questionnaire (Appendix F), and the CPRS).

### **Performance Monitoring**

Children's progress on the Cogmed program was monitored online via a Cogmed coach (the first author, AJH). Each week, the Cogmed coach would call all participants (both in the experimental and the placebo control group) to assess progress, provide motivation to the child, and troubleshoot any technical difficulties.

### **Pre-Test Equivalence of Experimental and Control Groups**

At the pre-test, there were no statistically significant differences ( $p > .05$ ) between the experimental and control group foster children on gender, age, AWMA scores, the CPRS, or the WJ-III subtest scores (see Tables 1 and 2).

### **Working Memory Ability, Academic Skills, and Behaviour at the Pre-Test**

On the AWMA, the mean score for participants on all four AWMA subscales was in the average range (see Table 2). However, 14.3% of children scored in the low-average range on Verbal STM, 28.6% scored in the low-average range on Verbal WM, 35.7% scored at or below the low-average range on VS-STM and 14.3% scored at or below the low-average range on VS-WM. On the WJ-III, participants, on average, scored below the population mean, with relatively weaker performance in math as compared to reading. This pattern of academic achievement for

children in care is consistent with previous research (Trout et al. 2008). On the CPRS, participants performed 1-1.5 SDs above the population mean on inattentiveness, hyperactivity, and executive functioning difficulties (see Table 2).

### **Data Analysis**

Data analysis was conducted only on the participants that met the cut-off criterion for having received the full dose of the Cogmed program (i.e., 20 or more completed sessions). A total of 15 participants had completed at least 20 sessions, 7 in the experimental group and 8 in the placebo control group.

**Missing data.** All variables had less than 15% of missing data, with the majority having less than 5% missing data. One participant was missing data on the pre-test AWMA, and 1 participant was missing data on one AWMA 6-month follow-up composite score due to technical difficulties. Due to the relatively small amount of missing data, the expectation maximization (EM) algorithm was used to address the missing data both at the item and full scale level, rather than mean substitution or multiple imputation (Schafer & Graham, 2002).

### **Primary Data Analyses**

**ANCOVA.** The most powerful approach for analyzing pre-test/post-test comparison group designs is the analysis of co-variance (ANCOVA) conducted via multiple regression (Gliner, Morgan, & Harmon, 2003). This approach uses differences in the pre-test scores of the experimental and control groups to reduce error variance by adjusting the post-test scores. ANCOVA via multiple regression was used to assess whether WMT improved working memory capacity (research question #1). The foster children's pre-test scores (on each of the 4 AWMA composite scores) served as a covariate at level 1 and group (working memory or placebo

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

control) was entered at level 2. Separate ANCOVAs were conducted to assess the impact of WMT on WM capacity from Time 1 to Time 2 and from Time 1 to Time 3.

ANCOVA via multiple regression was also used to assess whether WMT can produce improvements in math and reading skills over the longer term (research question #2) as well as whether WMT can produce improvements in executive functioning skills or symptoms of ADHD (research question #3). For research question #2, gain scores for each of the math and reading subtests were created (i.e., Time 3-Time 1) and served as the dependent variables (Gliner, Morgan, & Harmon, 2003). Next, pre-test AWMA scores served as the covariate at level 1 and group (working memory or placebo control) was entered at level 2. Separate ANCOVAs were conducted for each of the WJ-III subtests. For research question #3, gain scores were first created (i.e., Time 2-Time 1 and for Time 3-Time 1), for three CPSR subscales (Inattention, Hyperactivity, Executive Functioning), each of which served as the dependent variable. Next, AWMA composite scores at pre-test were entered at level 1, followed by group at level 2 (working memory or placebo control).

Hedges'  $g$ , which corrects for bias due to small sample size, was used as the index of effect size to determine the magnitude of the treatment effect of the WMT intervention. Hedges'  $g$  is very similar in magnitude to, but slightly more conservative than Cohen's  $d$ . As recommended by the WWC (2008, p. 37) for the calculation of Hedges'  $g$  when used with ANCOVA, the difference between the adjusted post-test means of the tutoring and control groups is divided by the *unadjusted* pooled within-group standard deviation. The formula we used was the following:

$$g = \frac{X'_1 - X'_2}{\sqrt{\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{(n_1 + n_2 - 2)}}}$$

“where  $X'_1$  and  $X'_2$  are adjusted post-test means,  $n_1$  and  $n_2$  are the student sample sizes, and  $S_1$  and  $S_2$  are the student-level unadjusted post-test *SD* for the intervention group and the comparison group, respectively” WWC (2008) p. 37.

## Results

### Primary Data Analysis Results

**Research Question #1: Can working memory be improved via working memory training over 6 weeks (i.e., from Time 1 to Time 2) or over a 6-month period (i.e., from Time 1 to Time 3)?**

**Verbal STM.** On the AWMA Verbal STM composite score, the difference between the adjusted post-test group means from Time 1 to Time 2, and from Time 1 to Time 3 was not statistically significant ( $B = -2.50$ ,  $t[13] = -.38$ ,  $p = .71$ ;  $B = -2.39$ ,  $t[13] = -.29$ ,  $p = .78$ ).

**Visual-spatial STM.** On the AWMA Visual-spatial STM composite score, the difference between the adjusted post-test group means from Time 1 to Time 2 was statistically significant, with an increase in visual-spatial STM for participants in the WMT group,  $B = 12.62$ ,  $t[13] = 2.30$ ,  $p = .04$ , Hedges  $g = 1.10$ . However, no significant differences between the group means were found from Time 1 to Time 3,  $B = 6.43$ ,  $t[13] = 1.29$ ,  $p = .22$ .

**Verbal WM.** On the AWMA Verbal WM composite score, the difference between the adjusted post-test group means from Time 1 to Time 2 was statistically significant,  $B = 11.33$ ,  $t[13] = 2.27$ ,  $p = .04$ , with an increase for participants in the WMT group, Hedges  $g = 0.35$ . However, no significant differences were found between the group means from Time 1 to Time 3,  $B = .54$ ,  $t[13] = .14$ ,  $p = .89$ .

**Visual-spatial WM.** On the AWMA Visual-spatial WM composite score, the difference between the adjusted post-test group means from Time 1 to Time 2 and from Time 1 to Time 3 was not statistically significant,  $B = .07$ ,  $t[13] = .01$ ,  $p = .99$ ;  $B = -3.53$ ,  $t[13] = -.70$ ,  $p = .50$ ; respectively.

***Research Question # 2: Can WMT produce improvements in reading and math skills over the longer term (i.e., 6-months post WMT)?***

### **Reading Results**

On the Broad Reading composite score, ANCOVA via multiple regression did not reveal any significant difference between the adjusted post-test group means from Time 1 to Time 3. Moreover, at the subscale score level (i.e., Letter-Word Identification, Reading Fluency, and Passage Comprehension), no significant group differences were found, even at the trend level, when controlling for pre-test Verbal WM, VS-WM or for VS-STM (all  $ps > .15$ ). However, when controlling for Verbal-STM scores at pre-test, the difference between the adjusted post-test group means from Time 1 to Time 3 on sentence comprehension was at the level of a trend, with higher scores for children in the experimental group,  $B = 5.28$ ,  $t[13] = 1.91$ ,  $p = .08$ .

### **Math Results**

When controlling for pre-test scores on Verbal WM, VS-WM, or VS-STM, ANCOVA via multiple regression did not reveal any significant difference between the adjusted post-test group means from Time 1 to Time 3 for the Broad Math composite scores. However, when controlling for Verbal STM scores at pre-test, the difference between the adjusted post-test group means from Time 1 to Time 3 on Broad Math was at the level of a trend, with higher scores for children in the experimental group,  $B = 6.11$ ,  $t[13] = 2.10$ ,  $p = .06$ . Moreover, no significant

group differences were found for Calculation, Math Fluency, and Applied Problems, after controlling for pre-test scores on Verbal WM, VS-WM, VS-STM, or Verbal STM (all  $ps > .15$ ).

***Research Question #3: Can WMT produce improvements in caregiver reported executive functioning skills or symptoms of ADHD over the short term (i.e., 6-weeks) or over the longer term (i.e., 6-months post WMT)?***

ANCOVA via multiple regression was used to assess whether WMT could improve executive functioning and symptoms of ADHD (inattention and hyperactivity) over the short and longer term. Gain scores were created for each CPRS subscale (inattention, hyperactivity, and executive functioning) for Time1-Time 2, and for Time1-Time 3 (Gliner, Morgan, & Harmon, 2003).

**Executive functioning.** No significant difference in the post-test group means was found for caregiver-rated Executive Functioning (as measured by the CPRS) from Time 1 to Time 2 or from Time 1 to Time 3, when controlling successively for pre-test VS-WM, Verbal WM, VS-STM. However, when controlling for pre-test Verbal STM, the ANCOVA revealed a difference between the adjusted post-test group means from Time 1 to Time 3, at the level of a trend, in the unexpected direction. That is, children in the experimental group had *higher* executive dysfunction than the control group children at the 6-month follow-up ( $B = 11.51$ ,  $t[13] = 2.11$ ,  $p = .06$ ).

**Inattention.** No significant group differences were found for changes in caregiver rated Inattention scores (as measured by the CPRS) from Time 1 to Time 2, or from Time 1 to Time 3, when controlling for pre-test VS-WM, Verbal WM, VS-STM, or Verbal STM (all  $ps > .10$ ).

**Hyperactivity.** No significant group differences were found for changes in caregiver rated Hyperactivity scores (as measured by the CPRS) from Time 1 to Time 2, or from Time 1 to

Time 3, when controlling for pre-test VS-WM, Verbal WM, VS-STM, or Verbal STM (all  $p$ s > .10).

### **Secondary Data Analyses**

Post hoc, the difference between the Start Index (average performance on Cogmed training days 2, 3, and 4) and the Max Index (average of the best 2 trials over the course of the 5-week training) was analysed using a paired samples  $t$ -test, in order to assess whether children in the experimental group improved in their WM performance over the course of the Cogmed program.

Next, we explored whether pre-test WM capacity (as measured by each of the 4 AWMA composite scores) as well as pre-test executive functioning, inattention, and hyperactivity scores (as measured by the CPRS) was related to the degree of improvement in WMT, as measured by the Cogmed Index-Improvement (the ‘Start Index’ subtracted from the ‘Max Index’). One participant had an outlier on both the Max Index and Index Improvement. As such, the two values were winsorized by reducing the values to the next highest non-outlier value (Dixon, 1960).

### **Secondary Data Analysis Results**

The experimental group significantly improved on the task, as illustrated by a significant difference between the Start Index and the Max Index (i.e., average of the best 2 trials over the course of the training), ( $t(6) = 9.68, p < .01$ ). For children in the experimental group, a correlation analysis showed no significant relationship between the Index-Improvement and the pre-test AWMA composite scores (Verbal STM  $r(5) = -.24, p = .61$ ; Verbal WM  $r(5) = .05, p = .91$ ; VS STM  $r(5) = -.51, p = .24$ ; VS WM  $r(5) = .70, p = .08$ ), or the pre-test CPRS executive

function subscale ( $r(5) = .50, p = .25$ ), inattention subscale ( $r(5) = .32, p = .48$ ), or the hyperactivity subscale ( $r(5) = .17, p = .98$ ). At the 6-week and 6-month post test, no significant correlations were found between the four AWMA composite scores, or the CPRS executive functioning, inattention, or hyperactivity subscale scores and the Index-Improvement ( $ps > .10$ ).

### **Discussion**

We explored, on a pilot basis, whether working memory capacity can be improved via WMT for children in foster care, and furthermore, whether WMT can improve math and reading skills, as well as caregiver reported executive functioning skills and symptoms of ADHD. Overall, the results suggest that the intervention (active working memory training) was significantly more effective than the placebo control in improving Verbal WM and VS-STM in the shorter term (i.e., at the 6-week follow-up). However, these results were not sustained over the longer term (i.e., at the 6-month post WMT follow-up). Moreover, the intervention did not appear to have an impact on VS-WM or Verbal STM. In terms of the impact of WMT on math and reading skills, no significant experimental effect was found on any of the WJ-III math and reading subtests administered. However, when controlling for pre-test Verbal STM, there was a trend towards significance, in favour of the experimental group, for Sentence Comprehension and Broad Math composite. Moreover, no significant experimental effect was found for caregiver reported executive functioning skills and degree of inattention and hyperactivity.

The hypothesis underlying WMT is that working memory performance principally reflects the effects of a general-purpose attentional system and that effective working memory training should (a) lead to a growth in a domain-general attentional capacity (i.e., near transfer effects), and (b) show transfer effects to untrained tasks (i.e., far transfer effects) (Barnett & Ceci, 2002; Shipstead, Redick, & Engle, 2012). Near-transfer effects are effects on tasks closely

related to trained tasks, whereas far-transfer effects are effects on tasks not closely related to trained tasks (Melby-Lervag & Hulme, 2013). The results of the current study suggest that WMT can enhance Verbal WM and VS-STM in the shorter term (i.e., near transfer effect), but not VS-WM or Verbal STM. Consistent with previous research, large effect sizes for verbal WM post training have been reported, while only small to moderate effect sizes for visuospatial WM (Melby-Lervåg & Hulme, 2013; Mezzacappa & Buckner, 2010). Thus, it is possible that a more intensive training and/or a longer training time may be required for inducing gains in visuospatial WM (Bergman-Nutley & Klingberg, 2014).

The secondary aim of the current study was to explore whether WMT could enhance gains in math and reading skills at 6-month follow-up (Time 3; i.e., far transfer effect). After controlling for pre-test AWMA composite scores, no significant group differences were found; albeit a trend towards significance was found for Sentence Comprehension and Broad Math Composite, when controlling for pre-test Verbal STM. These results are consistent with recent meta-analyses and reviews (Shipstead, Redick, & Engle, 2012; Chacko et al., 2013; Melby-Lervag & Hulme, 2013; Rapport, Orban, Kofler, & Friedman, 2013), which question the efficacy of WMT in enabling far transfer effects. Indeed, previous studies that have analysed the possibility of improving reading and math skills by means of WMT are contradictory (e.g., Dahlin, 2011; Holmes, Gathercole, & Dunning, 2009; Melby-Lervåg & Hulme, 2013; St Clair-Thompson, Stevens, Hunt, & Bolder, 2010; Swanson, Kehler, & Jerman, 2010). It has been suggested that the lack of far transfer to scholastic achievement as measured with standardized test instruments might not reflect actual improvement in everyday school performance, and may lack sufficient sensitivity to detect subtle and developing changes in learning abilities (St. Clair-Thompson, Stevens, Hunt, & Bolder, 2010). As such, future studies should include a

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

measurement of in-school performance (i.e., teacher ratings) to help clarify the potential impact WMT has on academic performance.

