ASSESSMENT OF A SCHOOL-BASED INTERVENTION FOR ELEMENTARY SCHOOL STUDENTS DIAGNOSED WITH FETAL ALCOHOL SPECTRUM DISORDER (FASD)

by

ERICA CATHERINE CLARK

B.Sc. The University of Guelph, 1996
M.Sc. Queen's University, 2003

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Abstract

In response to limited interventions for children and youth diagnosed with FASD and no evidence-based resources for elementary school teachers, we aimed to measure the effectiveness and fidelity of a year long professional development program for elementary school teachers teaching students diagnosed with fetal alcohol spectrum disorder (FASD). The British Columbia Ministry of Education Provincial Outreach Program for FASD (POPFASD) developed a professional development program intended to assist teachers to integrate students with FASD in the classroom. The intervention, which is based on the Neurobehavioral Approach, focuses on changing teachers' practice to create environmental, instructional, and curricular accommodations to support the unique needs of a student affected by FASD. A mixed-method research design using inductive thematic analysis and quasi-experimental methods was used in select schools in a northern British Columbian school district to examine the intervention. For the inductive thematic analysis, semi-structured interviews were done with principals, teachers, and caregivers of students with FASD. For the quasi-experimental component, teachers and students with and without FASD were assigned to an intervention or comparison group. Intervention and comparison groups were matched for teachers' years of experience and the age, gender, ethnicity, and disruptive classroom behaviour of students with FASD. Outcome measures included classroom behaviour and academic achievement of students with FASD and academic achievement of students without FASD. Themes derived from inductive analysis described how teachers participating in the professional development program changed their perceptions of and responses to students' behaviour. Principals and teachers in the intervention group also described

implementation of the professional development program and the impact it had on teachers and the rest of the school. Caregivers in both experimental groups discussed the importance of communication for consistent implementation of accommodations and changes they felt would improve the professional development program. A statistically significant improvement in students' classroom behaviour was observed when their teachers participated in the professional development program. The results provide support for the professional development program as an effective professional development program for elementary school teachers teaching students diagnosed with FASD; however, the sample size is too small to draw any definitive conclusions.

Preface

This dissertation is based on work conducted in a British Columbian school district by Dr. Anne George, Dr. Cindy Hardy, Dr. Peter MacMillan, Dr. Wendy Hall, Kathi Hughes, Stacey Wakabayshi, Dr. Carl Anserello, Saima Fewster, and Erica Clark. Kathi Hughes and Stacey Wakabayashi developed and implemented the professional development program described in this dissertation. The grant application was written by Dr. Anne George, Dr. Cindy Hardy, Dr. Peter MacMillan, Kathi Hughes, Stacey Wakabayashi, Dr. Carl Anserello, Saima Fewster, and Erica Clark. As the doctoral student, Erica Clark was also responsible for:

- designing the research study with the assistance of Drs. Anne George, Cindy Hardy, Peter MacMillan, Wendy Hall, and Carl Anserello, and Kathi Hughes, Stacey Wakabayashi, and Saima Fewster,
- administering the measures of classroom behaviour and academic achievement,
- organizing the academic skill testing,
- conducting the semi-structured interviews,
- entering and analyzing the quantitative data,
- transcribing and analyzing the qualitative data, and
- writing this dissertation with significant editorial support from Drs. Anne George, Cindy Hardy, Peter MacMillan, and Wendy Hall.

Supervision of the research process, which entailed reviewing the research proposal, providing advice during the research process, and reviewing the dissertation, was provided by Dr. Anne George, Dr. Cindy Hardy, Dr. Peter MacMillan, and Dr. Wendy Hall. Further, Dr. Anne George, Dr. Cindy Hardy, Dr. Peter MacMillan, Kathi Hughes,

Stacey Wakabayashi, and Saima Fewster attended monthly meetings to provide input and advice on the development and implementation of the research study.

Ethics approval was obtained from the University of British Columbia Behavioural Research Ethics Board (H07-03184) and the University of Northern British Columbia Research Ethics Board (E2008.0128.032).

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List of Abbreviations

ADHD	Attention Deficit Hyperactivity Disorder
ANT-C	Attentional Network Test for Children
ARBD	Alcohol-Related Birth Defects
ARND	Alcohol-Related Neurodevelopmental Disorder
BASC-2 POP	Behavioral Assessment System for Children 2nd Edition Portable Observation Program
BASC-2 SOS	Behavioral Assessment System for Children 2nd Edition Student Observation System
BASC-2 TRS	Behavioral Assessment System for Children 2nd Edition Teacher Rating Scale
BC	British Columbia
BRIEF	Behavior Rating Inventory for Executive Function
CBCL TRF	Child Behavior Checklist Teacher Report Form
CBM	Curriculum Based Measurement
CDBC	Complex Developmental Behavioural Condition
CPAT	Computerized Progressive Attention Training
DSM IV	Diagnostic and Statistical Manual for Mental Disorders
FAE	Fetal Alcohol Effects
FAS	Fetal Alcohol Syndrome
FASD	Fetal Alcohol Spectrum Disorder
FTE	Full Time Equivalent
HPA	Hypothalamic-pituitary-adrenal

IEP	Individual Education Plan
IOM	Institute of Medicine
KLN	What I Know, what I Learned, and what I Need to know
LEIC	Learner, Environment, Instruction, and Curriculum
MCFD	Ministry of Child and Family Development
PAE	Prenatal Alcohol Exposure
pFAE	Partial Fetal Alcohol Effects
pFAS	Partial Fetal Alcohol Syndrome
POPFASD	Provincial Outreach Program for Fetal Alcohol Spectrum Disorder
RATC	Roberts Apperception Test for Children
TA	Teacher Assistant
USA	United States of America
WISC III	Wechsler Intelligence Scale for Children Third Edition

Acknowledgements

This research project would not have been possible without the support provided by the following people and organizations: the Victoria Foundation Fetal Alcohol Spectrum Disorder (FASD) Action Fund, the Provincial Outreach Program for FASD (POPFASD), School District No. 57, Psycan, Dr. M. Anne George, Dr. Cindy Hardy, Dr. Peter MacMillan, Dr. Wendy Hall, Dr. Carl Anserello, Saima Fewster, Kathi Hughes, and Stacey Wakabayashi.

POPFASD, specifically Dr. Carl Anserello, Kathi Hughes, and Stacey Wakabayashi, recognized the need for an evidence-based professional development program for elementary school teachers on FASD. It was through their efforts that a research partnership with the University of British Columbia was initiated. Kathi Hughes and Stacey Wakabayashi drew on their considerable experience and expertise to develop the intervention studied in this dissertation.

Funding support was provided by the Victoria Foundation and Psycan. A grant from the Victoria Foundation's FASD Action Fund made possible the implementation and assessment of the professional development program. Additional funding support was provided through a discount on Behavioural Assessment System for Children 2nd Edition and Behaviour Rating Inventory for Executive Function tests from Psycan.

Countless hours were contributed by Dr. Anne George, Dr. Cindy Hardy, Dr. Peter MacMillan, Dr. Wendy Hall, Kathi Hughes, Stacey Wakabayashi, Saima Fewster, and Dr. Carl Anserello to ensure the success of this endevour. Dr. Anne George, Dr. Cindy Hardy, Dr. Peter MacMillan, Kathi Hughes, Stacey Wakabayashi, and Saima Fewster attended monthly meetings to contribute advice, ensure successful

implementation of the intervention and research methods. Considerable time was invested by all in supervision of the doctoral student and writing and reviewing the grant application, ethics applications, as well as this dissertation.

Finally, without the support of the administration, staff, students, and caregivers of School District No. 57, this research project would not have taken place. Administrators gave their support to this project allowing it too take place within district schools. Staff, particularly those in the intervention group, contributed significant amounts of time and resources to ensure the successful implementation and assessment of the professional development program. Teachers in the intervention group invested a significant amount of time developing new learning materials for their classrooms and altering the physical environment of their classrooms. Caregivers were generous in their support of the program consenting to participation for themselves and their children.

Dedication

This dissertation is dedicated to my family, supervisory committee, Provincial Outreach Program for Fetal Alcohol Spectrum Disorder, and the administrators, staff, caregivers, and students of School District No. 57. This dissertation has been an incredible learning experience and I cannot express how grateful I am for the support I received in this endeavour.

The knowledge and skills that I have I owe to the mentorship of my supervisory committee: Dr. M. Anne George, Dr. Cindy Hardy, Dr. Peter MacMillan, and Dr. Wendy Hall. I cannot express how appreciative I am of the time and patience they took to share their wisdom and expertise with me. The improvements I have made to my writing, critical thinking, and research skills I owe to them. In particular, I want to thank my supervisor, Dr. M. Anne George, for all the help she gave me during my doctorate degree.

I am grateful to the willingness of Kathi Hughes, Stacey Wakabayashi, and the rest of POPFASD for their willingness to take on the extra work of engaging in the research process with me and the rest of my research committee.

Finally, I am grateful to the generosity and trust given to me by the administrators, staff, caregivers, and students of School District No. 57. This dissertation would not have been possible without the countless hours invested by these individuals.

For my family, I am thankful for the unwavering support they provided me through the highs and lows of undertaking my doctorate degree.

1.0 Introduction

Fetal alcohol spectrum disorder (FASD), which is caused by prenatal alcohol exposure (PAE), represents a significant challenge to British Columbia (BC) elementary school teachers because of the nature of the disorder and the number of students affected. FASD is associated with a range of cognitive, behavioural, neurological, and physical features (Chudley et al., 2005) that present a challenge to elementary school teachers (Watson & Westby, 2003a). Based on western studies (mostly USA), the prevalence of FASD in Canada has been estimated to be 9.1-10 FASD/1,000 live births (Abel, 1995; Sampson et al., 1997). The prevalence estimate makes FASD one of the leading causes of developmental disability for children and; therefore, an issue for which teachers should receive professional development training (Burstyn, Sithole, & Zwaigenbaum, 2010; Health Canada, 2002).

A limited number of interventions have been studied to improve school performance, social skills, and executive function of children diagnosed with FASD (Bertrand, 2009; Premji, Benzies, Serret, & Hayden, 2007). All of the interventions we examined documented some degree of success (Bertrand, 2009; Premji, Benzies, Serret, & Hayden, 2007); however, none are professional development programs for teachers. There are professional development workshops available for teachers, including some provided by the British Columbia's Provincial Outreach Program for FASD (POPFASD), but none have been assessed for effectiveness. The lack of effectiveness studies may be due to limited time and resources devoted to research within the education system. POPFASD sought to address the lack of evidence-based professional development for teachers by creating a training program to improve teachers' practice in working with

students with FASD. POPFASD's year long intervention uses multiple forms to engage teachers as active learners to further develop their practice with respect to students diagnosed with an FASD.