Previous literature has suggested that symptoms of ADHD may be related to deficits in WM (Rogers et al. 2011; Gray, Rogers, Martinussen, & Tannock, 2015). Given the increased rates of ADHD for children in care (Garland et al., 2001), a secondary aim of the current study was to assess whether WMT could improve symptoms of ADHD. Although the majority of children in the current study did not have a diagnosis of ADHD, caregivers reported that their children in care had significant difficulties with attention/hyperactivity (see Tables 1 and 2). Contrary to what has been reported in previous studies (Klingberg et al., 2005; Mezzacappa & Buckner, 2010), the findings from the current study revealed no significant impact of WMT on caregiver rated executive functioning skills and symptoms of ADHD (i.e., inattention and hyperactivity). However, our findings are consistent with previous *controlled* trials, which suggests that WMT may not improve parental and teacher-rated reports of symptom of inattention or hyperactivity/impulsivity (Beck et al., 2010; Chacko et al., 2014; Gray et al. 2012; Green et al. 2012; van Dongen-Boomsma et al., 2014). Collectively, these findings suggest caution in attributing improvements in ADHD symptomatology found in earlier studies to WMT. It has been suggested that an intervention that improves a single component of executive functioning, such as WM, may be too limited to lead to meaningful reductions of behavioural symptoms (van Dongen-Boomsma, Vollebregt, Buitelaar, & Slaats-Willems, 2014). As such, an intervention that targets WM, alongside other aspects of executive functioning, such as inhibition and set shifting, may better improve symptoms of ADHD.

### **Limitations and Future Direction**

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

The sample size of the current pilot was smaller than anticipated, due to a variety of barriers encountered. First, the recruitment of participants for this project proved to be challenging in that many caregivers were not interested in “attention training”, which they saw as too far removed from a direct academic intervention such as tutoring. Moreover, two of the recruited participants changed foster homes, which subsequently led to them becoming attriters. While our recruitment efforts aimed to recruit only children in stable foster homes (i.e., who had been deemed likely to remain within the same foster home for the duration of the study), this attrition was unavoidable and exogenous to the study.

Another challenge was getting participants to complete the full “dose” of WMT (i.e., 20-25 sessions). Three participants (2 experimental and 1 control; 20% of the total sample) began the training but did not complete it, and, as such, were not included in the analyses. This occurred for a variety of reasons including: the children experienced increased biological parent visitations, had internet problems, or became bored with the program, all of which interrupted the weekly training. Moreover, the children who completed the full “dose” of the program may reflect a group of highly motivated and committed children and foster parents. As such, their performance may not represent that of a typical child in care. Future studies should assess how best to implement the WMT (e.g., in the classroom), to help boost the number of sessions completed.

Another limitation to the current study is the finding that the majority of the participants did not meet criteria for deficits in working memory capacity, as measured by the AWMA (see Table 2). Previous researchers have argued that WMT may be more beneficial for children with working memory deficits (Holmes, Gathercole, & Dunning, 2009). As such, future studies

should aim to recruit children in care with working memory difficulties, which would require pre-screening.

A final limitation to the current study was the lack of a waitlist control group. Previous researchers have found overall improvement in working memory capacity following WMT, but no significant difference between active WMT and placebo control groups in children with ADHD (Dongen-Boomsma, Vollebregt, Buitelaar, & Slaats-Willems, 2014) and intellectual disabilities (Söderqvist, Nutley, Ottersen, Grill, & Klingberg, 2012), suggesting that the placebo control may alone increase working memory capacity. Indeed, placebo effects following brief cognitive training have been documented (Foroughi, Monfort, Paczynski, McKnight, & Greenwood, 2016). As such, the failure to find a significant impact of WMT on VS-WM, and on far transfer effects, may be attributed to a placebo effect. Thus, to help clarify the differential effect of the placebo control group versus the active WMT group on WM capacity as well as near and far transfer effects, future studies should include a waitlist control group.

Given these limitations, the question of whether WMT is effective in improving working memory capacity for children in care remains unclear. These preliminary findings suggest that WMT can enhance Verbal WM and VS-STM, in the shorter term, but not VS-WM or Verbal STM. Moreover, whether and how far-transfer effects (e.g., academic skills) last beyond the training period is unclear. In the current study, no long-term maintenance of transfer effects of WMT were found, which is in line with other short intervention studies (e.g., Buschkuhl et al., 2008; Kronenberger, Pisoni, Henning, Colson, & Hazzard, 2011). We can only speculate about reasons, such as reduced motivation in the follow-up testing, or simply that the far-transfer effects were not strong enough to endure following the intervention. However, there are studies that provide some encouraging evidence of long-term maintenance of transfer effects (e.g.,

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Alloway et al., 2013; Borella et al., 2013; Holmes, Gathercole, & Dunning, 2009; Jaeggi et al., 2011, however see Roberts et al., 2016). Thus, more research is needed into the possible reasons for the variability in training benefits (which sometimes lasts and sometimes disappears), and whether methods such as occasional booster sessions might be necessary in order to achieve better long-term effects (Cepeda, Pashler, Vul, Wixted, & Rohrer, 2006). Moreover, future research should aim to answer the hypotheses of not only *if it works* but also *for whom it works*. For example, recent research has found that WMT is more effective for children with low working memory capacity and for children who score high on effortful control, compared with children who have low effortful control and low working memory capacity (Studer-Luethi, Bauer, & Perrig, 2016). Furthermore, to date, no published study using a control group has assessed whether working memory training can enhance, or potentiate, the effects of academic tutoring among children in foster care. It would thus be of interest to assess whether WMT could potentiate the effectiveness of other academic interventions (e.g., tutoring), on math and reading skills for children in care to help them achieve at a level that reflects their academic potential.

### **Conclusions**

The aim of this pilot study was to assess both process factors (e.g., ability to recruit participants, acceptability of the technology) as well as outcome factors (i.e., near and far transfer effects) related to WMT. In terms of process factors, as noted previously, recruitment for this study was quite challenging, in that many caregivers were not interested in “attention training”. As such, it would be recommended that future studies ask that the lead hand (i.e., a project manager in each child welfare agency) take more of an active role in that he/she iterates the importance of participating or offer a reward to caregivers and children for participating. In terms of acceptability of the intervention, there was little difference in level of interest,

enjoyment, and boredom between the two experimental groups (see Table 3). However, it would be of interest for future studies to include a qualitative component by interviewing participants about their experience with the program in order to gain a better understanding of potential barriers and feasibility about implementing an intervention of this nature.

The findings from the current study suggest, as some have already posited (Shipstead, et al., 2012), that the benefits of WMT appear to be most closely related to near transfer of training effects rather than to the generalization of training to far transfer effects (e.g., measures of inattention/hyperactivity and academic skills). Given the variability in the experimental effects (i.e., significant improvement for children in the WMT group in Verbal WM and VS-STM, but not Verbal STM or VS-WM), as well as the absence of far transfer effects, it is uncertain whether WMT may be a possible intervention for improving WM and academic skills for children in care. It is suggested that follow-up pilot studies be conducted that include: 1) a larger sample size (though still pilot in nature), 2) a waitlist control group, 3) a screen for low working memory ability, and 4) teacher ratings of in class academic performance, in order to better determine whether WMT could be a possible intervention to help improve WM capacity and academic outcomes for children in care.

**References**

- Alloway, T. P. (2007). *Automated Working: Memory Assessment: Manual*. Pearson.
- Alloway, T. P. (2009). Working memory, but not IQ, predicts subsequent learning in children with learning difficulties. *European Journal of Psychological Assessment, 25*, 92-98.
- Alloway, T. P., & Alloway, R. G. (2010). Investigating the predictive roles of working memory and IQ in academic attainment. *Journal of Experimental Child Psychology, 106*, 20-29.
- Alloway, T. P., Bibile, V., & Lau, G. (2013). Computerized working memory training: Can it lead to gains in cognitive skills in students? *Computers in Human Behavior, 29*, 632-638.
- Alloway, T. P., Gathercole, S. E., Adams, A. M., & Willis, C. (2005). Working memory abilities in children with special educational needs. *Educational and Child Psychology, 22*, 56-67.
- Alloway, T., Gathercole, S. E., Kirkwood, H., & Elliott, J. (2008). Evaluating the validity of the automated working memory assessment. *Educational Psychology, 28*, 725-734.
- Alloway, T. P., Gathercole, S. E., Kirkwood, H., & Elliott, J. (2009). The cognitive and behavioral characteristics of children with low working memory. *Child Development, 80*, 606-621.
- Alloway, T. P., Gathercole, S. E., & Pickering, S. J. (2006). Verbal and visuospatial short- term and working memory in children: Are they separable?. *Child Development, 77*, 1698-1716.
- Alloway, T. P., Gathercole, S. E., Willis, C., & Adams, A. M. (2004). A structural analysis of working memory and related cognitive skills in young children. *Journal of Experimental Child Psychology, 87*, 85-106.

- Ang, S. Y., Lee, K., Cheam, F., Poon, K., & Koh, J. (2015). Updating and working memory training: Immediate improvement, long-term maintenance, and generalisability to non-trained tasks. *Journal of Applied Research in Memory and Cognition, 4*, 121-128.
- Atkins, P. W., & Baddeley, A. (1998). Working memory and distributed vocabulary learning. *Applied Psycholinguistics, 19*, 537-552.
- Baddeley, A. (2003). Working memory: looking back and looking forward. *Nature Reviews Neuroscience, 4*, 829-839.
- Baddeley, A. (2003). Working memory and language: An overview. *Journal of Communication Disorders, 36*, 189-208.
- Baddeley, A. (1996). The concept of working memory. *Models of Short-Term Memory*, 1-27.
- Baddeley, A. (2012). Working memory: theories, models, and controversies. *Annual Review of Psychology, 63*, 1-29.
- Barnett, S. M., & Ceci, S. J. (2002). When and where do we apply what we learn?: A taxonomy for far transfer. *Psychological Bulletin, 128*, 612.
- Beck, S. J., Hanson, C. A., Puffenberger, S. S., Benninger, K. L., & Benninger, W. B. (2010). A controlled trial of working memory training for children and adolescents with ADHD. *Journal of Clinical Child & Adolescent Psychology, 39*, 825-836.
- Bergman-Nutley, S., & Klingberg, T. (2014). Effect of working memory training on working memory, arithmetic and following instructions. *Psychological Research, 78*, 869-877.
- Borella, E., Carretti, B., Zanoni, G., Zavagnin, M., & De Beni, R. (2013). Working memory training in old age: an examination of transfer and maintenance effects. *Archives of Clinical Neuropsychology, 28*, 331-347

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Bull, R., Espy, K. A., & Wiebe, S. A. (2008). Short-term memory, working memory, and executive functioning in preschoolers: Longitudinal predictors of mathematical achievement at age 7 years. *Developmental Neuropsychology, 33*, 205-228.
- Buschkuhl, M., Jaeggi, S. M., Hutchison, S., Perrig-Chiello, P., Däpp, C., Müller, M., ... & Perrig, W. J. (2008). Impact of working memory training on memory performance in old-old adults. *Psychology and Aging, 23*, 743.
- Cain, K., Oakhill, J., & Bryant, P. (2004). Children's reading comprehension ability: Concurrent prediction by working memory, verbal ability, and component skills. *Journal of Educational Psychology, 96*, 31.
- Cain, K., Oakhill, J., & Lemmon, K. (2004). Individual differences in the inference of word meanings from context: The influence of reading comprehension, vocabulary knowledge, and memory capacity. *Journal of Educational Psychology, 96*, 671.
- Carlson, M. C., Saczynski, J. S., Rebok, G. W., Seeman, T., Glass, T. A., McGill, S., ... & Fried, L. P. (2008). Exploring the effects of an “everyday” activity program on executive function and memory in older adults: Experience Corps®. *The Gerontologist, 48*, 793-801.
- Cepeda, N. J., Pashler, H., Vul, E., Wixted, J. T., & Rohrer, D. (2006). Distributed practice in verbal recall tasks: A review and quantitative synthesis. *Psychological Bulletin, 132*, 354.
- Chacko, A., Bedard, A. C., Marks, D. J., Feirsen, N., Uderman, J. Z., Chimiklis, A., ... & Ramon, M. (2014). A randomized clinical trial of Cogmed working memory training in school-age children with ADHD: a replication in a diverse sample using a control condition. *Journal of Child Psychology and Psychiatry, 55*, 247-255.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Chacko, A., Feirsen, N., Bedard, A. C., Marks, D., Uderman, J. Z., & Chimiklis, A. (2013).

Cogmed working memory training for youth with ADHD: a closer examination of efficacy utilizing evidence-based criteria. *Journal of Clinical Child & Adolescent Psychology*, *42*, 769-783.

Cheung, S. Y., & Heath, A. (1994). After care: the education and occupation of adults who have been in care. *Oxford Review of Education*, *20*, 361-374.

Cogmed. (2006). *Cogmed Working Memory Training*. Cogmed America Inc.

Conners, C. K. (2008). *Conners Comprehensive Behavior Rating Scale Manual*. Toronto, Ontario, Canada: Multi-Health Systems.

Dahlin, K. I. (2011). Effects of working memory training on reading in children with special needs. *Reading and Writing*, *24*, 479-491.

Dahlin, K. I. (2013). Working memory training and the effect on mathematical achievement in children with attention deficits and special needs. *Journal of Education and Learning*, *2*, 118.

Dixon, W. J. (1960). Simplified Estimation from Censored Normal Samples. *The Annals of Mathematical Statistics*, *31*, 385-391.

Dunning, D. L., Holmes, J., & Gathercole, S. E. (2013). Does working memory training lead to generalized improvements in children with low working memory? A randomized controlled trial. *Developmental Science*, *16*, 915-925.