In this study, we measure the effectiveness and fidelity of the professional development program developed by POPFASD for elementary school teachers working with students with FASD. The hypotheses are that a professional development program based on the Neurobehavioral Approach will improve the classroom behaviour and academic achievement of students with FASD thereby improving their school experience. It is further hypothesized that the academic performance of the whole class will improve when the teacher spends less time dealing with disruptive classroom behaviour. We examine whether the intervention is associated with improved classroom behaviour and academic achievement of students with FASD and improved academic achievement of the whole class using quasi-experimental methods. We also explore how the intervention affects principals, teachers, and caregivers using qualitative descriptive methods. Finally, we examine whether the cost of the professional development program is comparable to other ways school districts' may choose to support teachers.

2.0 Literature Review

2.1 Introduction and Methods

Extensive published literature exists on PAE spanning several disciplines including medicine, psychology, and education. A comprehensive review of the PAE literature was undertaken with a focus on disabilities, interventions, and professional development for teachers. Research reviewed included human and, where relevant, animal models. The purpose of this literature review is to summarize the research as it relates to children in terms of the:

1. diagnosis and terminology,
2. incidence and prevalence,
3. cognitive and behavioural disabilities associated with PAE,
4. available evidence on interventions, including their theoretical basis, for children prenatally exposed to alcohol, and
5. professional development for elementary school teachers.

2.1.1 Search Strategy

Searches were conducted of six electronic databases to provide a comprehensive review of the PAE literature. Databases chosen were PubMED, EMBASE (OvidSP), PsycINFO, Sociological Abstracts, ERIC (CSA interface), CBCA Fulltext Education, and Professional Development Collection. PubMED, which has a North American focus, and EMBASE (OvidSP), which has a European focus, were selected to provide comprehensive international coverage of the published biomedical and pharmaceutical literature. PsycINFO was chosen to obtain coverage of the psychological literature. Sociological Abstracts database provided coverage of the international literature for

social and behavioural sciences. ERIC (CSA interface) covers education and education-related journals with a focus on the United States of America (USA). CBCA Fulltext Education was also searched to cover the Canadian educational literature. Professional Development Collection was included for its coverage of literature on educating teachers. Together, the six databases provided comprehensive coverage of the relevant literature.

Years searched in each of the six databases varied. For EMBASE, the earliest year was dictated by when the database began indexing. In rest of the databases, the earliest year used was based on when the teratogenic effects of PAE were first identified in the research literature, specifically, 1968. Databases and years searched for each are:

- PubMED 1968 through 2009,
- EMBASE (OvidSP) 1982-2009,
- PsycINFO 1968-2009 for journals and 1987-2009 for books and book chapters,
- Sociological Abstracts 1968-2009,
- ERIC (CSA interface) 1967-2009, and
- Professional Development Collection 1968-2009.

A limited search of the grey literature was conducted. Websites for the BC Government's Ministry of Education, Ministry of Child and Family Development (MCFD), and Ministry of Health were searched for relevant reports. The search strategy for the grey literature was the same as that used for the published literature.

In an attempt to cover all of the English language literature and some French language literature on PAE and school-based interventions a search strategy was devised. The initial search used broad search terms to capture the maximum number of relevant articles. Later searches of subcategories narrowed the range of articles captured. French

language literature was only included for FASD incidence and prevalence studies because of limited French language skills. The strategy was based on two main categories with a number of subcategories. A term from the main category was paired with a subcategory term to narrow the search. For example, executive function was paired with fetal alcohol syndrome (FAS), fetal alcohol, fetal alcohol effects (FAE), FASD, and PAE. The categories and subcategories were:

1) prenatal alcohol exposure: FAS, fetal alcohol, FAE, FASD, PAE, pregnancy, drinking, alcoholism, terminology, history, diagnosis, brain development, brain structure, and brain imaging,
    a) epidemiology: epidemiology, prevalence, incidence, rate, diagnosis, screening, surveillance, prospective, and longitudinal
    b) cognition: executive function, memory, learning, abstract reasoning, academic achievement, language, metacognition, judgement, abstraction, neurocognitive, and neurobehavioural
    c) behaviour: mental disorder, mental health, mental illness, behaviour, psychiatric, neuropsychiatric, social skills, social communication, communication, impulsive behaviour, social perception, aggression, sexual behaviour, social behaviour, and motor activity
    d) interventions: interventions, school, counselling, early intervention (education), early intervention, and intervention studies
2) professional development of teachers:
    a) academic achievement: academic, academic achievement, reading, writing, and math

b) developmental disabilities: developmental disabilities, intellectual disabilities, mental retardation, and exceptionality,

c) behaviour: mental health, mental illness, and behaviour

Our literature review section provides a critical analysis of the PAE literature relevant to this study. A brief synthesis of terminology and diagnosis guidelines in Sections 2.2 and 2.3 describes the diagnostic labels teachers see in practice and how the accompanying information may affect their understanding of the disorder. Section 2.2 also provides definitions of terminology, such as PAE and FASD, used in this study. Section 2.4 includes critical analysis of FASD incidence and prevalence studies to define the scope of the issue teachers' face in British Columbia (BC) schools. Section 2.5 describes a theoretical framework that can be used to understand the complex interaction of PAE and other factors in the development of FASD. Section 2.5 also presents a critical analysis of research on the potential effects of PAE relevant to elementary school classrooms, including research on individuals diagnosed with FASD. Peer-reviewed research on interventions for children with PAE or diagnosed with FASD are critiqued in Section 2.6 with emphasis on how the results can inform teachers' practice.

2.2 Terminology

In this literature review, FASD refers to all clinically diagnosed effects of PAE while PAE refers to the broader spectrum of effects. The spectrum of effects associated with PAE is wider than that encompassed by FASD and the research literature, especially in the animal model research, is not limited to the clinically diagnosed effects. When the discussion is limited to a specific disorder, such as FAS, the corresponding diagnostic term is used.

FASD is an umbrella term that describes the continuum of the effects of PAE diagnosed by clinicians and includes all the diagnostic terms that have been developed by clinicians including FAS, Partial FAS (pFAS), FAE, Possible FAE (pFAE), Alcohol Related Neurodevelopmental Disorder (ARND), Alcohol Related Birth Defects (ARBD), Sentinel Physical Findings, Static Encephalopathy, and Neurodevelopmental Disorder (Astley & Clarren, 2000; Chudley et al., 2005). Possible FAE was recommended as a diagnosis (Rosett, 1980) then shortened to FAE by clinicians (Asante & Nelms-Matzke, 1985) before it was discarded as a diagnostic term (Stratton, Howe, & Battaglia, 1996). Diagnostic terms included in the Canadian Diagnostic Guidelines include FAS, pFAS, ARBD, ARND, and Neurodevelopmental Disorder (Chudley, et al., 2005) Some physicians in BC may still use the 4-Digit Diagnostic Code terminology which includes FAS, pFAS, Sentinel Physical Findings, Static Encephalopathy, and Neurodevelopmental Disorder (Astley & Clarren, 2000). Therefore, teachers in BC may see any of the following diagnoses for a student: FAS, pFAS, ARND, ARBD, Sentinel Physical Findings, Static Encephalopathy, or Neurodevelopmental Disorder (Astley & Clarren, 2000; Chudley et al., 2005). A teacher needs some knowledge of the diagnostic criteria outlined in Section 2.3 to begin to understand the meaning of the terminology.

2.3 Diagnostic Guidelines

Diagnostic guidelines for FASD have become more refined and objective since symptoms of PAE were first identified in France (Lemoine, Harousseau, Borteyru, & Menuet, 1968) and the USA (Jones, Smith, Ulleland, & Streissguth, 1973). Prior to 2005, a Canadian physician could diagnose FASD using the Institute of Medicine (IOM) criteria or the 4-Digit Diagnostic Code. The Canadian Diagnostic Guidelines were

published in 2005 and the multidisciplinary assessment they describe is the current standard for diagnosis of FASD in BC and the rest of Canada.

Diagnostic guidelines published by the IOM provide specific definitions for diagnosis of the whole spectrum of FASD (Stratton, Howe, & Battaglia, 1996). Diagnoses include FAS, pFAS, ARND, and ARBD (Stratton, Howe, & Battaglia, 1996). Hoyme et al. (2005) proposed revisions to the definitions for the syndrome features; however, the proposed revisions were not included in subsequent diagnostic guidelines (Astley & Clarren, 2000; Bertrand et al., 2005; Chudley et al., 2005). The diagnostic labels describe whether or not a student displays the physical features or neurocognitive delays necessary for a medical diagnosis; however, the labels do not indicate how a student will perform in the classroom (Ryan & Ferguson, 2006).

The 4-Digit Diagnostic Code was developed by clinicians at the University of Washington to provide a more precise description of the syndrome features in each diagnosis (Astley & Clarren, 2000). The four categories used for diagnosis of FAS in the 1996 Institute of Medicine (IOM) guidelines (Stratton, Howe, & Battaglia, 1996) were given objective definitions that included four different magnitudes of expression for each category (Astley & Clarren, 2000). The diagnoses of pFAS, ARND, and ARBD, used in the 1996 IOM Guidelines (Stratton, Howe, & Battaglia, 1996), were replaced with Atypical Fetal Alcohol Syndrome, Sentinel Physical Findings, Static Encephalopathy, and Neurobehavioral Disorder (Astley & Clarren, 2000). The scoring system used in the 4-Digit Diagnostic Code allows clinicians and researchers to convey the diversity of symptoms possible with PAE more precisely allowing for greater homogeneity in the populations described by each series of four numbers (Astley & Clarren, 2000). For

teachers, the 4-Digit Diagnostic Code may provide less clarity. Three of the diagnostic labels do not include the term "alcohol" so, without additional information, the teacher may be unaware his or her student has FASD.

The Canadian government developed the Canadian Diagnostic Guidelines in 2005 as the national standard for diagnosis of FASD (Chudley et al., 2005). The measurement system of the 4-Digit Diagnostic Code (Astley & Clarren, 2000) was combined with the terminology of the 1996 IOM guidelines (Stratton, Howe, & Battaglia, 1996) to create the Canadian Diagnostic Guidelines (Chudley et al., 2005). ARBD was left out because it is difficult to attribute causation to PAE when there are no other syndrome features and the diagnosis has limited clinical value (Chudley, et al., 2005). A brief description of the diagnostic criteria is described in Table 1:

Table 1: Brief summary of the diagnostic criteria for the Canadian Diagnostic Guidelines

Diagnosis	Prenatal alcohol exposure	Growth deficiency	Central nervous system damage or dysfunction	FAS facial phenotype
FAS with confirmed PAE	confirmed	mild to significant	probable or definite	at least two of the three anomalies
FAS without confirmed PAE	unknown	mild to significant	probable or definite	at least two of the three anomalies
pFAS	confirmed	none to significant	probable or definite	at least one of the three anomalies
ARND (Neurodevelopmental Disorder if <6years)	confirmed	none to significant	probable or definite	one or none of the three anomalies

Although it is helpful to establish which diagnostic labels a teacher should expect to see in Canada, the Canadian diagnostic guidelines do not improve a teacher's understanding of what challenges his or her student may be facing in the classroom.

The BC Ministry of Health established a Complex Developmental Behavioural Condition (CDBC) assessment team in each health region that uses the Canadian Diagnostic Guidelines (Chudley et al., 2005) for any multidisciplinary FASD assessments they undertake. A teacher can get information specific to the student if the assessment report is released to them; however, he or she may not understand the medical terminology used in the report. Most of the assessment reports released to BC schools use medical terminology teachers are unfamiliar with and, without additional training and resources to aid interpretation, the reports are of limited utility (K. Hughes, personal communication, 2006). Even when an assessment report contains recommendations for teachers the information may not be useful. In a qualitative study, teachers in Alaska reported the diagnostic reports they received were not helpful because the recommendations written for schools were too generic to apply to the classroom context (Ryan & Ferguson, 2006).

2.4 Prevalence of FASD

Current prevalence studies demonstrates FASD is widespread and; therefore, a disorder BC school teachers are likely to encounter amongst their students. The estimated prevalence of 9.1-10 FASD/1,000 live births makes it one of the leading causes of developmental disabilities for elementary school students (Burstyn, Sithole, & Zwaigenbaum, 2010; Health Canada, 2002). The Canadian prevalence is based on prospective birth cohort data and multiple data sources from the USA because Canadian

prevalence studies are lacking (Abel, 1995; Sampson et al., 1997). The prevalence of FASD is likely underestimated due to methodological problems with the USA studies (May & Gossage, 2001). In areas where the risk factors for FASD, such as low socioeconomic status or binge alcohol consumption, are high, teachers could be dealing with prevalence rates as high as 19% (Robinson, Conry, & Conry, 1987).

Prevalence studies from Canada and the USA can be categorized into two broad categories, active or passive surveillance, which have their own methodological weaknesses contributing to the underestimate of FASD prevalence (May & Gossage, 2001). Passive surveillance studies use birth defect monitoring systems and physician reporting and are the least likely to identify individuals with FASD because of their reliance on the ability of families to access diagnostic services and the willingness and ability of physicians to identify and report FASD (Druschel & Fox, 2007; May & Gossage, 2001). Active surveillance studies are more likely to locate individuals with FASD because researchers and health professionals are actively recruiting and assessing individuals (May & Gossage, 2001). The challenge for families to access diagnostic services is still significant for active surveillance studies (Habbick, Nanson, Snyder, Casey, & Schulman, 1996). Women at the greatest risk for having children with FASD are those who are:

- experiencing low socioeconomic status,
- experiencing poor nutrition,
- experiencing high stress,
- exposed to high levels of environmental pollutants, and

- not supported in their efforts to reduce alcohol, tobacco, and other drug use during pregnancy (Abel, 1995; Abel & Hannigan, 1995; Bingol et al., 1987; May et al., 2007; Robinson, Conry, & Conry, 1987).

These are also families likely to experience difficulty accessing health care services and that may lack the resources needed to access specialized assessment services. This means that teachers can expect a minimum of 0.9-1% of students to be affected by FASD in Canadian schools, often in family circumstances where resources and support are limited.

The prevalence research outlines the number of students likely to be affected in Canada while the psychological research describes the range of neurocognitive difficulties students diagnosed with FASD may be dealing with in the classroom. School districts can expect that regions with a number of the risk factors for FASD may have prevalence rates exceeding 1%, although the students may not be diagnosed. As described in the next section, students with FASD may experience a number of neurocognitive challenges.

2.5 Effects of PAE on the Child

FASD is a complex disorder where effects are influenced by prenatal and postnatal environments. As outlined in the previous section, the development of FASD in the foetus is affected by a number of other variables. Environmental influence does not stop at birth. Postnatal environmental factors, such as childhood trauma and poverty, may affect a child's development and, consequently, the severity of symptoms associated with FASD. This study examines children with FASD in the school environment; therefore, the review is limited to cognitive, behavioural, and emotional difficulties associated with FASD and the resources teachers can use when working with a student

with FASD. The Contextual Systems Model (Pianta & Walsh, 1996) provides a theoretical framework to understand how the postnatal environment influences a child with FASD and vice versa.

Research on the effect of PAE across the lifespan is still in the early stages. Access to diagnostic services in Canada is limited although the advent of the CDBC teams has improved accessibility in BC. Barriers to diagnosis have meant there are a limited number of children diagnosed each year that could be recruited for research studies. Therefore, much of the research has involved small samples. The small sample sizes preclude exploring the influence of a large number of postnatal variables on PAE and age-related changes in the effects of PAE.

2.5.1 Contextual Systems Model

The Contextual Systems Model (see Figure 1) refers to environments, such as the classroom or school, as systems and these terms are used interchangeably in this review. Key features of the model are:

1. the child is an open, dynamic system,
2. the quality of the relationships between the child and other systems and within other systems influences outcomes,
3. large numbers of factors interact over time to produce an outcome,
4. a linear relationship cannot be drawn between two or three factors as causing an outcome,
5. multiple perspectives are possible and can yield multiple explanations for any given outcome, and

6. behaviour and biology are complex; therefore, explanations of their mutual effects are complex.

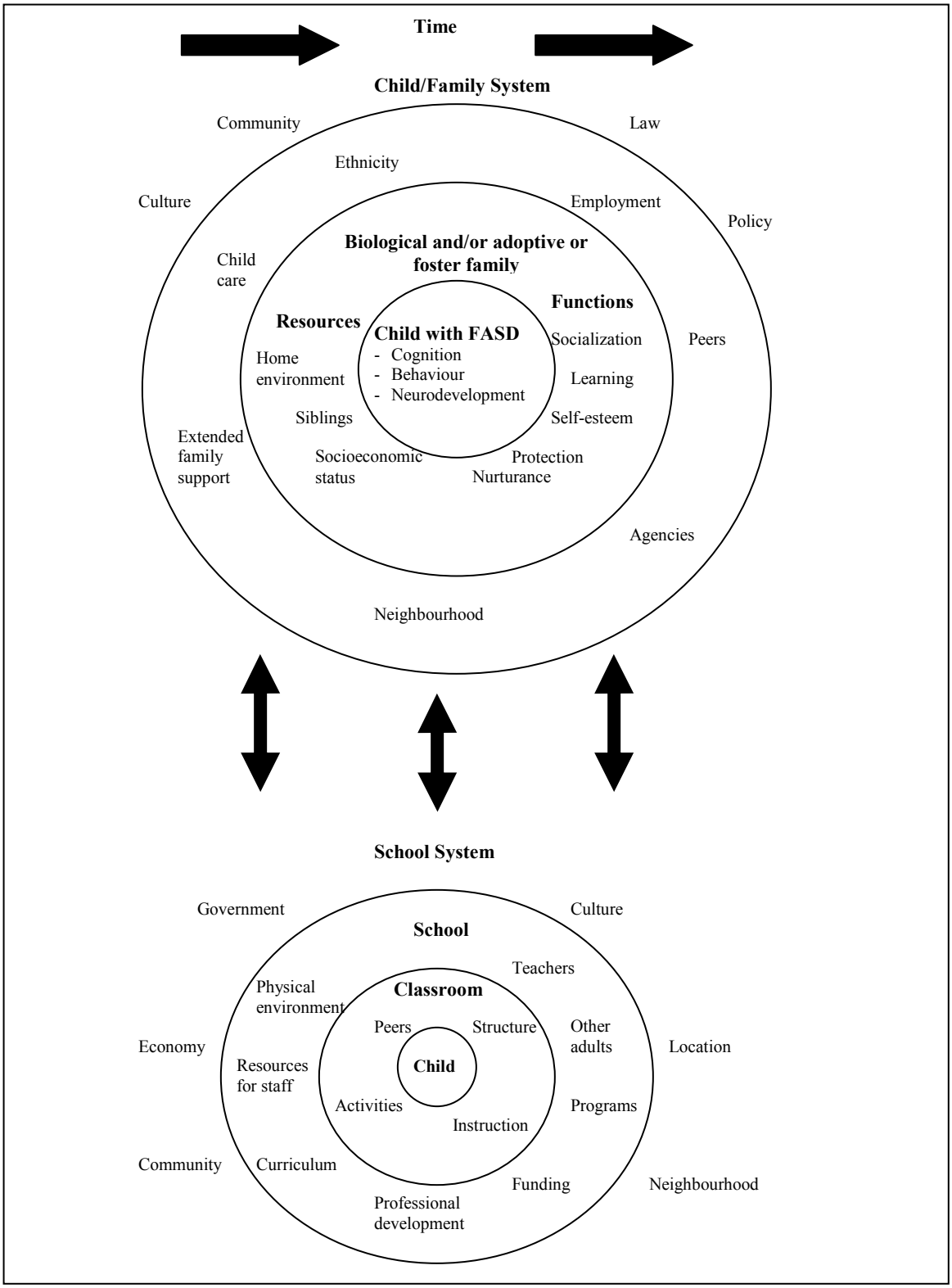

Figure 1: Conceptual Systems Model adapted from Pianta and Walsh (1996).

In the Contextual Systems Model the child is conceptualized as an open system in constant dynamic exchange with the systems or environments in which he or she lives (Pianta & Walsh, 1996). The concept of a person, in this case a child, as an open system was developed by Ford and Ford (1987). The biological structures and functions, behaviour, cognitive functions, purpose, and awareness combine in a self-organizing, adaptive control system (Ford & Ford, 1987). Function and development of the system is dynamic; that is, it changes in relation to the environment and the changes that environment undergoes (Ford & Ford, 1987). Time is an element of Pianta and Walsh's (1996) framework as past interactions between the child and different environments influence current and future interactions. Development of the child is integrated across all areas of the system; biological structures, behaviour, cognition, etc. The child's environment can help or hinder development depending on whether the resources provided by the environment are appropriate to the child's developmental stage (Pianta & Walsh, 1996).