Egeland, J., Aarlien, A. K., & Saunes, B. K. (2013). Few effects of far transfer of working memory training in ADHD: a randomized controlled trial. *PloS one*, *8*, e75660.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Foroughi, C. K., Monfort, S. S., Paczynski, M., McKnight, P. E., & Greenwood, P. M. (2016). Placebo effects in cognitive training. *Proceedings of the National Academy of Sciences*, 201601243.
- Froehlich, T. E., Lanphear, B. P., Epstein, J. N., Barbaresi, W. J., Katusic, S. K., & Kahn, R. S. (2007). Prevalence, recognition, and treatment of attention-deficit/hyperactivity disorder in a national sample of US children. *Archives of Pediatrics & Adolescent Medicine*, 161, 857-864.
- Mulcahy, M., & Trocmé, N. (2010). Children and youth in out-of-home care in Canada. *CECW Information Sheet*, 78.
- Garland, A. F., Hough, R. L., McCabe, K. M., Yeh, M. A. Y., Wood, P. A., & Aarons, G. A. (2001). Prevalence of psychiatric disorders in youths across five sectors of care. *Journal of the American Academy of Child & Adolescent Psychiatry*, 40, 409-418.
- Gathercole, S. E., Alloway, T. P., Willis, C., & Adams, A. M. (2006). Working memory in children with reading disabilities. *Journal of Experimental Child Psychology*, 93, 265-281.
- Gathercole, S. E., Brown, L., & Pickering, S. J. (2003). Working memory assessments at school entry as longitudinal predictors of National Curriculum attainment levels. *Educational and Child Psychology*, 20, 109-122.
- Gathercole, S. E., Lamont, E., & Alloway, T. P. (2006). Working memory in the classroom. *Working Memory and Education*, 219-240.
- Gathercole, S. E., Pickering, S. J., Knight, C., & Stegmann, Z. (2004). Working memory skills and educational attainment: Evidence from national curriculum assessments at 7 and 14 years of age. *Applied Cognitive Psychology*, 18, 1-16.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Gliner, J. A., Morgan, G. A., & Harmon, R. J. (2003). Pretest-posttest comparison group designs: Analysis and interpretation. *Journal of the American Academy of Child & Adolescent Psychiatry, 42*, 500-503.
- Gray, S. A., Chaban, P., Martinussen, R., Goldberg, R., Gotlieb, H., Kronitz, R., ... & Tannock, R. (2012). Effects of a computerized working memory training program on working memory, attention, and academics in adolescents with severe LD and comorbid ADHD: a randomized controlled trial. *Journal of Child Psychology and Psychiatry, 53*, 1277-1284.
- Gray, S. A., Rogers, M., Martinussen, R., & Tannock, R. (2015). Longitudinal relations among inattention, working memory, and academic achievement: testing mediation and the moderating role of gender. *PeerJ, 3*, e939.
- Holmes, J., Gathercole, S. E., & Dunning, D. L. (2009). Adaptive training leads to sustained enhancement of poor working memory in children. *Developmental Science, 12*, F9-15.
- Holmes, J., Gathercole, S. E., Place, M., Dunning, D. L., Hilton, K. A., & Elliott, J. G. (2010). Working memory deficits can be overcome: Impacts of training and medication on working memory in children with ADHD. *Applied Cognitive Psychology, 24*, 827-836.
- Jackson, S., & Ajayi, S. (2007). Foster care and higher education. *Adoption & Fostering, 31*, 62-72.
- Jaeggi, S. M., Buschkuhl, M., Jonides, J., & Shah, P. (2011). Short-and long-term benefits of cognitive training. *Proceedings of the National Academy of Sciences, 108*, 10081-10086.
- Kane, M. J., Hambrick, D. Z., Tuholski, S. W., Wilhelm, O., Payne, T. W., & Engle, R. W. (2004). The generality of working memory capacity: a latent-variable approach to verbal and visuospatial memory span and reasoning. *Journal of Experimental Psychology: General, 133*, 189.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Kavanaugh, B. C., Dupont-Frechette, J. A., Jerskey, B. A., & Holler, K. A. (2016).

Neurocognitive deficits in children and adolescents following maltreatment: Neurodevelopmental consequences and neuropsychological implications of traumatic stress. *Applied Neuropsychology: Child*, 1-15.

Kent, K. M., Pelham, W. E., Molina, B. S., Sibley, M. H., Waschbusch, D. A., Yu, J., ... &

Karch, K. M. (2011). The academic experience of male high school students with ADHD. *Journal of Abnormal Child Psychology*, 39(3), 451-462.

Klingberg, T. (2010). Training and plasticity of working memory. *Trends in Cognitive Sciences*, 14, 317-324.

Klingberg, T., Fernell, E., Olesen, P. J., Johnson, M., Gustafsson, P., Dahlström, K., ... &

Westerberg, H. (2005). Computerized training of working memory in children with ADHD-a randomized, controlled trial. *Journal of the American Academy of Child & Adolescent Psychiatry*, 44, 177-186.

Klingberg, T., Forsberg, H., & Westerberg, H. (2002). Training of working memory in children with ADHD. *Journal of Clinical and Experimental Neuropsychology*, 24, 781-791.

Kroesbergen, E. H., Van't Noordende, J. E., & Kolkman, M. E. (2012). Number sense in low-performing kindergarten children: effects of a working memory and an early math training. In *Reading, writing, mathematics and the developing brain: Listening to many voices*, 295-313. Springer Netherlands.

Kronenberger, W. G., Pisoni, D. B., Henning, S. C., Colson, B. G., & Hazzard, L. M. (2011).

Working memory training for children with cochlear implants: A pilot study. *Journal of Speech, Language, and Hearing Research*, 54, 1182-1196.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Loosli, S. V., Buschkuehl, M., Perrig, W. J., & Jaeggi, S. M. (2012). Working memory training improves reading processes in typically developing children. *Child Neuropsychology, 18*, 62-78.
- Martinussen, R., & Tannock, R. (2006). Working memory impairments in children with attention-deficit hyperactivity disorder with and without comorbid language learning disorders. *Journal of Clinical and Experimental Neuropsychology, 28*, 1073-1094.
- Martinussen, R., Hayden, J., Hogg-Johnson, S., & Tannock, R. (2005). A meta-analysis of working memory impairments in children with attention-Deficit/Hyperactivity disorder. *Journal of the American Academy of Child & Adolescent Psychiatry, 44*, 377-384
- Melby-Lervåg, M., & Hulme, C. (2013). Is working memory training effective? A meta-analytic review. *Developmental Psychology, 49*, 270.
- Meyer, M. L., Salimpoor, V. N., Wu, S. S., Geary, D. C., & Menon, V. (2010). Differential contribution of specific working memory components to mathematics achievement in 2nd and 3rd graders. *Learning and Individual Differences, 20*, 101-109.
- Mezzacappa, E., & Buckner, J. C. (2010). Working memory training for children with attention problems or hyperactivity: A school-based pilot study. *School Mental Health, 2*, 202-208.
- Mitic, W., & Rimer, M. (2002, December). The educational attainment of children in care in British Columbia. In *Child and Youth Care Forum* (Vol. 31, No. 6, pp. 397-414). Springer Netherlands.
- Oakhill, J., Yuill, N., & Garnham, A. (2011). The differential relations between verbal, numerical and spatial working memory abilities and children's reading comprehension. *International Electronic Journal of Elementary Education, 4*, 83.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Olesen P, Westerberg H, Klingberg T (2004). Increased prefrontal and parietal brain activity after training of working memory. *Nature Neuroscience*, 7, 75-79.
- Pickering, S. J., & Pickering, S. J. (2006). Working memory in dyslexia. *Working Memory and Neurodevelopmental Disorders*, 7-40.
- Polderman, T. J., Boomsma, D. I., Bartels, M., Verhulst, F. C., & Huizink, A. C. (2010). A systematic review of prospective studies on attention problems and academic achievement. *Acta Psychiatrica Scandinavica*, 122(4), 271-284.
- Polanczyk, G., & Jensen, P. (2008). Epidemiologic considerations in attention deficit hyperactivity disorder: a review and update. *Child and Adolescent Psychiatric Clinics of North America*, 17, 245-260.
- Raghubar, K. P., Barnes, M. A., & Hecht, S. A. (2010). Working memory and mathematics: A review of developmental, individual difference, and cognitive approaches. *Learning and Individual Differences*, 20, 110-122.
- Rapport, M. D., Orban, S. A., Kofler, M. J., & Friedman, L. M. (2013). Do programs designed to train working memory, other executive functions, and attention benefit children with ADHD? A meta-analytic review of cognitive, academic, and behavioral outcomes. *Clinical Psychology Review*, 33, 1237-1252.
- Redick T. S., Shipstead Z., Wiemers E. A., Melby-Lervåg M., Hulme C. (2015). What's working in working memory training? An educational perspective. *Educational Psychology Review*, 27, 617-633.
- Roberts, G., Quach, J., Spencer-Smith, M., Anderson, P. J., Gathercole, S., Gold, L., ... & Wake, M. (2016). Academic outcomes 2 years after working memory training for children with

- low working memory: a randomized clinical trial. *JAMA Pediatrics*, *170*, e154568-e154568.
- Rogers, M., Hwang, H., Toplak, M., Weiss, M., & Tannock, R. (2011). Inattention, working memory, and academic achievement in adolescents referred for attention deficit/hyperactivity disorder (ADHD). *Child Neuropsychology*, *17*, 444-458.
- Romano, E., Babchishin, L., Marquis, R., & Fréchette, S. (2015). Childhood maltreatment and educational outcomes. *Trauma, Violence, & Abuse*, *16*, 418-437.
- Salminen, T., Strobach, T., & Schubert, T. (2012). On the impacts of working memory training on executive functioning. *Frontiers in Human Neuroscience*, *6*, 166.
- Schulz, K. F., Altman, D. G., & Moher, D. (2010). CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials. *BMC Medicine*, *8*, 18.
- Seigneuric, A., Ehrlich, M. F., Oakhill, J. V., & Yuill, N. M. (2000). Working memory resources and children's reading comprehension. *Reading and Writing*, *13*, 81-103.
- Schafer, J. L., & Graham, J. W. (2002). Missing data: our view of the state of the art. *Psychological Methods*, *7*, 147.
- Shipstead, Z., Redick, T. S., & Engle, R. W. (2012). Is working memory training effective?. *Psychological Bulletin*, *138*, 628.
- Shipstead, Z., Redick, T. S., & Engle, R. W. (2012). Is working memory training effective?. *Psychological Bulletin*, *138*, 628.
- Soderqvist, S., & Nutley, S. B. (2015). Working Memory Training is Associated with Long Term Attainments in Math and Reading. *Frontiers in Psychology*, *6*.
- St Clair-Thompson, H., Stevens, R., Hunt, A., & Bolder, E. (2010). Improving children's working memory and classroom performance. *Educational Psychology*, *30*, 203-219.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Stone, S. (2007). Child maltreatment, out-of-home placement and academic vulnerability: A fifteen-year review of evidence and future directions. *Children and Youth Services Review, 29*, 139-161.
- Studer-Luethi, B., Bauer, C., & Perrig, W. J. (2016). Working memory training in children: Effectiveness depends on temperament. *Memory & Cognition, 44*, 171-186.
- Swanson, H. L., & Ashbaker, M. H. (2000). Working memory, short-term memory, speech rate, word recognition and reading comprehension in learning disabled readers: Does the executive system have a role?. *Intelligence, 28*, 1-30.
- Swanson, H. L., & Jerman, O. (2007). The influence of working memory on reading growth in subgroups of children with reading disabilities. *Journal of Experimental Child Psychology, 96*, 249-283.
- Swanson, H. L., Kehler, P., & Jerman, O. (2010). Working memory, strategy knowledge, and strategy instruction in children with reading disabilities. *Journal of Learning Disabilities, 43*, 24-47.
- Swanson, H. L., & Sachse-Lee, C. (2001). Mathematical problem solving and working memory in children with learning disabilities: Both executive and phonological processes are important. *Journal of Experimental Child Psychology, 79*, 294-321.
- Tabachnick, B. G., & Fidell, L. S. (2006). *Using Multivariate Statistics*, 5<sup>th</sup> ed. Boston: Pearson.
- Tideman, E., Vinnerljung, B., Hintze, K., & Isaksson, A. A. (2011). Improving foster children's school achievements: Promising results from a Swedish intensive study. *Adoption & Fostering, 35*, 44-56.
- Tordön, R., Vinnerljung, B., & Axelsson, U. (2014). Improving foster children's school performance: a replication of the Helsingborg study. *Adoption & Fostering, 38*, 37-48.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Trout, A. L., Hagaman, J., Casey, K., Reid, R., & Epstein, M. H. (2008). The academic status of children and youth in out-of-home care: A review of the literature. *Children and Youth Services Review, 30*, 979-994.
- Van Dongen-Boomsma, M., Vollebregt, M. A., Buitelaar, J. K., & Slaats-Willemse, D. (2014). Working memory training in young children with ADHD: a randomized placebo-controlled trial. *Journal of Child Psychology and Psychiatry, 55*, 886-896.
- Westerberg, H., Jacobaeus, H., Hirvikoski, T., Clevberger, P., Ostensson, M. L., Bartfai, A., & Klingberg, T. (2007). Computerized working memory training after stroke – a pilot study. *Brain Injury, 21*, 21-29.
- Westerberg H, Klingberg, T. (2007). Changes in cortical activity after training of working memory – a single-subject analysis. *Physiology & Behavior, 92*, 186-192.
- Wilson, K. M., & Swanson, H. L. (2001). Are mathematics disabilities due to a domain-general or a domain-specific working memory deficit? *Journal of Learning Disabilities, 34*, 237–248.
- Woodcock, R., McGrew, K., & Mather, N. (2001). Examiner's Manual. *Woodcock-Johnson III Tests of Achievement*. Rolling Meadows, IL: Riverside.

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Table 1

*Demographic Summary (means, standard deviations or percentages)*

	<b>Experimental Group M (SD) n = 7</b>	<b>Control Group M (SD) n = 8</b>
<b>Sex</b>		
Male: Female	3:4	5:3
<b>Age</b>	10.57 (1.62)	9.25 (1.04)
<b>School Grade</b>	5.57 (1.62)	4.13 (1.13)
<b>Age of entry into care</b>	6.71 (3.35)	5.33 (3.72)
<b>Reason for entry<sup>13</sup></b>		
Physical abuse	2 (15.4%)	2 (15.4%)
Sexual abuse	0 (0%)	1 (7.7%)
Neglect	5 (38.5%)	4 (30.8%)
Domestic Violence	3 (23.1%)	2 (15.4%)
Emotional Harm	4 (30.8%)	4 (30.8%)
Abandonment	2 (15.4%)	1 (7.7%)
Problem Behaviour	1 (7.7%)	1 (7.7%)
<b>Long term conditions*</b>		
Learning disability	2 (28.6%)	1 (12.5%)
ADHD	2 (28.6%)	3 (37.5.0%)
Developmental disability	0 (0%)	1 (12.5%)
<b>Length of time with current caregiver</b>	1.57 years	2.00 years

*Notes.* \*data were missing for 6 participants (3 from the control group and 3 from the experimental group)

<sup>13</sup> To note, these totals add up to more than 100% as children may have had exposure to numerous maltreatments

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Table 2

*Means and SDs of the pre-test, post-test, and 6-month follow-up scores of the experimental (adaptive working memory training) and placebo control groups on the AWMA sub-tests, the WJ-III, and the Conners Parent Rating Scale.*

	Experimental Group ( <i>n</i> = 7)			Control Group ( <i>n</i> = 8)		
	Pre-test	6-week post-test	6-month follow-up	Pre-test	6-week post-test	6-month follow-up
<b>Mean AWMA Composite Scores (standard scores)</b>						
<b>Verbal STM</b>	93.14 (5.32)	103.01 (12.26)	99.14 (16.80)	102.83 (13.65)	112.56 (14.37)	108.35 (14.45)
<b>Visuo-spatial STM</b>	91.40 (6.58)	109.44 (6.37)	100.01 (10.23)	90.88 (13.37)	96.55 (14.78)	93.27 (12.20)
<b>Verbal WM</b>	92.89 (4.86)	105.41 (9.19)	101.22 (9.92)	97.71 (12.09)	100.19 (18.52)	102.69 (6.16)
<b>Visuo-spatial WM</b>	98.22 (4.93)	103.99 (11.17)	102.34 (10.48)	94.02 (12.04)	100.11 (15.94)	103.56 (10.50)
<b>WJ-III scores</b>						
<b>Broad Reading (Standard Score)</b>	91.86 (6.57)		91.57 (7.28)	90.50 (4.04)		90.00 (5.35)
<b>Letter-Word Identification</b>	94.43 (7.44)	_____	92.29 (8.24)	93.88 (4.16)	_____	94.13 (6.31)
<b>Sentence Comprehension</b>	90.14 (5.87)		91.43 (6.53)	90.13 (3.44)		88.38 (5.24)
<b>Reading Fluency</b>	93.86 (7.34)		94.57 (7.81)	91.00 (10.60)		90.00 (10.18)
<b>Broad Math (Standard Score)</b>	83.43 (9.93)		83.83 (9.35)	88.63 (11.38)		86.13 (11.21)
<b>Calculation</b>	76.43 (12.23)	_____	76.57 (12.26)	80.75 (11.04)	_____	78.38 (12.48)
<b>Applied Problems</b>	92.57 (5.88)		94.50 (8.73)	96.75 (11.17)		95.38 (9.02)
<b>Math Fluency</b>	80.57 (6.24)		80.43 (4.89)	84.75 (8.78)		82.25 (11.13)
<b>Conners Parent Rating Scale (T Scores)</b>						
<b>Inattention</b>	64.14 (22.46)	62.86 (19.99)	63.57 (18.22)	61.50 (14.87)	56.88 (8.44)	59.88 (15.82)
<b>Hyperactivity</b>	61.29 (18.63)	65.43 (20.40)	59.43 (16.72)	67.13 (17.07)	60.25 (13.81)	65.63 (19.63)
<b>Executive Functioning<sup>14</sup></b>	57.71 (17.24)	62.14 (16.39)	60.71 (10.56)	55.88 (9.01)	53.13 (8.08)	52.75 (8.91)

<sup>14</sup> For executive functioning, higher T scores are indicative of greater executive functioning difficulties

Table 3

*n* values and percentage of participant responses to the 6-week follow-up questionnaire about their experience with the Cogmed WMT program \* = reported by caregiver

	<b>Experimental Group</b>	<b>Control Group</b>
	<b>6-week follow-up</b>	<b>6-week follow-up</b>
<b>How much did you enjoy the computer games?</b>		
Not much at all	0	2 (25.0%)
Somewhat enjoyable	3 (42.9%)	2 (25.0%)
Enjoyable	3 (42.9%)	4 (50%)
Very enjoyable	1 (14.3%)	0
<b>How interesting did you find the computer games?</b>		
Very interesting	0	1 (12.5%)
Interesting	5 (71.4%)	4 (50%)
Boring	1 (14.3%)	1 (12.5%)
Very boring	1 (14.3%)	2 (25.0%)
<b>As you completed more training, did you become bored with the computer games?</b>		
No	4 (57.1%)	2 (25.0%)
Yes	3 (42.9%)	5 (62.5%)
<b>* In your opinion, how much has the attention training program contributed to improvements in your child's relationship with you?</b>		
Very little	3 (42.9%)	1 (12.5%)
Some	3 (42.9%)	6 (75%)
A great deal	0	1 (12.5%)

### **General Discussion**

It has been well documented that children in care are at risk of academic difficulties (Berger et al., 2015). Despite this finding, relatively few academic interventions exist to help improve these outcomes (Forsman et al., 2012; Evans et al., 2017). The overall goal of the current dissertation was to evaluate the effectiveness of three academic interventions in being able to improve the math and reading skills of children in care.

#### **Brief review of the findings**

The first study of the dissertation evaluated the relative effectiveness of a one-to-one tutoring program, TutorBright, compared to a waitlist control group, on improving math and reading skills. As a secondary aim, this study also explored potential moderating variables (the educationally relevant domains of: age, gender, executive functioning, symptoms of PTSD, and caregiver involvement in academics) on the effectiveness of tutoring, as well as possible “spillover” effects of tutoring onto these same educationally relevant domains. The results indicated that the Tutorbright program was more effective than the waitlist control group in improving Reading Fluency, Reading Comprehension, and Math Calculation, but not on Letter Word Identification, Spelling, Math Fluency, or Applied Math Problems. Moreover, executive functioning and self-reported symptoms of PTSD (for older children) were significant moderators of the effects of tutoring for Letter-Word Identification and Math Fluency, respectively. More specifically, for children in the waitlist control group, those with higher executive functioning skills at pre-test performed better on Letter-Word Identification than those with lower executive functioning, and children in the tutoring group, with higher self-reported PTSD scores, performed more poorly on Math Fluency than children in the control group. Furthermore, age and controlling academic involvement by caregivers moderated the effects of

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

tutoring at the level of a trend for Broad Math and Reading Fluency, respectively. More specifically, younger children in the tutoring group performed better on Broad Math than older children in the tutoring group and for children in the waitlist control group, higher levels of caregiver involvement was related to better performance on Reading Fluency. No significant spillover effects of tutoring were found.

The second study aimed to assess whether a shorter version of the TYCW Direct Instruction tutoring method (i.e., 15 weeks) was as effective as a longer version (i.e., 25 weeks) for children in care. Similar to the first study, as a secondary aim, this study sought to explore potential moderating variables (i.e., age, gender, executive functioning, symptoms of PTSD, and caregiver involvement in academics) on the effectiveness of the two tutoring groups; that is, did certain children benefit more or less from 15 or 25 weeks of TYCW tutoring? Moreover, possible spillover effects of tutoring onto these same educationally relevant domains were assessed. With one exception (Math Fluency), no significant differences were found between the 15 and 25 week tutoring groups on the WJ-III math and reading subtests. Follow-up paired *t*-tests, collapsed across group, revealed significant improvement from pre-to-post testing on Letter-Word Identification, Reading Fluency, Broad Reading composite, Calculation, Math Fluency, Applied Problems, and Broad Math composite, with effect sizes (Cohen's *d*) ranging in size from 0.22 to 0.47. Moreover, children and caregivers reported relatively similar levels of improvement in math and reading skills across both tutoring groups. Together, these findings suggest that the 15 week TYCW program may be as effective as the 25 week TYCW program in improving academic skills. The moderation results revealed that children with higher executive functioning benefited more from the 15 weeks of tutoring for Calculation. Moreover, a trend towards significance was found for age (for Passage Comprehension), symptoms of PTSD (for

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

older children for Letter Word Identification and Math Fluency), as well as instrumental caregiver academic involvement (for Letter Word Identification, Spelling, and Broad Math composite). No statistically significant spillover effects were found; however, a trend towards significance was found for instrumental caregiver involvement, such that as the amount of tutoring increased, instrumental caregiver involvement also increased.

The third and final study was a pilot that aimed to assess whether WMT can enhance working memory capacity (both in the shorter term (i.e., immediately after the completion of WMT) and in the longer term (i.e., 6-months post completion of WMT) for children in care. Moreover, given the high prevalence of ADHD for children in care (McMillen et al., 2005) and the link between symptoms of ADHD, WM capacity, and academic skills (Rogers, Hwang, Toplak, Weiss, & Tannock, 2011), we explored whether WMT could enhance academic performance and symptoms of ADHD in the longer term (i.e., 6-months post completion of WMT). Children in care were randomly assigned to either the active (experimental) working memory training program, or to a placebo (control) group. Following 5 weeks of training, the results indicated that Verbal Working Memory and Visual-Spatial Short Term Memory significantly improved in the experimental group in the shorter term (i.e., immediately after the completion of the WMT); however, these findings were not sustained over the longer term (i.e., at 6-month follow-up). No significant improvement in math and reading skills or symptoms of ADHD were found.

As a secondary aim, Studies 1 and 2 of this dissertation also sought to explore the role of age, gender, and the educationally relevant domains of: behavioural difficulties, executive functioning, symptoms of PTSD, and caregiver academic involvement, on the effectiveness of tutoring. These are some of the first studies to explore possible moderating effects of tutoring on

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

either the general or in the in-care population. The findings across studies 1 and 2 suggest that executive functioning may moderate the effectiveness of tutoring for select WJ-III subtests, while symptoms of PTSD significantly moderated the effectiveness of tutoring in Study 1. Moreover, age and controlling caregiver academic involvement trended towards significance for Study 1, while age, symptoms of PTSD, and instrumental caregiver involvement in academic activities trended towards significance for Study 2. Together, these findings provide preliminary evidence to suggest that academic tutoring may be influenced by particular characteristics both within the child (e.g., executive functioning, symptoms of PTSD) and in the child's environment (e.g., caregiver involvement in academic activities). However, much more research is needed to build on the scarce literature in this area to better assess the variables that may impact the effectiveness of academic interventions.

No significant spillover effects of tutoring onto the educationally relevant domains of: behavioural difficulties, executive functioning, and caregiver academic involvement were found in either Study 1 or Study 2. However, in Study 2, there was a trend towards significance for instrumental caregiver involvement, such that as the amount of tutoring increased, instrumental caregiver involvement increased. These findings are consistent with those reported by Tideman et al. (2011), Harper & Schmidt (2012), and Marquis (2013), who all found very little impact of their academic interventions on the mental health of children in care. However, given the relatively small samples across these studies (including that of Studies 1 and 2 of the current dissertation), future studies should continue to investigate the possible "spillover" effects of tutoring on the mental health of children in care (or other educationally relevant variables) with larger sample sizes and different measures (e.g., self-report), while using a mixed-methods

approach, in an effort to determine if there is any evidence to suggest that performance in educationally relevant domains improves with improvements in basic academic skills.

### **Collective Implications Across Studies**

The amalgamation of the findings reveals several important implications. Firstly, the findings from all three studies provide additional evidence for the often low academic performance of children in care. Indeed, at pre-test children in the studies were, on average, performing below the population mean on both math and reading, with relatively weaker performance in math. This finding is in support of existing literature, suggesting that academic difficulties continues to be a need to be addressed for children in care (Evans et al., 2017). Secondly, the findings of the studies contribute to a growing body of international literature that suggests that the basic math and reading skills of children in care can be improved through targeted and structured intervention such as one-to-one tutoring (Forsman et al., 2012; Evans et al., 2017). In comparing the two tutoring interventions (i.e., Study 1 and Study 2), it appears as though the TYCW Direct Instruction method may be more powerful in helping to improve academic skills. Indeed, previous literature has argued that Direct Instruction is an effective method of improving academic skills (Flynn et al., 2012; Harper & Schmidt, 2016; Flores et al, 2013; Shillingsburg, Bowen, Peterman, & Gayman, 2015). Despite previous literature suggesting that WMT may be an effective method of improving academic skills for children in the general population (Holmes, Gathercole, & Dunning, 2009; Loosli, Buschkuehl, Perrig, & Jaeggi, 2012), the findings from the third study, suggest that that may not be the case for children in care. However, the small sample size of Study 3 may have been insufficient to find experimental effects.

Taken together, the three studies comprising the present dissertation offer a meaningful contribution to the existing literature, as their findings offer evidence in support of the effectiveness of academic tutoring in being able to begin to close the academic disparity of children in care. Moreover, the use of randomized control designs across studies demonstrates the methodological rigor that has been called for in child welfare-related research (Evans et al., 2017). The findings presented are highly relevant to the professional community of researchers and community members who are in pursuit of effective methods of helping children in care to improve academically.

### **Limitations and Directions for Future Research**

Despite the strengths and contributions of the present dissertation, several limitations exist which could be addressed by future research endeavors. First, future studies should aim to recruit more children in care. While the first two studies met the minimum sample size to find moderate effect sizes (i.e., 35 participants in each group; Coyne, Thombs, & Hagedoorn, 2010), the third study was well below this suggested threshold. Larger sample sizes would allow for more specific analyses to assess whether academic interventions are more or less beneficial for particular children.

Next, the current studies did not include a longitudinal component. To date, no published research has assessed the degree to which academic interventions for children in care produce lasting effects. Previous research with children in the general population suggests that the benefits of tutoring may decrease at 1-2 years follow-up. Indeed, in a recent meta-analysis of reading interventions for at-risk children, Suggate (2010) found that the effects of tutoring tended to decrease approximately 15 months post completion of the intervention. However, interventions administered to young children (i.e., those in kindergarten) at risk of academic

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

difficulties have been found to create more lasting effects (i.e., 1-3 years post completion of the intervention; Elbro & Petersen, 2004; Simmons, Coyne, Kwok, Harn, Kame'enui, 2008; however see Suggate, 2016). Given the variability in long term outcomes for academic interventions, it would be of interest for future research to assess the “staying power” of academic interventions for children in care, and, moreover, to assess whether certain children benefit more or less from intervention in the longer term. Interestingly, in a recent series of adolescent reading interventions summarized in Vaughn and Fletcher (2012), 1 year of intervention produced small effects that were largely not statistically significant. However, continuing the intervention with adolescents who had not responded adequately for 2–3 years led to moderate effect size advantages after the second year and a large effect on reading comprehension after 3 years. As such, researchers have argued that prolonged, or perhaps more intensive academic interventions may be particularly important for children who may not show initial improvement following the implementation of an academic intervention (Vaughn & Fletcher, 2012). Indeed, researchers have argued that academic interventions for some children should be appropriately viewed as analogous to insulin therapy, rather than as an inoculation against further math or reading failure (Blanchard, Schatschneider, Fletcher, Murray, Munger, & Vaughn, 2014; see Coyne, Kame'enui, Simmons, & Harn, 2004, for a discussion of this debate). It would be of interest for future studies to assess whether prolonged intervention is more beneficial for particular children in care (e.g., those at greatest risk of academic failure, older children). Moreover, given the lasting benefits of early academic intervention on later cognitive and academic performance (Camilli, Vargas, Ryan, & Barnett, 2010; Campbell & Ramey, 1994), future research should assess whether earlier academic intervention (i.e., upon entry into care) is

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

more effective than later academic intervention, in improving academic outcomes for children in care.

Third, the samples examined in the present dissertation consisted of a largely homogenous group of participants, and as such, findings may offer limited external validity. Indeed, children across all three studies were English speaking, had limited behavioural issues, and were in stable foster homes. Moreover, while ethnicity was not information that was collected for the participants, no children were identified as of Aboriginal origin. Given the findings that that placement instability, behavioural difficulties, and ethnic minority status are predictive of academic difficulties (Sebba et al., 2015; O'Higgins, Sebba, & Gardner, 2017), it would be of benefit for future studies to recruit more heterogenous samples of children in care and to assess the role of ethnicity, if any, on the effectiveness of academic interventions.

Fourth, pre- and post-test information was obtained from only two sources (the foster parents and children who were direct participants), rather than gaining the perspective of a third-party, such as the child welfare worker or the child's school teacher. Therefore, the use of multiple informants, including the child in care, as well as the Children's Aid workers or the children's teachers, may be useful resources of additional and corroborating information. Moreover, future studies building on this research may also consider the inclusion of a qualitative data component, in order to supplement the findings from the existing quantitative data. Including a qualitative aspect could enable the identification of specific themes or elements, in order to help further interpret the quantitative data obtained (the utilization of a mixed-methods approach would undoubtedly add richness and comprehensiveness to these existing studies in an effort to further understand the experience of participants).

### **Conclusions**

Overall, the results from these studies demonstrate that the math and reading skills of children in care can be improved through targeted one-to-one intervention. It is hoped that future intervention efforts will build on these results and continue to enhance the academic outcomes of children in care, ultimately allowing them to achieve their full potential.