The Contextual Systems Model has varying dimensions; the quality of the relationships between systems range from good to bad and the nature of the contact from engaged to disengaged. These relationships are bi- and multi-directional such that relationships in the child/family system can affect relationships in the school system. Time is an important element of the model as the nature of the relationships changes. A child who is abused by an adult in their home environment may, over time, develop problem behaviours which negatively affects their relationships with caregivers, teachers, and peers.

PAE can affect several systems and relationships within the Contextual Systems Model. PAE is associated with a range of neurocognitive difficulties amongst children diagnosed with FASD that can negatively affect the relationships between the child and his or her caregivers, peers, teachers, and other adults. For example, a child diagnosed with FASD may have limited skills for coping with stress. If all of the child's coping skills are focused on dealing with changes in the home environment between foster care and care of his or her biological family, his or her capacity to cope with the demands of the classroom and school systems may be limited. Knowledge of PAE, in the form of an FASD diagnosis, can also change, for better or worse, the way teachers and other adults perceive the child or react to that knowledge. Professional development and resources on FASD can increase a teacher's understanding of the disorder and change his or her relationship with a diagnosed student. The resources may also lead teachers to alter the instruction, curriculum, and physical environment of the classroom which affects the student with FASD. This section reviews cognitive and behavioural difficulties associated with PAE in school-aged children to describe the characteristics a child diagnosed with FASD may have and how they can influence the school system.

2.5.2 Information Processing Speed

Research studies administering batteries of neurobehavioural tests to birth cohorts suggest PAE may adversely affect information processing speed which may account for some of the lower test scores seen for memory, attention, and problem solving (Jacobson, 1998; Kable & Coles, 2004; Streissguth, Barr, Sampson, & Bookstein, 1994). Research specifically focusing on information processing did find PAE was associated with slower information processing speed and decreased efficiency (Burden, Jacobson, & Jacobson,

2005). Jacobson (1998), Kable and Coles (2004), and Streissguth, Barr, Sampson, Bookstein, and Darby (1989) all noted slower reaction time on a wide range of neurobehavioural tests. The slower reaction times followed a dose response pattern in all three studies indicating students who receive a greater dose of PAE are more likely to have a slower information processing speed (Jacobson, 1998; Kable & Coles, 2004; Streissguth, Barr, Sampson, & Bookstein, 1994). The association remained significant after controlling for a number of covariates including: parental education, quality of the home environment, prenatal smoking, prenatal illicit drug use, prenatal nutrition, and postnatal nutrition (Jacobson, 1998; Kable & Coles, 2004; Streissguth, Barr, Sampson, & Bookstein, 1994). Streissguth, Barr, Sampson, and Bookstein (1994) repeated the neurobehavioural measures with preschoolers and school-aged children and noted that the postnatal environmental covariates did not appear to influence test scores until children reached 7.5 years of age.

Although the studies demonstrated PAE is associated with slower reaction times on different neurobehavioural tests, they did not indicate whether the findings were due to slower information processing speed, an effect of PAE on the specific cognitive or behavioural skill tested, or a combination of the two. Burden, Jacobson, and Jacobson (2005) sought clarity on the issue by examining information processing speed and efficiency and its effect on working memory tasks at 7.5 years. The authors looked at three things:

1. accuracy of performance on working memory tasks as PAE increases,
2. reaction time on the simplest level of each task to determine the effect of increasing PAE on information processing speed, and
3. rate that reaction time increased relative to task difficulty (i.e. line slope) to determine the effect of PAE on information processing efficiency.

An adverse effect of PAE on working memory tasks was found independent of any difficulties with information processing speed and efficiency (Burden, Jacobson, & Jacobson, 2005). PAE also had a dose response adverse effect on information processing speed and efficiency that made working memory task performance appear worse than it actually was (Burden, Jacobson, & Jacobson, 2005). Burden, Jacobson, and Jacobson's (2005) results are limited to working memory task performance and the literature would benefit from similar research on other cognitive processes.

In summary, apparent deficits or delays in cognitive function may be due, at least in part, to slower information processing speed and efficiency. The implication of these findings is that interventions could improve learning and memory that is impeded by slow information processing. Researchers documenting delays in reaction time for neurobehavioural tests (Jacobson, 1998; Kable & Coles, 2004; Streissguth, Barr, Sampson, & Bookstein, 1994) and examining information processing speed and efficiency (Burden, Jacobson, & Jacobson, 2005) observed the influence of postnatal environmental variables. The results suggest that targeting children's postnatal environments at home or school may reduce the impact of PAE. Finally, the contribution of information processing speed and efficiency to working memory task performance suggests that students with FASD may experience greater success in school if they have

more time to process instructions, learn new material, complete school work, or write tests; particularly when the curriculum becomes more complex.

2.5.3 Executive Function

Executive function may be adversely affected by PAE (Dolan, Stone, & Briggs, 2010; Boyd, Ernhart, Green, Sokol, & Martier, 1991; Burden, Jacobson, Sokol, & Jacobson, 2005). Although a poorly defined construct (Miyake et al., 2000), general agreement suggests that executive function encompasses complex cognitive processes necessary for adaptive behaviour (Jurado & Rosseli, 2007). Executive function abilities are required to study a problem, develop and implement a plan, and persevere at solving the problem, while inhibiting inappropriate behaviour (Jurado & Rosseli, 2007). Some of the cognitive processes that are referred to as executive function abilities include attention, abstract thinking, flexible thinking, impulse control, creativity, problem solving, planning, and goal formation (Anderson, Northam, Hendy, & Wrenall, 2001; Delis, Kaplan, & Kraemer, 2001; Jurado & Rosseli, 2007). The frontal and prefrontal lobes are associated with most of the executive function abilities in humans (Stuss & Alexander, 2000) and animal models (Fryer et al., 2007). Animal model research has demonstrated that particular brain regions are vulnerable to the effects of PAE (Mihalick, Crandall, Langlois, Krienke, & Dube, 2001).

Research on executive function and PAE indicates the range of difficulties a student with FASD may experience and demonstrates this is an area in need of further research. Studies document the presence or absence of an association using task-based measures without exploring the influence of PAE in detail or looking at potential age-related changes (Miyake et al., 2000). Impairments in executive function abilities that

have been observed in children with PAE are attention (Streissguth, Barr, Sampson, Parrish-Johnson, & Kirchner, 1986; Streissguth, Barr, Sampson, & Bookstein, 1994), working memory (Streissguth, Barr, & Sampson, 1990), impulsivity (Nanson & Hiscock, 1990; Olmstead, Martin, Brien, & Reynolds, 2009), problem solving (McGee, Fryer, Bjorkquist, Mattson, & Riley, 2008; McGee, Schonfeld, Roebuck-Spencer, Riley, & Mattson, 2008), letter fluency (Vaurio, Riley, & Mattson, 2008), abstract thinking, and flexible thinking (Mattson, Goodman, Caine, Delis, & Riley, 1999). The variety of executive function impairments noted in the research means a teacher cannot make assumptions about what executive function difficulties a student with FASD may have; therefore, an assessment of his or her abilities is necessary.

Impairments in working memory are consistently associated with PAE. Streissguth, Barr, and Sampson (1990) and Burden, Jacobson, Sokol, and Jacobson (2005) found PAE associated with poor performance at age 7 on three tests of working memory: forward and backward digit span and arithmetic subtests of the Wechsler Intelligence Scale for Children Third Edition (WISC III; Wechsler, 1991). Impairments on the same working memory tests were found in youth aged 14 to 16 years (n = 9) and diagnosed with FAS (Olson, Feldman, Streissguth, Sampson, & Bookstein, 1998) and youth aged 9 to 18 years and diagnosed with FAS or FAE (n = 10) (Kodituwakku, Handmaker, Cutler, Weathersby, & Handmaker, 1995). Although there are only a few studies on working memory using a limited number of tests, the research suggests that working memory impairments may be a consistent and enduring characteristic of students with FASD. The research does not indicate whether there are age-related changes in the influence of PAE on working memory; therefore, teachers will not know how an

assessment of executive functions at age eight applies to the ability of the same student at age 11.

There are inconsistencies in the research findings on the adverse effects of PAE with respect to impulsivity and hyperactivity suggesting these symptoms may not be due to PAE. The inconsistencies are due to differences in study design; in particular age classification of PAE and control of postnatal environmental factors. Contrasting results with respect to impulsivity and hyperactivity were observed by Nanson and Hiscock (1990) and by Brown et al. (1991). Nanson and Hiscock found an association with hyperactivity and impulsivity in a more severely affected sample of children aged 5-12 years diagnosed with FAS or FAE from Saskatoon, Canada; however, postnatal environmental factors were not controlled for in the analysis (Nanson & Hiscock, 1990). Brown et al. did not find that association when they controlled for postnatal factors, but their sample was both younger (age 5.8 years) and not diagnosed with FASD. These findings indicate a teacher should not assume a student with PAE will be impulsive and hyperactive. Instead, the research suggests that hyperactivity and impulsivity are more likely to be associated with a poor quality home environment.

Research on the association between PAE and sustained attention is also inconsistent but the reasons are less clear (Dolan, Stone, & Briggs, 2009). Streissguth, Barr, Sampson, Parrish-Johnson, and Kirchner (1986), George (2001), and Streissguth, et al. (1994) noted an association between PAE and sustained attention at 7, 8, and 14 years respectively while Boyd et al. (1991) and Richardson, Ryan, Willford, Day, and Goldschmidt (2002) found no association at 4.8 and 10 years respectively. Since

sustained attention is necessary to focus on school work, this association has important implications for teachers.

Differences in sample age and PAE classification could account for the differences between 4.8 (Boyd, Ernhart, Greene, Sokol, & Martier, 1991) and 7 (Streissguth, Barr, Sampson, Parrish-Johnson, & Kirchner, 1986) years but explanations for contradictory findings at 10 (Richardson, Ryan, Willford, Day, & Goldschmidt, 2002) and 14 (Streissguth, Sampson, Olson, et al., 1994) years are less clear. They may be related to confounding variables such as socioeconomic status. Boyd et al. may not have detected an association at 4.8 years because of the young age of their sample and their failure to examine the effects of binge maternal alcohol consumption in their analysis. Richardson et al. and Streissguth et al. included covariates for the postnatal environment in their analysis and examined the influence of binge alcohol consumption and have contradictory finings.