**References**

- Berger, L. M., Cancian, M., Han, E., Noyes, J., & Rios-Salas, V. (2015). Children's academic achievement and foster care. *Pediatrics, 135*(1), e109-e116.
- Blachman, B. A., Schatschneider, C., Fletcher, J. M., Murray, M. S., Munger, K. A., & Vaughn, M. G. (2014). Intensive reading remediation in grade 2 or 3: Are there effects a decade later?. *Journal of Educational Psychology, 106*(1), 46.
- Camilli, G., Vargas, S., Ryan, S., & Barnett, W. S. (2010). Meta-analysis of the effects of early education interventions on cognitive and social development. *Teachers College Record, 112*, 597-620.
- Campbell, F. A., & Ramey, C. T. (1994). Effects of early intervention on intellectual and academic achievement: A follow-up study of children from low-income families. *Child Development, 65*(2), 684-698.
- Coyne, M. D., Kame'enui, E. J., Simmons, D. C., & Harn, B. A. (2004). Beginning reading intervention as inoculation or insulin: First-grade reading performance of strong responders to kindergarten intervention. *Journal of Learning Disabilities, 37*(2), 90-104.
- Coyne, J. C., Thombs, B. D., & Hagedoorn, M. (2010). Ain't necessarily so: Review and critique of recent meta-analyses of behavioral medicine interventions in health psychology. *Health Psychology, 29*(2), 107.
- Elbro, C., & Petersen, D. K. (2004). Long-term effects of phoneme awareness and letter sound training: An intervention study with children at risk for dyslexia. *Journal of Educational Psychology, 96*(4), 660.
- Evans, R., Brown, R., Rees, G., & Smith, P. (2017). Systematic review of educational interventions for looked- after children and young people: Recommendations for

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- intervention development and evaluation. *British Educational Research Journal*, 43(1), 68-94.
- Flores, M. M., Nelson, C., Hinton, V., Franklin, T. M., Strozier, S. D., Terry, L., & Franklin, S. (2013). Teaching reading comprehension and language skills to students with autism spectrum disorders and developmental disabilities using direct instruction. *Education and Training in Autism and Developmental Disabilities*, 41-48.
- Flynn, R. J., Marquis, R. A., Paquet, M. P., Peeke, L. M., & Aubry, T. D. (2012). Effects of individual direct-instruction tutoring on foster children's academic skills: A randomized trial. *Children and Youth Services Review*, 34(6), 1183-1189.
- Forsman, H., & Vinnerljung, B. (2012). Interventions aiming to improve school achievements of children in out-of-home care: A scoping review. *Children and Youth Services Review*, 34(6), 1084-1091.
- Harper, J., & Schmidt, F. (2012). Preliminary effects of a group-based tutoring program for children in long-term foster care. *Children and Youth Services Review*, 34(6), 1176-1182.
- Harper, J., & Schmidt, F. (2016). Effectiveness of a group-based academic tutoring program for children in foster care: A randomized controlled trial. *Children and Youth Services Review*, 67, 238-246.
- Holmes, J., Gathercole, S. E., & Dunning, D. L. (2009). Adaptive training leads to sustained enhancement of poor working memory in children. *Developmental Science*, 12, F9-15.
- Loosli, S. V., Buschkuehl, M., Perrig, W. J., & Jaeggi, S. M. (2012). Working memory training improves reading processes in typically developing children. *Child Neuropsychology*, 18, 62-78.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Marquis, R. (2013). *The gender effects of a foster parent-delivered tutoring program on foster children's academic skills and mental health: A randomized field trial*. Retrieved from ProQuest Digital Dissertations.

McMillen, J. C., Zima, B. T., Scott, L. D., Auslander, W. F., Munson, M. R., Tollie, M. T., & Spitznagel, E. L. (2005). Prevalence of psychiatric disorders among older youths in the foster care system. *Journal of the American Academy of Child & Adolescent Psychiatry, 44*(1), 88-95.

O'Higgins, A., Sebba, J., & Gardner, F. (2017). What are the factors associated with educational achievement for children in kinship or foster care: A systematic review. *Children and Youth Services Review, 79*, 198-220.

Rogers, M., Hwang, H., Toplak, M., Weiss, M., & Tannock, R. (2011). Inattention, working memory, and academic achievement in adolescents referred for attention deficit/hyperactivity disorder (ADHD). *Child Neuropsychology, 17*(5), 444-458.

Sebba, J., Berridge, D., Luke, N., Fletcher, J., Bell, K., Strand, S., ... O'Higgins, A. (2015). *The educational progress of looked after children in England: Linking care and educational data*. Oxford: Rees Centre (Retrieved from [http://reescentre.education.ox.ac.uk/wordpress/wpcontent/uploads/2015/11/EducationalProgressLookedAfterChildrenOverviewReport\\_Nov2015.pdf](http://reescentre.education.ox.ac.uk/wordpress/wpcontent/uploads/2015/11/EducationalProgressLookedAfterChildrenOverviewReport_Nov2015.pdf)).

Shillingsburg, M. A., Bowen, C. N., Peterman, R. K., & Gayman, M. D. (2015). Effectiveness of the direct instruction language for learning curriculum among children diagnosed with autism spectrum disorder. *Focus on Autism and Other Developmental Disabilities, 30*(1), 44-56.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Simmons, D. C., Coyne, M. D., Kwok, O. M., McDonagh, S., Harn, B. A., & Kame'enui, E. J. (2008). Indexing response to intervention: A longitudinal study of reading risk from kindergarten through third grade. *Journal of Learning Disabilities, 41*(2), 158-173.
- Suggate, S. P. (2010). Why what we teach depends on when: Grade and reading intervention modality moderate effect size. *Developmental Psychology, 46*, 1556–1579.
- Suggate, S. P. (2016). A meta-analysis of the long-term effects of phonemic awareness, phonics, fluency, and reading comprehension interventions. *Journal of Learning Disabilities, 49*(1), 77-96.
- Tideman, E., Vinnerljung, B., Hintze, K., & Isaksson, A. A. (2011). Improving foster children's school achievements: Promising results from a Swedish intensive study. *Adoption & Fostering, 35*(1), 44-56.
- Vaughn, S., & Fletcher, J. M. (2012). Response to intervention with secondary school students. *Journal of Learning Disabilities, 45*, 244– 256.

Appendix A

**CAREGIVER CONSENT FORM—Study 1**

I, (name of caregiver) \_\_\_\_\_ wish to participate in this study of math and reading tutoring for children in care. The research is being carried out by Professor Robert Flynn and Ms. Andrea Hickey of the Centre for Research on Educational and Community Services at the University of Ottawa, in collaboration with your local Children's Aid Society (CAS), with funding provided by your CAS and Professor Flynn's University research account. The study addresses the problem of often poor educational outcomes among children in care and will test the effectiveness of a new tutoring program to improve children's reading skills, and math skills. The tutoring will consist of 1.5 hour sessions twice a week in math and reading (approximately 3 hours/week). The tutoring will be done by local trained tutors at your child's home. The research is aimed at finding out whether the tutoring program is more effective than a waitlist-control group. The study will last for approximately 10 months, from September 2014, to June, 2015.

If you and your child in care agree to participate in the study, your child will be randomly assigned to one of 2 groups (either a waitlist control group or to the tutoring group). If, at the end of the study, the children who received the tutoring have greater gains in math and in reading, then the children in the waitlist control group will have the opportunity to receive the tutoring, at no cost.

**Study Requirements**

You understand that your participation and that of your child in care in this study will involve the following activities:

1. You will be asked to fill out some paper and pencil questionnaires on two occasions: before the tutoring starts and at the end of the study. These questionnaires will ask about your child's attention, strengths and difficulties, as well as general background information. Previous researchers have found that exposure to traumatic life experiences may negatively impact academic achievement. Therefore, you will be asked to complete a questionnaire about symptoms of trauma for your child in care (only if your child is between the ages of 7-9). Completing these questionnaires will take about 40 minutes of my time.
2. Your child in care will be assessed on his/her math and reading skills on the same two occasions (prior to the start of tutoring and again at the end of the study). This will take approximately 2 hours.
3. You will be asked to bring your child to each of the two assessment occasions, which will be held at your local CAS.
4. The tutoring will occur at either your local CAS or your home (whichever is most convenient for the tutor and your child in care). If the tutoring does take place at your home, then you will be required to stay at the home while your child is being tutored.

If you agree to take part in the study, you will also agree to provide transportation for your child in care for the assessments. You will also agree to complete all of the questionnaires on each assessment occasion, while your child in care is being tested.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

Your participation and that of your child in care is strictly voluntary, and you are free to refuse to participate or to withdraw from the study at any moment. This study is being conducted independently of your local CAS. Therefore, if you or your child in care refuse to participate or withdraw from the study, the services that you or your child in care receive from our local CAS will not be affected in any way.

The assessment and questionnaire results from the pre-intervention, and follow-up assessments will be kept strictly confidential and the results and final report will not identify any individual caregiver or child in care. The information will be held in a locked, secure data-storage room at the Centre for Research on Educational and Community Services for a period of five years. In the trauma questionnaires, there are some questions that ask about suicide and self-harming behaviour. If your child indicates that he/she is suicidal or hurting himself/herself, we will let you know and will inform the child's CAS child welfare worker. Your CAS agency will receive a copy of the assessment data to keep on file. If your child chooses to withdraw from the study, we will keep his/her data under lock and key with the other project data, for a period of 5 years.

We will put what we learn about you and your child in care together with what we learn about other caregivers and their children in care, so no one will be able to tell what answers came from you or your child. Also, when we tell other people about the research, we will not use your name or your child's name, so no one will be able to tell whom we are talking about.

There are two copies of the caregiver consent form, one that you will keep and one that you will return to the person administering the testing. If you have any questions about this study, you may contact the project coordinator, Andrea Hickey or the principal investigator, Robert Flynn. If you have any questions about the ethical aspects of the research or wish to make a complaint about how it is being conducted, you may contact the Protocol Officer for Ethics in Research, University of Ottawa, 550 Cumberland St, Room 154. e-mail [ethics@uottawa.ca](mailto:ethics@uottawa.ca)

Caregiver's signature \_\_\_\_\_ Date \_\_\_\_\_

\_\_\_\_\_  
Robert J. Flynn, PhD, CPsych  
Principal Investigator

\_\_\_\_\_  
Andrea Hickey  
Project Coordinator

**CHILD-IN-CARE ASSENT FORM – Study 1**

The names of the people doing this project are Robert Flynn and Andrea Hickey, from the University of Ottawa. We have found that many children in care have challenges in school. Since education is so important for their future, we are trying to learn about ways to improve their school success. If you would like, you can be in our study, which will last for approximately 10 months, from September 2014 to June, 2015.

If you decide you want to be in our study, you will need to fill out some questionnaires and do some reading and math work to see how you are progressing throughout the 10 months of the study. You will also be asked to take part in math and reading tutoring for about 3hrs each week to help you improve your reading and math skills. You will always be free to decide not to answer any questions that you are not comfortable with.

We will also be asking you about any traumatic/difficult experiences that you may have had in your life. Also, if you say during the study that you want to hurt yourself or others, then we will have to let your caregiver and your CAS worker know.

We will put what we learn about you together with what we learn about other children in care in the study, so no one will be able to tell what answers came from you. Also, any information that you give us will be kept secret, and your name will never be used when we talk about the results of the study.

Your CAS worker and caregiver have to say it’s OK for you to be in the study. After they decide, you get to choose if you want to do it, too. If you don’t want to be in the study, no one will be mad at you. Also, if you want to be in the study now and change your mind later, that’s OK. You can stop at any time.

If you have any questions about the study or if you decide you don’t want to be in the study any more, you can contact Andrea Hickey.

We will give you a copy of this form in case you want to ask questions later.

**Agreement of the child in care to be in the study**

I have decided to be in the study even though I know that I don’t have to do it. All my questions have been answered.

Child In Care’s signature \_\_\_\_\_

Date \_\_\_\_\_

Robert J. Flynn \_\_\_\_\_  
PhD, CPsych, Principal Investigator

Andrea Hickey \_\_\_\_\_  
Project coordinator

**CAREGIVER CONSENT FORM – Study 2**

I, (name of caregiver) \_\_\_\_\_ wish to participate in this study of math and reading tutoring for children in care. The research is being carried out by Professor Robert Flynn and Ms. Andrea Hickey of the Centre for Research on Educational and Community Services at the University of Ottawa, in collaboration with your local Children’s Aid Society (CAS), with funding provided by your CAS and Professor Flynn’s University research account. The study addresses the problem of often poor educational outcomes among children in care and will test the relative effectiveness of two durations of a tutoring program (15 weeks vs. 25 weeks of tutoring) to improve children’s reading skills, and math skills. The tutoring will consist of 1.5 hour sessions twice a week in math and reading (approximately 3 hours/week). The tutoring will be done by local trained tutors at your child’s home or local CAS. The research is aimed at finding out whether the 15 weeks of tutoring is as effective as 25 weeks of tutoring. The study will last for approximately 10 months, from September 2014, to June, 2015.

If you and your child in care agree to participate in the study, your child will be randomly assigned to one of the two tutoring groups (either 15 or 25 weeks of tutoring). If, at the end of the study, the 25 weeks of tutoring is more beneficial than the 15 weeks, all of the children who only received 15 weeks of tutoring, will have the opportunity to continue with the tutoring, at no cost.

**Study Requirements**

You understand that your participation and that of your child in care in this study will involve the following activities:

1. You will be asked to fill out some paper and pencil questionnaires on two occasions: before the tutoring starts and at the end of the study (either 15 or 25 weeks later). These questionnaires will ask about your child’s attention, strengths and difficulties, as well as general background information. Previous researchers have found that exposure to traumatic life experiences may negatively impact academic achievement. Therefore, you will be asked to complete a questionnaire about symptoms of trauma for your child in care (only if your child is between the ages of 7-9). Completing these questionnaires will take about 40 minutes of your time.
2. Your child in care will be assessed on his/her math and reading skills on the same two occasions (prior to the start of tutoring and again at the end of the study). This will take approximately 2 hours.
3. You will be asked to bring your child to each of the two assessment occasions, which will be held at your local CAS.
4. The tutoring will occur at either your local CAS or community centre (whichever is most convenient for the tutor and your child in care). If in any exceptional cases the tutoring does take place at your home (e.g., because of illness, etc.), then you will be required to stay at the home.

If you agree to take part in the study, you will also agree to provide transportation for your child in care for the assessments. You will also agree to complete all of the questionnaires on each assessment occasion, while your child in care is being tested.

Your participation and that of your child in care is strictly voluntary, and you are free to refuse to participate or to withdraw from the study at any moment. This study is being conducted

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

independently of your local CAS. Therefore, if you or your child in care refuse to participate or withdraw from the study, the services that you or your child in care receive from our local CAS will not be affected in any way.

The assessment and questionnaire results from the pre-intervention, and follow-up assessments will be kept strictly confidential and the results and final report will not identify any individual caregiver or child in care. The information will be held in a locked, secure data-storage room at the Centre for Research on Educational and Community Services for a period of five years. In the trauma questionnaires, there are some questions that ask about suicide and self-harming behaviour. If your child indicates that he/she is suicidal or hurting himself/herself, we will let you know and will inform the child's CAS child welfare worker. Your CAS agency will receive a copy of the assessment data to keep on file. If your child chooses to withdraw from the study, we will keep his/her data under lock and key with the other project data, for a period of 5 years.

We will put what we learn about you and your child in care together with what we learn about other caregivers and their children in care, so no one will be able to tell what answers came from you or your child. Also, when we tell other people about the research, we will not use your name or your child's name, so no one will be able to tell whom we are talking about.

There are two copies of the caregiver consent form, one that you will keep and one that you will return to the person administering the testing. If you have any questions about this study. If you have any questions about the ethical aspects of the research or wish to make a complaint about how it is being conducted, you may contact the Protocol Officer for Ethics in Research, University of Ottawa, 550 Cumberland St, Room 154; e-mail [ethics@uottawa.ca](mailto:ethics@uottawa.ca).

Caregiver's signature \_\_\_\_\_ Date \_\_\_\_\_

\_\_\_\_\_  
Robert J. Flynn, PhD, CPsych  
Principal Investigator

\_\_\_\_\_  
Andrea Hickey  
Project Coordinator

**CHILD-IN-CARE ASSENT FORM – Study 2**

The names of the people doing this project are Robert Flynn and Andrea Hickey, from the University of Ottawa. We have found that many children in care have challenges in school. Since education is so important for their future, we are trying to learn about ways to improve their school success. If you would like, you can be in our study, which will last for approximately 10 months, from September 2014 to June, 2015.

If you decide you want to be in our study, you will need to fill out some questionnaires and do some reading and math work to see how you are progressing throughout the 10 months of the study. You will also be asked to take part in math and reading tutoring for about 3hrs each week (for either 15 or 25 weeks) to help you improve your reading and math skills. You will always be free to decide not to answer any questions that you are not comfortable with.

We will also be asking you about any traumatic/difficult experiences that you may have had in your life. Also, if you say during the study that you want to hurt yourself or others, then we will have to let your caregiver and your CAS worker know.

We will put what we learn about you together with what we learn about other children in care in the study, so no one will be able to tell what answers came from you. Also, any information that you give us will be kept secret, and your name will never be used when we talk about the results of the study.

Your CAS worker and caregiver have to say it's OK for you to be in the study. After they decide, you get to choose if you want to do it, too. If you don't want to be in the study, no one will be mad at you. Also, if you want to be in the study now and change your mind later, that's OK. You can stop at any time.

If you have any questions about the study or if you decide you don't want to be in the study any more, you can contact Andrea Hickey.

We will give you a copy of this form in case you want to ask questions later.

**Agreement of the child in care to be in the study**

I have decided to be in the study even though I know that I don't have to do it. All my questions have been answered.

Child In Care's signature \_\_\_\_\_ Date \_\_\_\_\_

Robert J. Flynn \_\_\_\_\_  
PhD, CPsych, Principal Investigator

Andrea Hickey \_\_\_\_\_  
Project Coordinator

**CAREGIVER CONSENT FORM – Study 3**

I, (name of caregiver) \_\_\_\_\_ wish to participate in this study of attention training for children in care. The research is being carried out by Professor Robert Flynn and Ms. Andrea Hickey of the Centre for Research on Educational and Community Services at the University of Ottawa, in collaboration with your local Children’s Aid Society (CAS). The study addresses the problem of often poor educational outcomes among children in care and will test the relative effectiveness of two attention training interventions to improve children’s attention, reading skills, and math skills. Each intervention will consist of 30-45 minute sessions of internet-based computer training that my child in care will do 5 days a week for 5 weeks, with my encouragement. The research is aimed at finding out whether the attention training interventions, by themselves, help build attention, reading and math skills. We will also be asking you if your child has experienced any traumatic experiences in his/her life (e.g., abuse or neglect), as we want to find out if exposure to trauma influences how well the interventions work. The study will last for approximately 8 months, from the first assessment, to the 6-month follow-up.

If I and my child in care agree to participate in the study, my child will be randomly assigned to one of the two attention training groups. If, at the end of the study, one of the attention training interventions seems to have been more beneficial than the other one, all of the children who did not receive this more beneficial training program will have the opportunity of taking it, at no cost.

**Study Requirements**

I understand that my participation and that of my child in care in this study will involve the following activities:

1. I will be asked to fill out some paper and pencil questionnaires about your child in care, on three occasions: before the attention training, right after the training, and 6 months later. Completing all of these questionnaires will take about 40 minutes each time and will occur while your child in care is being assessed. The questionnaires will ask about your child in care’s attention, behaviour, and background information.
2. My child in care will do some attention testing on the same three occasions, for about 45 minutes, and also some testing for an additional 75 minutes in reading and math on two occasions: before the attention training and at the 6-month follow-up.

If I agree to take part in the study, I will also agree to provide transportation for my child in care for the assessments. I will also be my child’s “training aid” and will supervise and encourage my child in care to correctly complete the attention intervention on the internet for 35-45 minutes a day, 5 days a week, for 5 weeks. Finally, I will agree to complete all of the questionnaires on each assessment occasion, while my child in care is being tested.

My participation and that of my child in care is strictly voluntary, and we are free to refuse to participate or to withdraw from the study at any moment. This study is being conducted independently of your local CAS. Therefore, if I or my child in care refuse to participate or withdraw from the study, the services that I or my child in care receive from our local CAS will not be affected in any way.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

The assessment and questionnaire results from the pre-intervention, post-intervention, and follow-up assessments will be kept strictly confidential and the results and final report will not identify any individual caregiver or child in care. The information will be held in a locked, secure data-storage room at the Centre for Research on Educational and Community Services for a period of five years. The only limitation on confidentiality is if your child in care, during the assessments, indicates that they intend to harm themselves or others. In such a case, we will let you know and will inform the child's CAS child welfare worker.

We will put what we learn about you and your child in care together with what we learn about other caregivers and their children in care, so no one will be able to tell what answers came from you or your child. Also, when we tell other people about the research, we will not use your name or your child's name, so no one will be able to tell whom we are talking about.

There are two copies of the caregiver consent form, one that I will keep and one that I will return to the person administering the testing. If I have any questions about this study, I may contact the project coordinator, Andrea Hickey. If I have any questions about the ethical aspects of the research or wish to make a complaint about how it is being conducted, I may contact the Protocol Officer for Ethics in Research, University of Ottawa, 550 Cumberland St, Room 154; ; e-mail [ethics@uottawa.ca](mailto:ethics@uottawa.ca)

Caregiver's signature \_\_\_\_\_ Date \_\_\_\_\_

\_\_\_\_\_  
Robert J. Flynn, PhD, CPsych  
Principal Investigator

\_\_\_\_\_  
Andrea Hickey  
Project Coordinator

**We are aware that your time is precious. Thank you for reading this material and for your participation.**

**CHILD-IN-CARE ASSENT FORM – Study 3**

The names of the people doing this project are Robert Flynn and Andre Hickey, from the University of Ottawa. We have found that many children in care have challenges in school. Since education is so important for their future, we are trying to learn about ways to improve their school success. If you would like, you can be in our study, which will last for approximately 10 months, from September 2014 to June, 2015.

If you decide you want to be in our study, you will need to fill out some questionnaires and do some reading and math work to see how you are progressing throughout the 10 months of the study. You will also be asked to play some computer games 5 days a week for 5 weeks, for about 35 minutes each time. You will always be free to decide not to answer any questions that you are not comfortable with. As part of this study, you may also receive math and reading tutoring to help you to improve your reading and math skills.

We will also be asking you about any tough experiences that you may have had in your life. Also, if you say during the study that you want to hurt yourself, then we will have to let your caregiver and your CAS worker know.

We will put what we learn about you together with what we learn about other children in care in the study, so no one will be able to tell what answers came from you. Also, any information that you give us will be kept secret, and your name will never be used when we talk about the results of the study.

Your CAS worker and caregiver have to say it's OK for you to be in the study. After they decide, you get to choose if you want to do it, too. If you don't want to be in the study, no one will be mad at you. Also, if you want to be in the study now and change your mind later, that's OK. You can stop at any time.

If you have any questions about the study or if you decide you don't want to be in the study any more, you can contact Andrea Hickey. We will give you a copy of this form in case you want to ask questions later. Agreement of the child in care to be in the study I have decided to be in the study even though I know that I don't have to do it. All my questions have been answered.

Child In Care's signature \_\_\_\_\_ Date \_\_\_\_\_  
Robert J. Flynn \_\_\_\_\_  
PhD, CPsych, Principal Investigator

Andrea Hickey \_\_\_\_\_  
Project Coordinator

Appendix B  
Referral Information Form for CAS-Studies 1, 2 and 3

**Please refer children in your CAS to the project if they meet the following criteria:**

- Either a Crown Ward or Society Ward
- Currently in foster care, kinship care, adoption probation, or customary care
- Likely to be available for three assessments over an 8-month period
- Aged 7-14, inclusive
- Either an average student or having some difficulty academically (i.e., not gifted)
- Not intellectually disabled (i.e. IQ above 70)
- Have access in the home to a computer with high speed Internet
- Have English as their primary language or be able to read and understand English well

**Instructions: Please fill in the information below regarding a child you wish to refer.**

Child's Name: \_\_\_\_\_

Child's D.O.B: \_\_\_\_\_

Gender: \_\_\_\_\_

Child's primary language: \_\_\_\_\_

Child's school grade: \_\_\_\_\_

CAS Worker's Name: \_\_\_\_\_

CAS Worker's phone #: \_\_\_\_\_

CAS Worker's e-mail address: \_\_\_\_\_

Is the child of Aboriginal ethnic background? Yes \_\_\_ No \_\_\_

**Background Information on the child** (*When uncertain, please make your best estimate; write "Don't Know" if you are really unsure of the answer.*)

1. How old was the child when placed in out-of-home care **for the very first time** (at this or another child welfare agency)?

Age (in years) \_\_\_\_\_ (Please write zero if the child was less than 1 year old when first placed.)

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

2. Number of years and months that child has been in the **current** placement:: \_\_\_\_\_ years  
\_\_\_\_\_ months

3. Estimated number of **previous** placements in out-of-home care: \_\_\_\_\_ placements

4. Which of the following best describes the child's current placement? (**Mark one only**)

Foster care       Kinship care       Adoption probation       Customary care (in the case of Aboriginal children)

5. Primary reasons for current admission to service: Child in care came into care because of:  
(**Mark all that apply.**)

**Physical harm** (i.e., the child in care has been or is at risk of being physically harmed as a result of an act or action by a caregiver [commission] or is at risk of being harmed as a result of caregiver's failure to take actions to protect him/her [omission].)

**Sexual harm** (i.e., the child in care has been or is at risk of being sexually harmed as a result of an act or action by a caregiver [commission] or is at risk of being harmed as a result of the caregiver's failure to take actions to protect him/her [omission].)

**Neglect** (i.e., the child in care has been or is at risk of neglect as a result of the caregiver's failure to provide adequate care for him/her. This may be by commission or omission.)

**Domestic violence** (i.e., the child in care has been exposed to domestic violence.)

**Emotional harm** (i.e., the child in care has been or is at risk of being emotionally harmed as a result of specific behaviours of the caregiver towards him/her [commission] or is at risk of being harmed as a result of the caregiver's failure to take actions to protect him/her [omission].)

**Abandonment/separation** (i.e., the child in care has been abandoned or is at risk of being separated from the family as a result of intentional or unintentional actions of the caregiver.)

**Problematic behaviour** (i.e., the child in care's behaviour is so problematic that it exceeds the birth family's capacity to care for the young person.)

**Other**

6. Does the child have any of the following long-term conditions? In this question, "long-term conditions" refer to conditions that have lasted or are expected to last 6 months or more and have been diagnosed by a health professional. (Please check all that apply.)

None       Epilepsy       Fetal Alcohol Spectrum Disorder       Cerebral Palsy

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Developmental Disability     Learning Disability     Attention Deficit Disorder
- Emotional, Psychological, or Nervous Disorder     Post Concussion Syndrome
- Any other long-term condition (if so, please specify): \_\_\_\_\_

### **Academic Information** (*Please write "Don't Know" if unknown*)

1. How many unplanned changes in school has the child ever had (i.e., other than the usual, planned changes in school that children typically experience)? \_\_\_\_\_ unplanned changes
2. Approximately how well is the child currently doing in school (overall)?  
 Average     Not too well (below average)     Not well at all (very poorly)
3. Has the child ever repeated a grade in school?     yes     no

Signature of referring child welfare worker \_\_\_\_\_

Thank you for taking the time to complete this referral form.

---

**Appendix C**  
**Pre-test Caregiver Questionnaire – Studies 1, 2, & 3**

***Caregiver Survey (pre-test)***

*The following questions ask about your child-in-care's background information. (If you have two children in care enrolled in the program, please fill out one copy of this Caregiver Survey Questionnaire for each child.) The purpose of this Caregiver Survey Questionnaire is to gather general information about your child in care and about you, as the caregiver who knows the child best.*

**1. Local Children's Aid Society that serves the child in care (please check one):**

- Sudbury CAS     Highland Shores CAS     Niagara CAS     Ottawa CAS  
 Simcoe CAS

**2. Today's date:** \_\_\_\_\_

**3. Your name:** \_\_\_\_\_

**4. Your contact information:**

Current telephone number: (\_\_\_\_\_) \_\_\_\_\_ home

(\_\_\_\_\_) \_\_\_\_\_ cell

Current email address: \_\_\_\_\_

Current mailing address:

\_\_\_\_\_ (street and number, apt. if applicable)

\_\_\_\_\_ (city, province)

\_\_\_\_\_ (postal code)

**5. Name of your child in care:** \_\_\_\_\_

**6. Date of birth and age of your child in care: DOB:** \_\_\_\_\_  
years old

**7. What grade in school is your child in care in this year (2014/2015)?** \_\_\_\_\_  
( My child in care does not attend school)

**8. What is your child in care's primary language:** \_\_\_\_\_

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

**9. What language(s) are spoken often in your home (Mark all that apply):**

- English       French       First Nations or Inuit language       Other

**10. How many years in total have you, the caregiver, been providing foster care to children or youths (i.e., including but not limited to this child in care)?**

- Less than 1 year       1-3 years       4-9 years       10 years and over

**11. Total number of children or youths in your home who are 21 years of age or less and who are:**

a) In care, including this child in care? \_\_\_\_\_ Number in care

b) Not in care? \_\_\_\_\_ Number not in care

**12. How long has your child in care been living with you? (If less than one year, indicate number of months).**

\_\_\_\_\_ years      \_\_\_\_\_ months (if less than one year)

### **Academics:**

**13. At the present time, does the child have an Individual Education Plan (IEP) that was established by an Identification and Placement Review Committee (IPRC)?**

- Yes       No

**14. If the child has an IEP, do you know which category (or categories) were identified in the IPRC process?**

- Yes       No

*If Yes, please check the category (or categories) identified in the IPRC process:*