Where the Richardson et al. and Streissguth et al.'s studies differed was in the socioeconomic status of their samples; Richardson et al.'s (2002) sample comprised low socioeconomic status, inner city children while Streissguth et al.'s (1994) sample included low and middle class children. It is possible that the adverse effects of PAE were not significant in Richardson et al.'s (2002) regression modeling because socioeconomic status and the postnatal environment masked an adverse effect of PAE on sustained attention. George's (2001) study found an association between SES and attention and an association between PAE and attention in a sample with diverse SES; therefore, it is possible the effects of PAE on attention are masked in the low SES sample. If this is the case, it suggests that the effect of the postnatal environment may

have a greater impact on sustained attention than PAE. Therefore, teachers may be able to improve a student's attention span through making changes to his or her environment.

Lack of research on the influence of PAE across children's developmental stages impedes our ability to fully understand executive function. Adverse effects of PAE on executive functions can affect the classroom environment; however, the current state of the evidence is of limited use to teachers. Executive function abilities are critical to academic performance (Mattson, Goodman, Caine, Delis, & Riley, 1999; McGee, Fryer, Bjorkquist, Mattson, & Riley, 2008). Attention is required to stay focused on a lesson, do seat work, listen to instructions, and participate in structured activities; poor attention could negatively affect relationships with peers and teachers; and impulsivity and poor social problem-solving skills could alienate children from their peers.

Current empirical literature indicates a student diagnosed with FASD is likely to experience difficulty with one or more executive function abilities but it does not indicate which functions are likely to be affected or the severity of the effects. The evidence also does not indicate whether difficulties with executive function abilities are static deficits or delays in development that could be improved through a school-based intervention. Research studies do indicate a teacher should expect a student to have challenges with his or her executive function abilities that will require adjustments made to the classroom environment and instruction. An assessment of the student's executive functions by a school psychologist or health professional would provide the teacher with better information on which to base his or her accommodations.

2.5.4 Learning and Memory

PAE is associated with a number of learning and memory impairments in children with two types, verbal and visual, being particularly relevant for teachers. Verbal learning and memory are important for language development which children need for written and verbal communication in school. Visual learning and memory include two subsystems: visual and spatial. Visual learning and memory are involved in working with symbols, pictures, numbers, and words. Spatial learning and memory are responsible for how a person learns and retains information about his or her environment and spatial orientation in it. Spatial working memory is part of executive function and is the cognitive process that holds spatial information for short-term manipulation. Spatial learning and memory and spatial working memory are involved in acquiring and retaining arithmetic skills. Research into the adverse influence of PAE on visual and verbal memory and learning and memory is increasing our understanding of the academic challenges students with FASD may face; however, there remains substantial gaps in the literature.

2.5.4.1 Visual Memory and Spatial Working Memory

Poor performance on visual memory and spatial working memory are associated with PAE in children. Information on the profile of visual memory, spatial memory, and spatial working memory challenges is lacking; however, existing research is sufficient to indicate teachers should expect a student with FASD to have memory difficulties that need to be accommodated. Animal model research studies suggest the effects of PAE on spatial memory could be reduced postnatally but there are no studies to support these

findings with humans (Christie et al., 2005; Gabriel, Johnston, & Weinberg, 2002; Umar, Rikhy, Dringenberg, Brien, & Reynolds, 2006).

PAE is associated with impaired visual and spatial memory task performance but it is not clear if one or both of the visual memory subsystems are affected by PAE. Cognitive processes are interdependent and the influence of PAE on a memory system may be indirect. In children aged 8 to 15 years (n = 89) with FASD, Green et al. (2009) found performance on a spatial working memory task decreased as complexity of the task increased. Hamilton, Kodituwakku, Sutherland, and Savage (2003) found children 8 to 16 years (n = 8) had poor performance on place learning but not cued navigation of a spatial memory task. Uecker and Nadel (1996) tested children aged 5 to 12 years (n = 30) diagnosed with FAS and found impaired performance on delayed but not immediate object recall, a measure of visual memory, and difficulty with general spatial memory. These studies document an adverse association between PAE and visual memory, spatial memory, and spatial working memory indicating teachers should expect students diagnosed with FASD may have memory impairments which negatively affect reading and math skills.

Kaemingk and Halverson (2000) extended this literature by looking at the relative influence of these cognitive processes. They examined perceptual, verbal, and spatial memory task performance in children aged 6 to 16 (n = 20) with FAS or FAE and found the association with poor spatial memory task performance was not significant after controlling for perceptual and verbal memory task performance. Kaemingk and Halverson's (2000) study is the first to begin looking at the relative influence of other cognitive processes on the association between PAE and spatial memory and

demonstrates there are considerable gaps in our understanding of how PAE affects the visual memory subsystems. The existing studies use small samples with unknown PAE dosage limiting the ability to draw conclusions according to age cohort and PAE dose. Information on the possible profile of visual and spatial memory problems is also lacking so, while teachers should expect some degree of memory impairment amongst students with FASD, the profile of these impairments is unclear.

Animal model research suggests that spatial memory impairments associated with PAE may be compensated for by postnatal interventions. Christie et al. (2005) found spatial memory improved in rats with PAE when they could partake in voluntary exercise. Umar, Rikhy, Dringenberg, Brien, and Reynolds (2006) found that when guinea pigs exposed to PAE were given non-spatial training prior to completing the spatial memory task they performed better. Gabriel, Johnston, and Weinberg (2002) found postnatal handling of rats reduced the adverse effects of PAE on spatial navigation tasks. These findings are limited to animal model research but they suggest that altering the postnatal environment may improve spatial learning and memory skills which suggest teachers may be able to improve memory skills. For example, increasing physical education time may improve spatial memory resulting in improved math performance. Familiarizing students with the steps involved in a spatial memory task may also improve their performance.

2.5.4.2 Verbal Learning and Memory

PAE is adversely associated with performance on verbal learning and immediate recall memory tasks in low socioeconomic status samples with moderate to heavy PAE (greater than .45 ounces of absolute alcohol per day). New evidence is emerging that

examines the profile of verbal learning and memory difficulties associated with PAE but more work needs to be done on age-related changes and the postnatal environmental influences (Mattson & Roebuck, 2002; Roebuck-Spencer & Mattson, 2004).

Research studies document poor performance on verbal learning tasks on low socioeconomic status samples with moderate to heavy PAE (Mattson, Riley, Delis, Stern, & Jones, 1996; Mattson, Riley, Gramling, Delis, & Jones, 1998; Rasmussen, Horne, & Witol, 2006; Streissguth, Barr, & Sampson, 1990; Willford, Richardson, Leech, & Day, 2004) but not middle class samples with low PAE (Fried, O'Connell, & Watkinson, 1992; Fried & Watkinson, 1990). In a predominantly Caucasian, middle class birth cohort with low PAE (.45 ounces of absolute alcohol per day or less) no association between PAE and verbal learning was observed (Fried, O'Connell, & Watkinson, 1992; Fried & Watkinson, 1990). George (2001) found a correlation between increasing PAE and decreasing reading performance in a large population-based study that included low to high socioeconomic status children. Other studies consistently find adverse effects of PAE on verbal learning in predominantly low socioeconomic status samples exposed to more than .45 ounces of absolute alcohol per day (Mattson, Riley, Delis, Stern, & Jones, 1996; Mattson, Riley, Gramling, Delis, & Jones, 1998; Rasmussen, Horne, & Witol, 2006; Streissguth, Barr, & Sampson, 1990; Willford, Richardson, Leech, & Day, 2004). The findings are replicated in samples including the full range of school age years (Mattson & Roebuck, 2002; Rasmussen, Horne, & Witol, 2006; Roebuck-Spencer & Mattson, 2004). None of the research studies that include a range of ages in their sample have had samples large enough to examine age-related changes in the influence of PAE; a gap that needs to be addressed in future studies. With the exception of George (2001)

and Streissguth, Barr, and Sampson (1990), few studies have examined the influence of postnatal environment, in particular, the quality of the home environment. These studies found poor quality home environments did affect verbal learning; however, there was still a negative association between PAE and verbal learning or reading (George, 2001; Streissguth, Barr, & Sampson, 1990).

Early research on verbal memory used immediate recall tasks and found poor performance is associated with PAE (Streissguth, Barr, & Sampson, 1990). Later studies used immediate and delayed recall verbal memory tasks and found the association between PAE and impaired verbal memory is weaker for delayed recall tasks (Mattson, Riley, Delis, Stern, & Jones, 1996; Mattson, Riley, Gramley, Delis, & Jones, 1998; Willford, Richardson, Leech, & Day, 2004). When Mattson and Roebuck controlled for the amount of verbal learning children achieved in trials they found recall of verbal information was not significantly different between children with PAE and controls. Roebuck-Spencer and Mattson (2004) re-analyzed their data in a subsequent study while classifying the memory tasks according to the presence or absence of implicit learning strategies. Their new analysis indicated PAE is not associated with poor performance on verbal memory tasks when the task uses an implicit learning strategy (Roebuck-Spencer & Mattson, 2004). The sample used in the study is small, 35 youth between 8 and 16 years, and the dose of prenatal alcohol exposure is unknown, which limits generalization of study findings.

Mattson and Roebuck (2002) examined the profile of verbal learning and memory in more detail and made some observations useful for teachers. Mattson and Roebuck (2002) administered verbal and non-verbal learning and memory tasks to children 8 to 16

years (n = 35) exposed to heavy PAE using multiple learning trials to examine apparent learning plateaus in greater detail. Confirmation of prenatal exposure to heavy alcohol consumption was provided by the mothers; however, the specific dosage was unknown. The number of learning trials exceeded that used in earlier studies and demonstrated that, although children with PAE reach a learning plateau earlier than controls, they may still be able to learn new material with additional trials (Mattson & Roebuck, 2002). As with the verbal memory findings, these results need to be replicated with a larger sample that allows for comparisons based on age, degree of PAE, postnatal environment, and which tasks are more vulnerable to PAE. Nonetheless, Mattson and Roebuck's (2002) findings suggest a teacher should repeat lessons to students with FASD even after they appear to have reached a plateau in knowledge acquisition.