**Behaviour/Communication**

Autism

Deaf and Hard-of Hearing

Language Impairment

Speech Impairment

Learning Disability

**Intellectual**

Giftedness

Mild Intellectual Disability

Developmental Disability

**Physical**

Physical Disability

Blind and Low Vision

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

15. Compared to his/her age group, how is your child in care performing in school in reading and math? (Check one answer for reading and one for math)

<p><b>Reading</b></p>	<p><b>EXCELLENT</b> (Above Average)</p> <p>The child is in the age-appropriate grade but is doing work <u>above</u> this grade level (e.g., grade 4 is the child's age-appropriate grade; the child is in grade 4 but is doing work at a <u>higher</u> grade level)</p> <p style="text-align: center;"><input type="checkbox"/></p>	<p><b>GOOD</b> (Average)</p> <p>The child is in the age-appropriate grade and is doing work at this <u>same</u> grade level (e.g., grade 4 is the child's age-appropriate grade; the child is in grade 4 and is doing grade 4 level work)</p> <p style="text-align: center;"><input type="checkbox"/></p>	<p><b>NEEDS IMPROVEMENT</b> (Below Average)</p> <p>The child is in the age-appropriate grade but is doing work <u>below</u> this grade level (e.g., grade 4 is the child's age-appropriate grade; the child is in grade 4 but is doing work at a <u>lower</u> grade level)</p> <p style="text-align: center;"><input type="checkbox"/></p>	<p><b>POOR</b> (Well Below Average)</p> <p>The child is in a grade <u>lower</u> than the age-appropriate grade and is also doing work at a <u>lower</u> grade level (e.g., grade 4 is the child's age-appropriate grade; but the child is in grade 3 and doing work <u>at or below</u> the grade 3 level)</p> <p style="text-align: center;"><input type="checkbox"/></p>
<p><b>Math</b></p>	<p><b>EXCELLENT</b> (Above Average)</p> <p>The child is in the age-appropriate grade but is doing work <u>above</u> this grade level (e.g., grade 4 is the child's age-appropriate grade; the child is in grade 4 but is doing work at a <u>higher</u> grade level)</p> <p style="text-align: center;"><input type="checkbox"/></p>	<p><b>GOOD</b> (Average)</p> <p>The child is in the age-appropriate grade and is doing work at this <u>same</u> grade level (e.g., grade 4 is the child's age-appropriate grade; the child is in grade 4 and is doing grade 4 level work)</p> <p style="text-align: center;"><input type="checkbox"/></p>	<p><b>NEEDS IMPROVEMENT</b> (Below Average)</p> <p>The child is in the age-appropriate grade but is doing work <u>below</u> this grade level (e.g., grade 4 is the child's age-appropriate grade; the child is in grade 4 but is doing work at a <u>lower</u> grade level)</p> <p style="text-align: center;"><input type="checkbox"/></p>	<p><b>POOR</b> (Well Below Average)</p> <p>The child is in a grade <u>lower</u> than the age-appropriate grade and is also doing work at a <u>lower</u> grade level (e.g., grade 4 is the child's age-appropriate grade; but the child is in grade 3 and doing work <u>at or below</u> the grade 3 level)</p> <p style="text-align: center;"><input type="checkbox"/></p>

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

**16. Does your child in care receive special/resource help at school because of a physical, emotional, behavioural, or some other learning-related difficulty that limits the kind or amount of school work he/she can do?**

- Yes       On a waitlist to be assessed for or to receive such resource help       No

**17. Does your child in care currently receive any of the following educational services from any source? If so, how many weeks has he/she been receiving this help?**

a) Homework club (outside of school hours)	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, for how many weeks _____
b) Peer tutoring (i.e., tutoring by another young person) at school or out of school	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, for how many weeks _____
c) Bookworm club (child receives books in the mail)	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, for how many weeks _____
d) Professional tutoring:		
• Kumon math tutoring	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, for how many weeks _____
• Kumon reading tutoring	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, for how many weeks _____
• Sylvan tutoring	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, for how many weeks _____
• Teach Your Children Well Tutoring	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, for how many weeks _____
e) Computer-based reading or math activities	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, for how many weeks _____
f) Any other educational service (if so, please specify)_____	<input type="checkbox"/> Yes <input type="checkbox"/> No	If yes, for how many weeks _____

**19. How far do you hope your child in care will go in school?**

- Secondary or high school graduation
- Apprenticeship program
- Private career college
- College of Applied Arts and Technology
- A university degree
- More than one university degree

**Medications**

**20. Please list the prescription medication(s) – and current dosage for each – that your child in care is currently receiving to improve his/her attention, mood, or behaviour (e.g., Ritalin, 20mg per day)**

Medication #1: \_\_\_\_\_ Dosage: \_\_\_\_\_

Medication #2: \_\_\_\_\_ Dosage: \_\_\_\_\_

Medication #3: \_\_\_\_\_ Dosage: \_\_\_\_\_

Medication #4: \_\_\_\_\_ Dosage: \_\_\_\_\_

Thank you for completing this questionnaire ☺

**Appendix D**

6 week Post-test Caregiver Questionnaire – Study 3

*The following questions ask about your experience with the Attention Training program that the child in your care has recently completed. (If you have two children in care enrolled in the program, please fill out one copy of this Caregiver Survey for each child.) Please answer the questions as frankly as possible.*

1. Children's Aid Society: \_\_\_\_\_ Today's date: \_\_\_\_\_

2. Your name: \_\_\_\_\_

3. If there has been any change in your contact information since we first met with you (in September or October, 2013), please indicate your current contact information:

Please check if there has been no change in your contact information

My contact information has changed:

Current telephone number: (\_\_\_\_\_) \_\_\_\_\_

Current email address: \_\_\_\_\_

Current mailing address:

\_\_\_\_\_ (street and number, apt. if applicable)

\_\_\_\_\_ (city, province)

\_\_\_\_\_ (postal code)

**Your role as the foster child's caregiver in the Attention Training program**

4. Your role in the Attention Training program was to encourage the child in your care to complete the required exercises every day, that is, 5 days a week for 5 weeks.

4a. How clearly did you understand that this was your role before your child began the Attention Training program? *(please check one)*

Very clear

Somewhat clear

Not very clear

4b. How often did you, in fact, encourage the children in your care to do the exercises? *(please check one)*

Every day

A few days a week

Once a week or less often

**Obstacles to the child's completion of the daily exercises required by the Attention Training program**

5. Please check if any of the following obstacles interfered with the child's completion of the required daily computer-based exercises *(please check all that apply)*:

we had problems with the high-speed internet connection in our home

we had other problems with the computer in our home

I or someone other than the child in the program was sick?

the child enrolled in the Attention Training program was sick

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- the child had a lot of homework?
- the child was heavily involved in extracurricular activities?
- the child had behavior problems that made completion of the exercises difficult?
- the child occasionally refused to do the exercises?
- the child often refused to do the exercises?
- the child's visits with birth parents interfered with completion of the exercises
- other obstacle(s) (*please specify*):

**Please answer the following questions about the child in your care who recently completed the Attention Training program.**

6. Child's name: \_\_\_\_\_
7. Child's age and date of birth: Current age: \_\_\_\_\_ years (DOB): \_\_\_\_\_
8. At the present time, does the child in your care have an Individual Education Plan (IEP) that was established by an Identification and Placement Review Committee (IPRC)?
- Yes  No
9. If your foster child has an IEP, do you know which category (or categories) were identified in the IPRC process?
- Yes  No
- If Yes, please check the category (or categories) identified in the IPRC process:*
- |   |   |  |
|---|---|--|
| <b>Behavior</b>                                   | <b>Intellectual</b>                                   | <input type="checkbox"/> <b>Multiple</b> |
| <b>Communication</b>                              | <input type="checkbox"/> Giftedness                   |  |
| <input type="checkbox"/> Autism                   | <input type="checkbox"/> Mild Intellectual Disability |  |
| <input type="checkbox"/> Deaf and Hard-of-Hearing | <input type="checkbox"/> Developmental Disability     |  |
| <input type="checkbox"/> Language Impairment      | <b>Physical</b>                                       |  |
| <input type="checkbox"/> Speech Impairment        | <input type="checkbox"/> Physical Disability          |  |
| <input type="checkbox"/> Learning Disability      | <input type="checkbox"/> Blind and Low Vision         |  |
10. If your foster child does have an IEP, in your opinion, is it being satisfactorily implemented?
- Yes  No  Uncertain

**Current Medications of Child (if any)**

11. Please list the prescription medication(s) – and current dosage for each – that your foster child is currently receiving to improve his/her attention, mood or behaviour (e.g., Ritalin, 20 mg per day)

Medication #1: \_\_\_\_\_ Dosage: \_\_\_\_\_

Medication #2: \_\_\_\_\_ Dosage: \_\_\_\_\_

Medication #3: \_\_\_\_\_ Dosage: \_\_\_\_\_

Medication #4: \_\_\_\_\_ Dosage: \_\_\_\_\_

**Current Educational Services Received by Child (if any)**

12. Is the child in your care who has recently completed the Attention Training program currently receiving any of the following educational services from any source?

a) Homework club	<input type="checkbox"/> yes <input type="checkbox"/> no	If yes, how many weeks? _____
b) Peer tutoring (i.e., tutoring by another young person) at school or out of	<input type="checkbox"/> yes <input type="checkbox"/> no	If yes, how many weeks? _____

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

school	
c) Bookworm club	<input type="checkbox"/> yes <input type="checkbox"/> no If yes, how many weeks? ____
d) Professional tutoring (i.e., Sylvan, Kumon etc.)	<input type="checkbox"/> yes <input type="checkbox"/> no If yes, how many weeks? ____
e) Teach Your Children Well Tutoring	<input type="checkbox"/> yes <input type="checkbox"/> no If yes, how many weeks? ____
f) Computer-based help with reading or math (if so, please specify): _____	<input type="checkbox"/> yes <input type="checkbox"/> no If yes, how many weeks? ____
g) Any other tutoring (if so, please specify): _____	<input type="checkbox"/> yes <input type="checkbox"/> no If yes, how many weeks? ____

**Caregiver Involvement in Attention Training Program:**

13. In an average week of the Attention Training program, how much time did you spend supervising your child as they worked with the attention training on the computer?

- 1 hour or more
- 45-60 min
- 30-45 min
- 15-30 min
- less than 15 min

14. In an average week, how much time in total did your child in care spend working on the attention training on the computer (with or without your supervision)?

- 1 hour or more
- 45-60 min
- 30-45 min
- 15-30 min
- less than 15 min

15. When your child in care used the attention training on the computer, what level of supervision did he/she require from an adult in the home:

- frequent supervision
- supervision from time to time
- little or no supervision

16. In general, how cooperative was your child in care with the attention training?

- Child cooperated well and enjoyed doing the training.
- Child cooperated most of the time.
- Child did not cooperate, needed strong encouragement to do the work.

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- Child did not want to do the work, had temper tantrums to avoid it.

17. On average, how many **breaks per session** did your child in care take while completing the attention training?

- over 10 breaks  
 5-10 breaks  
 3-4 breaks  
 1-2 breaks  
 No breaks were taken

### Improvements:

18. In your opinion, how much has **the attention training program** contributed to improvements in the following:

a) Child's reading achievement?	<input type="checkbox"/> a great deal <input type="checkbox"/> some <input type="checkbox"/> very little	Comment :
b) Child's math achievement?	<input type="checkbox"/> a great deal <input type="checkbox"/> some <input type="checkbox"/> very little	Comment :
c) Child's overall school work?	<input type="checkbox"/> a great deal <input type="checkbox"/> some <input type="checkbox"/> very little	Comment :
d) Child's overall positive attitude towards school?	<input type="checkbox"/> a great deal <input type="checkbox"/> some <input type="checkbox"/> very little	Comment :
e) Child's self-esteem?	<input type="checkbox"/> a great deal <input type="checkbox"/> some <input type="checkbox"/> very little	Comment :
f) Child's behavior?	<input type="checkbox"/> a great deal <input type="checkbox"/> some <input type="checkbox"/> very little	Comment :
g) Child's happiness?	<input type="checkbox"/> a great deal <input type="checkbox"/> some <input type="checkbox"/> very little	Comment :
h) Child's relationship with you?	<input type="checkbox"/> a great deal <input type="checkbox"/> some <input type="checkbox"/> very little	Comment :

**Comments:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**Appendix E**

6-week Post test Child Survey –Study 3

Name of child: \_\_\_\_\_ Age: Years \_\_\_\_\_ Months \_\_\_\_\_

You recently completed a 5-week Attention Training Program on your computer. The following questions ask about your experiences with the program (check one answer for each question):

1. Overall, how much did you enjoy the computer games?
  - Not much at all
  - Somewhat enjoyable
  - Enjoyable
  - Very enjoyable
2. Overall, how hard (difficult) did you find the computer games?
  - Very hard
  - Not too hard
  - Easy
  - Too easy
3. Overall, how interesting or boring did you find the computer games?
  - Very interesting
  - Interesting
  - Boring
  - Very boring
4. Overall, how strong was your wish to do well on the computer games?
  - Very strong
  - Strong
  - Weak
  - Very weak
5. As you completed more days of training, did you find that:
  - a. You got more answers right on the computer games? Yes \_\_\_ No \_\_\_
  - b. You enjoyed the computer games more? Yes \_\_\_ No \_\_\_
  - c. You found the computer games more difficult? Yes \_\_\_ No \_\_\_
  - d. You wanted to do better on the computer games? Yes \_\_\_ No \_\_\_
  - e. You tried harder to do better on the computer games? Yes \_\_\_ No \_\_\_
  - f. You became more bored with the computer games? Yes \_\_\_ No \_\_\_
  - g. You paid more attention to what your teacher was saying in school? Yes \_\_\_  
No \_\_\_
  - h. You found your school work easier to do? Yes \_\_\_ No \_\_\_
6. What did you like most about the computer games?  
\_\_\_\_\_  
\_\_\_\_\_

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

7. What did you like least about the computer games?

---

---

**Appendix F**

6-month Post Test Caregiver Questionnaire – Studies 1, 2, and 3

*The following questions ask about you and your child in care over the past 6-months. (If you have two children in care enrolled in the program, please fill out one copy of this Caregiver Survey for each child.) Please answer the questions as frankly as possible.*

1. Children's Aid Society: \_\_\_\_\_ Today's date: \_\_\_\_\_

2. Your name: \_\_\_\_\_

3. If there has been any change in your contact information since we first met with you (in September or October, 2013), please indicate your current contact information:

Please check if there has been no change in your contact information

My contact information has changed:

Current telephone number: (\_\_\_\_\_) \_\_\_\_\_

Current email address: \_\_\_\_\_

Current mailing address:

\_\_\_\_\_ (street and number, apt. if applicable)

\_\_\_\_\_ (city, province)

\_\_\_\_\_ (postal code)

**Please answer the following questions about the child in your care who was part of the Teach Your Children Well tutoring project.**

4. Child's name: \_\_\_\_\_ Child's current school grade: \_\_\_\_\_

5. Child's age and date of birth: Current age: \_\_\_\_\_ years (DOB): \_\_\_\_\_

6. At the present time, does the child in your care have an Individual Education Plan (IEP) that was established by an Identification and Placement Review Committee (IPRC)?