2.5.4.3 Memory Strategies

Recent research examining the effects of PAE on memory strategies indicates promising strategies for teachers. Pei, Rinaldi, Rasmussen, Massey, and Massey (2008) found that children with FASD (n = 30) had the greatest difficulty with memory tasks that typically require internal recitation to learn. Another study examined age-related developments in memory strategies and found PAE is associated with a delay in switching from visual to verbal memory strategies (Rasmussen, Pei, Manji, Loomes, & Andrew, 2009). Delaying the switch from visual to verbal memory strategies would affect the ability to store new information. These studies are the first to examine the development of memory strategies in children with FASD and they indicate that considerable work needs to be done in this area with larger samples of children in different age groups whose PAE dosage is known; however, they point to strategies that

can be used in the classroom, such as teaching students with FASD to use internal recitation and other verbal memory strategies.

2.5.4.4 Summary

PAE appears to be associated with impairments in verbal and visual learning and memory impairments but existing research is limited in scope. More work is needed to understand the profile of learning and memory impairments in school-aged children. Lack of understanding of how PAE affects learning and memory at different ages is the most significant gap in knowledge. The small sample sizes that characterize current research prevent any age-related comparisons; an issue that needs to be addressed in future studies. Currently, a teacher could expect a child with PAE to have learning and memory impairments but the teacher would have to assess the child's abilities to determine what those impairments might be. A report on a child's learning and memory skills from previous years may not be applicable as the age-related effects of PAE on learning and memory are unknown. The existing research does demonstrate teachers should anticipate memory difficulties amongst students with FASD and indicates teachers may be able to accommodate those difficulties in the classroom.

2.5.5 Stress Response

Animal model research studies have consistently found an association between PAE and impairments to the stress response system (Lee, Imaki, Vale, & Rivier, 1990; Weinberg, 1992; 1998). Similar research on humans is limited (Hellemans, Sliwowska, Verma, & Weinberg, 2010; Jacobson, Bihun, & Chiodo, 1999).

PAE is consistently associated with alterations in the hypothalamic-pituitary-adrenal (HPA) axis in animals, which is an important part of the neuroendocrine stress

response system (Lee, Imaki, Vale, & Rivier, 1990). Stress response of prenatally exposed animals differs by sex and type of stressor (Weinberg, 1992; 1998). Females appear to be more vulnerable to adverse effects of PAE on the HPA axis (Weinberg, 1998). The severity of effects associated with PAE in animal models varies when different postnatal stressors, such as movement restrictions, isolation, and water deprivation, are used (Weinberg, 1992; 1998). These findings suggest that if children's HPA axes are affected by PAE it may not be possible to predict how well they respond to postnatal stressors. Jacobson, Bihun, and Chiodo (1999) found PAE was associated with higher post-stress cortisol levels following a heel prick in a sample of 89 inner-city African-American infants at 13 months. Whether the association would be present using a different postnatal stressor or at different ages is unknown. The implication for teachers is that, while it is likely that a student with FASD has some impairment in his or her stress response system associated with PAE, it is difficult to determine what types of stressors will be problematic. For example, one student may find being restricted to their seat stressful while another student may not.

PAE is associated with anxious behaviour in animal models. Animals exposed to PAE may exhibit hyper-responsiveness to stress and depressive and despair behaviour (Weinberg, 1993; Weinberg, Sliwowska, Lan, & Hellemans, 2008; Zhang, Sliwowska & Weinberg, 2005). This association has led researchers to hypothesize that the influence PAE may have on the HPA axis in humans is an increase in their vulnerability to the development of depression or anxiety disorders in later years; called the stress-diathesis hypothesis (Hellemans, Sliwowska, Verma, & Weinberg, 2010). Limited human research supports this hypothesis but it is not conclusive. Helm, Laussman, and Eis

(2010) observed an increase in the risk for behavioural or emotional problems among children with increased stressors including PAE. Helm, Laussman, and Eis' study was cross-sectional so it cannot establish temporal order of the behavioural problems and postnatal stressors; however, it does provide support for the stress-diathesis hypothesis. Longitudinal research is needed to examine whether PAE has long term affects on the stress response system or increases the vulnerability of children with PAE to postnatal stress.

Current research suggests PAE may affect children's stress response but is not sufficient to determine effects relative to other postnatal influences. Teachers should be aware of the potential for hyper-responsiveness to stress among children with PAE based on the animal model research; however, a child's postnatal environment may have a greater impact on their stress response system.

2.5.6 Social and Communication Skills

FASD and heavy (at least 14 drinks per week) or binge (four or more drinks on one occasion) PAE are associated with decreases in social and communication skills (McGee, Bjorkquist, Price, Mattson, & Riley, 2009; Rasmussen, Becker, McLennan, Urichuk, & Andrew, 2010; Schonfeld, Paley, Frankel, & O'Connor, 2006). One study examined the relationship between PAE and executive function (Schonfeld, Paley, Frankel, & O'Connor, 2006) while others explored language development (Carney & Chermak, 1991; Church, Eldis, Blakley, & Bawle, 1997; Coggins, Timler, & Olsway, 2007; McGee, Bjorkquist, Riley, & Mattson, 2009). Schonfeld et al. found executive function, particularly behaviour regulation and metacognition, accounted for a significant

percentage of the variation in social skills of children aged 6 to 11 years (n = 98) diagnosed with FASD.

Language is an important part of communication and research examining passive and expressive language development has found a consistent negative association with PAE (Carney & Chermak, 1991; Church, Eldis, Blakley, & Bawle, 1997; Coggins, Timler, & Olsway, 2007; Conry, 1990; Janzen, Nanson, & Block, 1995; Mattson, Riley, Gramling, Delis, & Jones, 1998; McGee, Bjorkquist, Riley, & Mattson, 2009; Thorne, Coggins, Olson, & Astley, 2007). The learning and memory challenges that may underlie observed impairments in language development need to be explored. With limited literature on the mechanisms linking PAE and social or language impairments, teachers lack good evidence to guide them on approaches for improving social skills of students with FASD.

2.5.7 Problem Behaviour

PAE appears to have a limited effect on problem behaviour in school-aged children. With the exception of George (2001) and Sood et al. (2001), studies documenting a significant association between problem behaviour and PAE are limited by small samples or inadequate control of postnatal environment variables (Brown et al., 1991; Nash et al., 2006; Steinhausen, Willms, Metzke, & Spohr, 2003). Steinhausen et al. administered the Developmental Behavior Checklist (Einfeld & Tonge, 1992) to children aged 2 to 12 years (n = 12) with FAS or FAE and a comparison group of 15 children with nonspecific intellectual disability matched for age, IQ, and gender. The children with FAS or FAE had significantly worse scores on scales measuring disruptive behaviour, self-absorption, communication disturbance, anxiety, autistic behaviour, and

antisocial behaviour (Steinhausen, Willms, Metzke, & Spohr, 2003). Nash et al. administered the Child Behavior Checklist (CBCL; Achenbach, 1999) to three groups of children: children with FASD, children with Attention Deficit Hyperactivity Disorder (ADHD), and typically developing children, aged 6 to 16 years (n = 30 in each group) matched for age and socioeconomic status. Children with FASD scored worse than the two control groups on scales measuring hyperactivity, inattention, lying and cheating, lack of guilt, and disobedience (Nash et al., 2006). Neither Steinhausen et al. nor Nash et al. controlled for past or current home environments, number of home placements, current parental substance use, childhood trauma, or other postnatal environmental variables that could have contributed to the development of the behaviour problems found.

Brown et al. (1991) used the CBCL (Achenbach, 1999) to compare three groups of low socioeconomic status, inner city, African-American children at 5 years of age: 19 children with no PAE, 15 with PAE during first trimester only, and 20 with PAE throughout pregnancy. Problems with internalizing and externalizing behaviour were noted for children exposed to PAE throughout pregnancy; however, after controlling for current parental substance use a statistically significant association was only observed for PAE and externalizing problem behaviour (Brown et al., 1991). No other postnatal environmental variables, related to the quality of the home environment or parent-child relationship, were included in the analysis (Brown et al., 1991). The influence of current parental drinking suggests postnatal environmental variables may exacerbate the relationship between PAE and problem behaviour.

George (2001) and Sood et al.'s (2001) studies controlled for a number of postnatal environmental factors and found a dose-response association between PAE and problem behaviour. Sood et al.'s study sample included only inner city African-American children with low socioeconomic status so it is possible that an adverse effect of PAE on behaviour may only be present in low SES samples. George's study included a diverse range of SES and an association between PAE and behaviour was present after controlling for SES. Franklin, Deitz, Jirikowitz, and Astley (2008) found an association between sensory-processing difficulties and problem behaviour scores on the CBCL (n = 44, aged 5 to 10 years) suggesting the influence of the postnatal environment on behaviour may include the child's ability to process sensory information. More research is needed to determine what the effect of PAE on behaviour is relative to the postnatal environment. The current research has two major implications for teachers: first, not all children with PAE will have problem behaviours, and second, that the postnatal environment has significant effects on the behaviour of children with PAE. This suggests that the postnatal school environment may be targeted to improve the behaviour of children with PAE.

2.5.8 Summary

Research on the adverse effects of PAE is extensive although limitations in study design or sampling affect interpretation of findings. Adverse effects are documented for a number of cognitive processes including information processing speed, executive function, and learning and memory but the literature provides limited information on the profile of those cognitive difficulties and no information on age-related changes. It is also not clear the extent to which PAE affects the development of problem behaviour in

children and youth with FASD. Considerable evidence suggests that the postnatal environment has a significant influence on the development of cognitive and behavioural difficulties; therefore, targeting environments may lead to improvements. The literature would benefit from research studies that examine age-related effects of PAE and further examination of the profile of cognitive difficulties.

Research on the adverse effects of PAE in school-aged children provides teachers with knowledge about the types of difficulties students with FASD may experience. A teacher could expect a student diagnosed with FASD to have difficulties with information processing speed and efficiency, coping with stress, and elements of executive function, learning and memory. Depending on the postnatal environment, the student may have problem behaviours. The teacher would have no information to guide him or her on what age-related changes to expect or what elements of the cognitive processes are most likely to be affected; however, he or she could assess the student's skills in those areas and make appropriate accommodations.