Yes

No

7. If your foster child has an IEP, do you know which category (or categories) were identified in the IPRC process?

Yes

No

*If Yes, please check the category (or categories) identified in the IPRC process:*

**Behavior**

**Communication**

Autism

Deaf and Hard-of-Hearing

Language Impairment

Speech Impairment

Learning Disability

**Multiple**

**Intellectual**

Giftedness

Mild Intellectual Disability

Developmental Disability

**Physical**

Physical Disability

Blind and Low Vision

8. If your foster child does have an IEP, in your opinion, is it being satisfactorily implemented?

Yes

No

Uncertain

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

**Current Medications of Child (if any)**

9. Please list the prescription medication(s) – and current dosage for each – that your foster child is currently receiving to improve his/her attention, mood or behaviour (e.g., Ritalin, 20 mg per day)

Medication #1: \_\_\_\_\_ Dosage: \_\_\_\_\_  
 Medication #2: \_\_\_\_\_ Dosage: \_\_\_\_\_  
 Medication #3: \_\_\_\_\_ Dosage: \_\_\_\_\_  
 Medication #4: \_\_\_\_\_ Dosage: \_\_\_\_\_

**Current Educational Services Received by Child (if any)** If yes, for how many weeks has your child in care received it? \_\_\_\_\_

10. Is the child in your care who took part in the Teach Your Children Well tutoring program currently receiving (or has he/she received since starting the tutoring program) any of the following educational services from any source?

h) Homework club	<input type="checkbox"/> yes <input type="checkbox"/> no <b>If yes</b> , for how many weeks has your child in care received it _____ ?
i) Peer tutoring (i.e., tutoring by another young person) at school or out of school	<input type="checkbox"/> yes <input type="checkbox"/> no <b>If yes</b> , for how many weeks has your child in care received it _____ ?
j) Bookworm club	<input type="checkbox"/> yes <input type="checkbox"/> no <b>If yes</b> , for how many weeks has your child in care received it _____ ?
k) Professional tutoring (i.e., Sylvan, Kumon etc.)	<input type="checkbox"/> yes <input type="checkbox"/> no <b>If yes</b> , for how many weeks has your child in care received it _____ ?
l) Computer-based help with reading or math (please specify): _____	<input type="checkbox"/> yes <input type="checkbox"/> no <b>If yes</b> , for how many weeks has your child in care received it _____ ?
f) Any other tutoring (please specify): _____	<input type="checkbox"/> yes <input type="checkbox"/> no <b>If yes</b> , for how many weeks has your child in care received it _____ ?

**11. On average, how much time do you spend reading with your child in care each week? Please check one response only.**

- 10 or more hours each week
- 5-10 hours each week
- 1-4 hours each week
- less than 1 hour each week

**12. On average, how much time do you spend on homework help with your child in care each week? Please check one response only.**

IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

- 10 or more hours each week
- 5-10 hours each week
- 1-4 hours each week
- less than 1 hour each week

**13. On average, how much time do you spend on math work with your child in care each week?**

**Please check one response only.**

- 10 or more hours each week
- 5-10 hours each week
- 1-4 hours each week
- less than 1 hour each week

**14. Since starting the Teach Your Children Well tutoring program, approximately how many days of school has your child missed? \_\_\_\_\_ days**

**Improvements:**

**15. Since your child in care started the tutoring [or attention training] program, has there been any **improvement**, in your opinion, in any of the following areas?**

a) Child's reading achievement?	<input type="checkbox"/> a great deal <input type="checkbox"/> some <input type="checkbox"/> very little	Comment :
b) Child's math achievement?	<input type="checkbox"/> a great deal <input type="checkbox"/> some <input type="checkbox"/> very little	Comment :
c) Child's school work?	<input type="checkbox"/> a great deal <input type="checkbox"/> some <input type="checkbox"/> very little	Comment :
d) Child's attitude towards school?	<input type="checkbox"/> a great deal <input type="checkbox"/> some <input type="checkbox"/> very little	Comment :
e) Child's self-esteem?	<input type="checkbox"/> a great deal <input type="checkbox"/> some <input type="checkbox"/> very little	Comment :
f) Child's behavior?	<input type="checkbox"/> a great deal <input type="checkbox"/> some <input type="checkbox"/> very little	Comment :
g) Child's happiness?	<input type="checkbox"/> a great deal <input type="checkbox"/> some <input type="checkbox"/> very little	Comment :
h) Child's relationship with you?	<input type="checkbox"/> a great deal <input type="checkbox"/> some <input type="checkbox"/> very little	Comment :

**Appendix G**

Tutoring Experience Questionnaire: Child version – Studies 1 & 2

**1. My tutor paid attention to me during the tutoring sessions. (check one only)**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**2. My tutor let me know that he/she liked being with me.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**3. My tutor made an effort to help me learn.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**4. I could count on my tutor to come for my tutoring sessions every week.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**5. My tutor helped me see what I'm good at during the tutoring sessions.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**6. My tutor helped me to do my best.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**7. My tutor helped me to improve in reading and math.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**8. My tutor helped me follow the rules of the tutoring program.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**9. My tutor praised my efforts and progress.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**10. My tutor told me how I can do better in reading and math.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**11. I liked and felt comfortable with my tutor.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**12. My tutor was there for me when I needed help.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**13. My tutor treated me fairly.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**14. My tutor listened to what I had to say.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**15. My tutor understood my needs.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**16. My tutor worked with me to help me reach my goals.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**Overall experience with tutoring program**

**1. Overall, tutoring in reading helped me to become a better reader.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**2. Overall, tutoring in math helped me to become better in math.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**3. Overall, the tutoring I received has helped me do better in school.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

**4. Overall, getting more of this tutoring would be helpful for me in school.**

A great deal \_\_\_\_ Some \_\_\_\_ Very little \_\_\_\_

1. What did you like most about your tutoring sessions?

2. What did you like least about your tutoring sessions?

**Appendix H**

## One Year Test-Retest Correlations for Select WJ-III Subtests

<b>WJ-III Subtest</b>	<b>Correlation value (r)</b>
Letter-Word Identification	.95
Reading Fluency	.88
Passage Comprehension	.92
Spelling	.95
Broad Reading	.97
Calculation	.94
Math Fluency	.95
Applied Problems	.96
Broad Math	.98

## Pre-Test/Post-Test Correlations for the WJ-III Subtests and Covariates for Study 1

	<b>Pre-test/Post-test Correlation value (r)</b>
Letter-Word Identification	.94
Reading Fluency	.88
Passage Comprehension	.86
Spelling	.93
Broad Reading	.94
Calculation	.85
Math Fluency	.88
Applied Problems	.75
Broad Math	.91
CEFI Total Score	.69
SDQ Total Difficulties	.51
PSLS	
Instrumental Involvement	.55
Controlling Involvement	.55

**Appendix I**

Study 1 – ANCOVA results for Research Question #1

Letter-Word Identification

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.657	3.641		1.554	.125
	letter_word_ID_pre	.930	.041	.941	22.836	.000
2	(Constant)	5.498	3.722		1.477	.144
	letter_word_ID_pre	.930	.041	.940	22.672	.000
	group_tutorbright	.352	1.430	.010	.246	.806

a. Dependent Variable: letter\_word\_id\_post

Reading Fluency

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	15.812	5.038		3.138	.003
	reading_fluency_pre	.856	.059	.876	14.636	.000
2	(Constant)	12.972	5.061		2.563	.013
	reading_fluency_pre	.863	.057	.883	15.161	.000
	group_tutorbright	4.497	2.038	.128	2.207	.031

a. Dependent Variable: reading\_fluency\_post

# IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

## Passage Comprehension

Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	26.614	4.332		6.143	.000
	passage_comp_pre	.708	.052	.856	13.632	.000
2	(Constant)	25.367	4.281		5.926	.000
	passage_comp_pre	.703	.051	.849	13.809	.000
	group_tutorbright	3.517	1.734	.125	2.029	.046

a. Dependent Variable: passage\_comp\_post

## Spelling

Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.276	3.953		1.082	.283
	Spelling_pre	.955	.046	.930	20.860	.000
2	(Constant)	5.189	4.119		1.260	.212
	Spelling_pre	.952	.046	.927	20.697	.000
	group_tutorbright	-1.419	1.745	-.036	-.813	.419

a. Dependent Variable: spelling\_post

# IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

## Broad Reading

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	10.466	3.231		3.239	.002
	broad_reading_pre	.898	.038	.944	23.513	.000
2	(Constant)	9.360	3.266		2.866	.006
	broad_reading_pre	.898	.038	.943	23.775	.000
	group_tutorbright	2.350	1.458	.064	1.612	.112

a. Dependent Variable: broad\_reading\_post

## Calculation

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	20.363	4.163		4.892	.000
	Calcuation_pre	.735	.054	.854	13.510	.000
2	(Constant)	18.610	4.162		4.472	.000
	Calcuation_pre	.727	.053	.845	13.642	.000
	group_tutorbright	4.744	2.340	.126	2.027	.047

a. Dependent Variable: calculation\_post

## Math Fluency

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	10.927	4.363		2.505	.015
	Math_fluency_pre	.874	.058	.877	15.069	.000
2	(Constant)	10.812	4.392		2.462	.016
	Math_fluency_pre	.870	.059	.874	14.818	.000
	group_tutorbright	.781	1.534	.030	.509	.612

a. Dependent Variable: math\_fluency\_post

# IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

## Applied Problems

Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	28.804	6.191		4.652	.000
	applied_problems_pre	.678	.073	.747	9.259	.000
2	(Constant)	28.788	6.243		4.611	.000
	applied_problems_pre	.678	.074	.746	9.102	.000
	group_tutorbright	.133	2.260	.005	.059	.953

a. Dependent Variable: applied\_problems\_post

## Broad Math

Coefficients <sup>a</sup>						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	16.238	3.470		4.680	.000
	Broad_math_pre	.803	.045	.906	17.675	.000
2	(Constant)	15.618	3.487		4.479	.000
	Broad_math_pre	.797	.045	.899	17.530	.000
	group_tutorbright	2.206	1.713	.066	1.288	.202

a. Dependent Variable: broad\_math\_post

**Appendix J**

Tutor Data Monitoring Forms – Studies 1 & 2

**TutorBright Project : Weekly Tutor Survey (Study 1)**

1. **Your name:** \_\_\_\_\_
  
2. **Name of the child you tutored:** \_\_\_\_\_ (first name, last initial of the child)
  
3. **How many tutoring sessions did you do with this child this week?** \_\_\_\_\_ (i.e., 0, 1, or 2)
  
4. **Dates of each session:**  
Session 1: \_\_\_\_\_  
Session 2: \_\_\_\_\_
  
5. **How many minutes were each session:**  
  
Session 1: \_\_\_\_\_ mins  
Session 2: \_\_\_\_\_ mins
  
6. **For session 1:**  
How much time was spent on TutorBright reading materials, PLUS reading homework help based on TutorBright: \_\_\_\_\_ mins.  
  
How much time was spent on reading homework help, without using the TutorBright program: \_\_\_\_\_ mins.  
  
How much time was spent on TutorBright reading materials only, without any reading homework help \_\_\_\_\_ mins.  
  
What TutorBright language lessons were covered, if any (Reading comprehension, vocabulary, grammar, writing, etc.)  
\_\_\_\_\_  
  
What kind of homework help, if any, was covered (e.g. writing assignment; test/exam prep)?  
\_\_\_\_\_  
  
How much time was spent on TutorBright math materials, PLUS math homework help based on TutorBright: \_\_\_\_\_ mins

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

How much time was spent on Math homework help, without using the TutorBright program \_\_\_\_\_ mins

How much time was spent on TutorBright math materials only, without any math homework help \_\_\_\_\_ mins

What TutorBright lessons were covered, if any (Numeration, measurement, geometry, word problems, etc.)

What kind of homework help, if any, was covered (e.g. Multiplication; exam prep)?

---

How much time was spent on other activities (e.g., relationship building, taking breaks, managing behaviour)?

---

### 7. For session 2:

How much time was spent on TutorBright reading materials, PLUS reading homework help based on TutorBright: \_\_\_\_\_ mins.

How much time was spent on reading homework help, without using the TutorBright program: \_\_\_\_\_ mins.

How much time was spent on TutorBright reading materials only, without any reading homework help \_\_\_\_\_ mins.

What TutorBright language lessons were covered, if any (Reading comprehension, vocabulary, grammar, writing, etc.)

---

What kind of homework help, if any, was covered (e.g. writing assignment; test/exam prep)?

---

How much time was spent on TutorBright math materials, PLUS math homework help based on TutorBright: \_\_\_\_\_ mins

How much time was spent on Math homework help, without using the TutorBright program \_\_\_\_\_ mins

How much time was spent on TutorBright math materials only, without any math homework help \_\_\_\_\_ mins

What TutorBright lessons were covered, if any (Numeration, measurement, geometry, word problems, etc.)

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

What kind of homework help, if any, was covered (e.g. Multiplication; exam prep)?

---

How much time was spent on other activities (e.g., relationship building, taking breaks, managing behaviour)?

---

### **8. Overall, how engaged was the child in the tutoring this past week? (Please check one)**

- Highly engaged
- Engaged
- Not very engaged (please describe briefly any problems encountered this past week: \_\_\_\_\_

---

---

**TYCW Project : Weekly Tutor Survey (Study 2)**

1. **Your name:** \_\_\_\_\_

2. **Name of the child you tutored:** \_\_\_\_\_ (first name, first initial of the child)

3. **How many tutoring sessions did you do with this child this week?** \_\_\_\_\_ (i.e., 0, 1, or 2)

5. **Dates of each session:**

Session 1: \_\_\_\_\_

Session 2: \_\_\_\_\_

6. **How many minutes were each session:**

Session 1: \_\_\_\_\_ mins

Session 2: \_\_\_\_\_ mins

7. **How much time was spent on reading tutoring?**

Session 1: \_\_\_\_\_ mins

Session 2: \_\_\_\_\_ mins

8. **What was the level, lesson(s) taught (i.e., Toolbox 1, Lessons 1-2), and fluency for reading?**

Session 1: \_\_\_\_\_

Session 1 Sound/Word/Story fluency: \_\_\_\_\_

Session 2: \_\_\_\_\_

Session 2 Sound/Word/Story fluency: \_\_\_\_\_

9. **How much time was spent on math tutoring?**

Session 1: \_\_\_\_\_ mins

Session 2: \_\_\_\_\_ mins

10. **What was the level, lesson(s) taught (i.e., Counting fluency; counting by 4s to 120), and fluency for math?**

Session 1: \_\_\_\_\_

Session 1 Math fluency: \_\_\_\_\_

Session 2: \_\_\_\_\_

Session 2 Math fluency: \_\_\_\_\_

11. **Overall, how engaged was the child in the tutoring this past week? (Please check one)**

⊖ Highly engaged

⊖ Engaged

## IMPROVING ACADEMIC SKILLS FOR CHILDREN IN CARE

⊖ Not very engaged (please describe briefly any problems encountered this past week: \_\_\_\_\_

---