Currently, there is limited information to indicate whether a cognitive impairment is an enduring deficit or delay in developing a cognitive skill. Knowing whether a cognitive impairment is a delay or deficit has implications for how a teacher addresses it through adjustments to instruction and curriculum. Specific information that could be used to make appropriate accommodations to instruction and curriculum would need to be developed based on an assessment of the individual student. Research examining the influence of the postnatal environment suggests the teacher might see improvements in cognitive skills by adjusting the student's environment. In summary, a FASD diagnosis could inform a teacher in general terms to expect cognitive impairments and, possibly,

behavioural problems but a detailed assessment of the student's strengths and weaknesses would be necessary to identify how the student could be accommodated in the classroom environment.

2.6 Interventions for Children affected by FASD

This section reviews intervention research for school-aged children with FASD. Fifteen studies on interventions to improve school performance, executive function, behaviour, and social skills are analyzed for their relevance to BC teachers working with students with FASD.

2.6.1 School Performance Interventions

Four studies (see Table 2) examined interventions to improve academic achievement in students diagnosed with FASD and are discussed in detail.

Table 2: Intervention studies targeting school performance of students diagnosed with FASD

Citation	Study type	Sample size	Intervention
Adnams et al., 2007	Randomized control trial	65	Language and literacy training administered by speech and language therapist and included language therapy, phonological awareness, and literacy training
Coles, Kable, & Taddeo, 2009; Kable, Coles & Taddeo, 2007	Randomized control trial	61	Six weeks of individualized math tutoring
Johnson & Lapadat, 2000	Case study	1	Phonetic based tutoring program
Porter-Larsen, 2000	Case study	1	Phonetic based tutoring program

2.6.1.1 Language and Literacy Intervention

Adnams et al. (2007) used a randomized control trial design to test a language and literacy intervention intended to improve academic skills of students aged 9-10 years diagnosed with FASD in South Africa. Selection of the intervention was based on evidence that early phonological training improves phonological awareness, reading, and spelling. Three groups were compared: students with FASD (n = 20) in the intervention group, students with FASD (n = 20) in the first control group, and control students without FASD (n = 25) for the second control group. Students with FASD were randomly assigned to the intervention or control group. The non-FASD control group was randomly selected from a larger group of eligible students. All participants attended the same poorly resourced state schools.

In the trial, the intervention group received 38 hours of language therapy, phonological awareness, and literacy training administered by an experienced speech and language therapist over a nine month period. Standardized, valid, and reliable outcome measures assessed students' self-efficacy, behaviour, academic achievement and pre-literacy skills. Students diagnosed with FASD in the intervention and control groups did not differ on measures of behaviour, self-efficacy, academic skills, or pre-literacy prior to the intervention. FASD intervention and control groups scored significantly worse than the non-FASD control group on measures of self-efficacy, behaviour, academic achievement, and pre-literacy skills. There were no significant pre-intervention differences between the FASD intervention and control groups. No mention was made of whether the test administrators or data analysts were blind to group membership.

The intervention offered by Adnams and colleagues (2007) appeared to improve performance on tests measuring the specific pre-literacy skills targeted by the language and literacy training but no improvement was seen on academic achievement, behaviour, or self-efficacy. Post-intervention, students with FASD in the intervention group performed significantly better than the FASD control group on measures of pre-literacy skills but not academic achievement. The FASD intervention group's post-intervention pre-literacy scores were still significantly lower than the non-FASD control group but the post-intervention difference was smaller than the pre-intervention difference. Non-significant academic achievement results could be because the test was not sensitive enough to detect a change in nine months, more time may be needed for pre-literacy improvements to affect academic achievement, or the results may indicate the students had impairments in another cognitive process that impeded performance on the academic achievement tests. Further research is needed to determine why the language and literacy training could improve pre-literacy skills but not academic achievement.

Adnams et al. (2007) are the first group to demonstrate improvements in cognitive skills of students with FASD using a standardized intervention; however, the effects could be due to the mode of delivery rather than the content. It is possible that the improvements in the intervention group were due to the small group learning format rather than the language and literacy curriculum.

Similar language and literacy training could be used to improve pre-literacy skills of students in BC, if the schools had access to a speech and language therapist. In the preceding study, the language and literacy training program was administered by an experienced speech and language therapist and may not be effective if administered by a

teacher or teacher's assistant (TA). BC school districts do employ speech and language therapists but whether they consult with teachers, provide direct services to students, or both may vary between districts. As a result, Adnams et al.'s findings (2007) may be of limited utility for teachers, if there is no speech and language therapist available to administer the training. Further research is needed to determine whether a teacher or TA could be trained to provide the language and literacy training and achieve significant improvement in students' pre-literacy skills.

2.6.1.2 Math Tutoring Intervention

Kable, Coles, and Taddeo (2007) and Coles, Kable, and Taddeo (2009) tested the effectiveness of a psycho-educational program to improve deficits in math and pre-math skills for children diagnosed with FASD post-intervention and at six months follow-up. Sixty-one students aged 3 to 10 years of age were recruited from the Atlanta, Georgia area and randomly allocated to an intervention or control group. Intervention and control groups received a standard psycho-educational treatment that included a comprehensive neurodevelopmental evaluation and developing an individualized education plan (IEP) with each student's school. The psycho-educational intervention also included caregiver workshops on FASD, behaviour management, and other resources while supports, such as psychiatric case management, were made available. The intervention group received six weeks of math tutoring. Curriculum for participants aged 5 to 10 was based on the High Scope Curriculum Series (Hohmann, 1991), while the preschool curriculum was developed by a Head Start program development consultant. The curriculum for all ages was designed to accommodate slower processing speed, difficulties with visual or spatial processing, and poor inter-hemispheric transfer of information; all potential problems for

students with FASD (Kable et al., 2007). The math tutoring intervention was delivered one-to-one at home by the caregiver and at school by a staff person. Caregivers in the intervention group received training to support math learning at home. A special educator met with teachers of students in the intervention group to discuss any neurodevelopmental problems the student had as well as students' IEP goals. Outcome measures for behaviour and math are standardized, reliable, and valid (Kable et al., 2007). Parents knew their children's group assignment when they completed the behavioural assessment; however, those doing the math assessments were blind to group membership.

Intervention and control groups had significant improvement in math scores at post-intervention and six months post-intervention, although the intervention group made significantly higher gains. The math tutoring appears to be a successful intervention for improving math skills of students with FASD. The intervention was a combination of home and school tutoring so it is unknown if it would have been as effective if only the school tutoring had been undertaken. For students with FASD that qualify for TA resources, the math tutoring would be a useful resource to improve students' math skills. For students that do not qualify for TA resources, it may be difficult for the teacher to devote time to one-to-one math tutoring.

The psycho-educational intervention provided to the intervention and control groups was associated with statistically significantly fewer internalizing, externalizing, and total problem behaviours reported by parents and teachers post-intervention and at six months post-intervention. There was no control group for the psycho-educational intervention so it is not possible to attribute the behavioural improvements to the

intervention; however, the results suggest it may affect problem behaviour and is worthy of further investigation.

2.6.1.3 Phonetic Based Tutoring Intervention

Johnson and Lapadat (2000) and Porter-Larsen (2000) conducted case studies of phonetically based one-to-one tutoring. Johnson and Lapadat's subject was a 14-year-old girl while Porter-Larsen's subject was an 8-year-old boy. The studies were based on prior research demonstrating that fluency and comprehension of reading depends on knowledge of the sound-symbol relationship and spelling. Studies with students with learning disabilities have demonstrated the effectiveness of phonetic-based tutoring (Adams, 1997; Chall, 1997).

Johnson and Lapadat's (2000) study used a structured, multisensory, phonetic tutoring approach three hours per week for four months to improve reading, writing, and spelling. Porter-Larsen (2000) used a supplemented reading program over a three month period. The WRAT3 (Wide Range Achievement Test 3) spelling scores (Wilkinson, 1993), Woodcock Reading Mastery Tests – Revised (Woodcock, 1987), and Behaviour Assessment System Scale for Children (BASC; Reynolds & Kamphaus, 1992) were outcome measures for Johnson and Lapadat's study while Porter-Larsen used the Woodcock Reading Mastery Tests – Revised and qualitative assessments.

Johnson and Lapadat (2000) found statistically significant improvements on all scales of the spelling and readings tests except the Woodcock Reading Mastery Tests – Revised basic skills scale which showed no change. No change was found on the BASC. Porter-Larsen (2000) reported the student had reading achievement improvements in the areas of word attack, word comprehension, passage comprehension, visual auditory

learning, and letter identification. Both case studies found phonetic-based tutoring was associated with improved reading skills; however, it is possible that the improvements were due to the one-to-one tutoring regardless of whether it was a phonetically-based program. Case study findings are not generalizable so it is not possible to claim the intervention would work for other students with FASD; other students may have different cognitive difficulties affecting the effectiveness of the tutoring program. This intervention could be helpful to classroom teachers if they have a student with FASD experiencing similar cognitive difficulties and there is a TA who can administer the one-on-one tutoring program.

2.6.2 Executive Function Interventions

Five studies examined interventions to improve one or more executive function skills (see Table 3).

Table 3: Intervention studies targeting executive functions of students diagnosed with FASD

Citation	Study type	Sample size	Intervention
Bertrand, 2009	Randomized control trial	78	Neurocognitive habilitation to improve executive function skills
Loomes, Rasmussen, Pei, Manji, & Andrew, 2008	Randomized control trial	33	Teaching children to use rehearsal memory strategy to improve attention
Oesterheld et al., 1998	Randomized double-blind cross-over trial	4	Administering psycho-stimulant medication to children
Riley et al., 2003	Randomized control trial	10	Cognitive control therapy teaching children self-regulation
Snyder, Nanson, Snyder, & Block, 1997	Randomized double-blind cross-over trial	11	Administering psycho-stimulant medication to children to improve attention

2.6.2.1 Neurocognitive Habilitation Intervention

The goal of the neurocognitive habilitation intervention was to improve the executive function of children diagnosed with FASD who were in foster care. Detailed findings have not yet been published by the study authors; however, a summary has been published by the Interventions for Children with Fetal Alcohol Spectrum Disorders Research Consortium (Bertrand, 2009). Children in foster care with FASD may be especially vulnerable to learning difficulties because they lived in a poor quality home and likely experienced abuse prior to entering foster care and can change foster homes every few years (Streissguth, Barr, Kogan, & Bookstein, 1997). The researchers in this

study sought to improve children's skills for dealing with the negative experiences by increasing their executive function skills.

A total of 78 children between 6 and 11 years and their caregivers were randomized to intervention and control groups. No information was provided on recruitment so it is not possible to determine how representative the sample is of children with FASD in foster care. There was no blinding in the study. The control group received the normal standard of care through referrals at existing agencies. The intervention group children received a 12 week neurocognitive habilitation group therapy program while their caregivers participated in a parent education group. Outcome measures were the Behavior Rating Inventory of Executive Function (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000) and Roberts Apperception Test for Children (RATC; McArthur & Roberts, 1982) to measure executive functioning and perceptions of common interpersonal situations respectively. Pre-intervention, the experimental and control groups were equivalent for the outcome measures.

The intervention included neurocognitive habilitation group therapy for children and workshops for caregivers about FASD and how to support their children (Bertrand, 2009). The neurocognitive habilitation therapy for executive function included self-regulation techniques and strategies to improve executive function skills such as memory, problem-solving, planning, sequencing, and cause and effect reasoning. The neurocognitive habilitation therapy was delivered by licensed clinical psychologists, licensed social workers, and pre- and post-doctoral students supervised by a licensed psychologist.

Post-intervention, the intervention group scored significantly higher on the BRIEF and RATC multivariate omnibus scores. There was no significant effect on individual BRIEF subscales suggesting the significant effect on the omnibus scores was due to small improvements in a number of executive function skills. The Resolution subscale of the RATC showed statistically significant improvement for the intervention group indicating that group members improved their ability to narrate stories and identify unrealistic solutions to problems. These results suggest the neurocognitive habilitation therapy could be used to improve self-regulation and executive functioning skills of children diagnosed with FASD in foster care but the limited information in the study summary precludes determining whether the results can be generalized beyond the study sample. The intervention would be useful to BC elementary school teachers if they have access to the professionals needed to deliver the program.

2.6.2.2 Rehearsal Memory Training Intervention

The goal of Loomes et al.'s (2008) study was to determine whether rehearsal training was an effective intervention to improve memory for numbers amongst children with FASD. Children use multiple memory strategies, although different strategies are used at different ages (Bjorklund, 2005; Siegler, 1999). Typically developing children usually begin using the active rehearsal strategy at seven years of age (Gathercole & Baddeley, 1990). Atypically developing children begin using active rehearsal when their intellectual level reaches that of a typically developing seven-year-old (Jarrold, Baddeley, & Hewes, 2000). Previous studies found rehearsal training is an effective way to improve memory of typically and atypically developing children and Loomes et al. (2008) sought to achieve the same for children with FASD.

The authors recruited a sample of 33 children diagnosed with FASD. Children were matched with the control group for age and gender and assigned to the experimental or no treatment control group. All children completed a digit span memory test adapted from the Working Memory Test Battery for Children (Pickering & Gathercole, 2001). The adaptation was a 10 second delay between giving the children the numbers and asking them to recall the numbers. The 10 second delay gave children the opportunity to use a memory strategy if they chose to. No information was provided on how adding the 10 second delay affected the reliability or validity of the working memory test.

In Loomes et al.'s (2008) study, the testing and, for the experimental group, rehearsal training took place in two sessions. During the first session, experimental children did the pre-test, took a short break, were given instructions on using rehearsal, and then completed the post-test. Control children did the pre-test, took a short break, and then did the post-test. Experimental and control groups did the second post-test 6 to 21 days after the first session.

The experimental group had a significant improvement in number memory at post-test one and again at post-test two while the control group did not. Experimental groups had equivalent number memory scores at pre-test and post-test one; however, the experimental group had significantly higher scores at post-test two. The test administrator was not blind to group membership. Their results suggest children with FASD may benefit from rehearsal training. The additional improvement at post-test two for the experimental group also suggests that the benefits from rehearsal training improve after children with FASD have had time to practice using the strategy.

A weakness of the study is lack of data on the extent to which executive function and memory deficits existed in the sample, which was a convenience sample; therefore, findings may not be generalizable beyond the sample used in this study.

A key advantage of Loomes et al.'s (2008) work is the ease of implementation in the classroom. An elementary school teacher could administer the rehearsal memory strategy to one or more students with FASD without needing intensive one-to-one resources.

2.6.2.3 Psycho-Stimulant Medication Intervention

Two studies have explored the potential of psycho-stimulant medications to improve the attention of school-aged children with FASD (Oesterheld et al. 1998; Snyder, Nanson, Snyder, & Block, 1997). Both studies used a randomized double-blind cross over design. Oesterheld et al. recruited four Native American children (5 to 11 years) from a residential school in South Dakota; two boys with FAS and two girls with pFAS. All four children in Oesterheld et al.'s study were at least 1.5 standard deviations above the mean on two standard measures of hyperactivity and impulsivity and were not prescribed psycho-stimulant medication when recruited. Snyder et al.'s study included 11 children from Saskatchewan (6 to 16 years) with FAS who were taking psycho-stimulant medication prescribed by a developmental paediatrician when recruited. All 11 children in Snyder et al.'s study were diagnosed with ADHD using the Diagnostic and Statistical Manual of Mental Disorders Fourth Edition (DSM IV; American Psychiatric Association, 1994). Both studies excluded children with FASD that had other diagnoses including bipolar, depressive, and seizure disorders (Oesterheld et al., 1998; Snyder et al., 1997).

Oesterheld et al. (1998) and Snyder et al. (1997) both found significant improvements in parent reports of hyperactive behaviour but not teacher reports; both used standardized psychological measures. Snyder et al. found no significant change in teacher or parent report of attention or impulsivity.

Oesterheld et al.'s (1998) and Snyder et al.'s (1997) studies use samples that are neither representative of the population of school-aged children with FASD nor are they representative of children with FASD with attention problems. The samples are small and represent very specific groups of children with FASD. Oesterheld et al.'s sample lived in a residential school limiting generalization to non-institutionalized populations. Snyder et al. only recruited children with FASD already taking psycho-stimulant medications so it is likely that the study excluded any children with FASD and attention or hyperactivity problems that did not respond to psycho-stimulant medication. Oesterheld et al.'s and Snyder et al.'s studies suggest that psycho-stimulants may decrease hyperactivity for some children with FASD but the effects are not strong enough to be detected in the classroom for these studies. For elementary school teachers, this means that suggesting caregivers ask their healthcare provider about psycho-stimulant medication may result in a small or no observable change in classroom behaviour.

2.6.2.4 Cognitive Control Therapy Intervention

The aim of the cognitive control therapy was to teach students diagnosed with FASD in South Africa strategies to improve their critical thinking skills so they could learn through self-observation and self-regulation thereby improving their school performance (Riley et al., 2003). A summary of the study by Adnams, Rossouw, Perold, Kodituwakku, and Kalberg has been published in Riley et al. (2003). Prior research with

children with cognitive impairments and learning difficulties showed improved adaptive learning skills after cognitive control therapy (Riley et al., 2003). In Adnams et al.'s study, ten children with FASD (mean age 8.5 years) were randomly assigned to intervention and control groups; however, students in the intervention group had statistically significantly worse behaviour than controls pre-intervention indicating randomization was unsuccessful (Riley et al., 2003). There was no blinding in the study. The study sample was from a poor Western Cape region of South Africa.

An experienced therapist administered the cognitive control therapy one hour per week for 10 months to the intervention group. The Cognitive Control Therapy (Riley et al., 2003) included therapy in the five metacognitive domains:

- phase I body position and movements and self-awareness,
- phase II focal attention,
- phase III processing information in the presence of distractions,
- phase IV controlling external information, and
- phase V categorizing information.

Students were tested pre-and post-intervention with the Cognitive Control Battery (Santostefano, 1978) and a comprehensive neuropsychological battery including the Ravens Coloured Progressive Matrices (Raven, Raven, & Court, 2003), Test of Reception of Grammar (Bishop, 1983), word association, absurdities, visual-motor integration, visual perception and motor performance, letter and category fluency, tests of phonological loop, and measures of spatial and visual memory. Students' school achievement and behaviour were documented by teachers. Primary caregivers were

interviewed for information about home environmental factors that could influence the students' learning, such as the physical environment or the presence of books.

In this study, the intervention group had a statistically significant improvement in behaviour post-intervention while behaviour scores for the control group did not change significantly. No statistically significant change was found in the post-intervention neuropsychological test scores. Therapists reported improvements in students' self-efficacy, motivation, cooperation, self-confidence, and emotionality that were not detected by the quantitative analysis. Teachers reported improved general school achievement, attitude to learning, writing, self-confidence, and self-activity for students in the intervention group but this was not detected by the quantitative analysis.

Adnams and colleagues suggest two possible explanations for the improvements reported by teachers and therapists (cited in Riley et al., 2003). First, the study was underpowered so the improvements noted by teachers and therapists may not have been adequate to detect with a sample of 10 students. Second, teachers and therapists were not blinded to group assignment which may have influenced their perception of students' performance. The results suggest the cognitive control therapy may be a promising intervention for school-aged children with FASD but research is needed with a Canadian sample.

2.6.3 Behavioural Interventions

The four studies (see Table 4) describing behavioural interventions designed to improve behaviour of children diagnosed with FASD used three different study designs: randomized controlled trial (Bertrand, 2009), randomized two-group longitudinal design (Bertrand, 2009), and single sample pre- and post-intervention study (Kerns, MacSween,

Vander Wekken, & Gruppuso, 2010; Malbin, 2006). Detailed findings from the randomized controlled trial and randomized two-group longitudinal study have not been published but a summary is available from the Interventions for Children with Fetal Alcohol Spectrum Disorders Research Consortium (Bertrand, 2009).

Table 4: Intervention studies targeting behaviour of children diagnosed with FASD

Citation	Study type	Sample size	Intervention
Bertrand, 2009	Randomized two-group longitudinal design	46 children plus caregiver	Parent-child interaction therapy versus parent-only support and management program
Bertrand, 2009	Randomized control trial	52 children plus caregiver	Specialized behavioural consultation called Families Moving Forward versus community standard of care
Kerns, MacSween, Vander Wekken, & Gruppuso, 2010	Single sample pre/post-intervention	12 children	Computerized progressive attention training program to improve attention
Malbin, 2006	Single sample pre/post-intervention	19 children	Education for multidisciplinary teams that develop strategies for children

2.6.3.1 Parenting Support Interventions

The Parent-Child Interaction Therapy study aimed to compare the effectiveness of two behaviour therapy programs, the Parent-Child Interaction Therapy and Parenting Support and Management program, to decrease problem behaviour of children diagnosed with FASD and parental stress (Bertrand, 2009). Parent-Child Interaction Therapy uses live, coached practice of parenting skills to improve parent and child interactions. The Parenting Support and Management program used components of other behavioural

programs found to be effective including group discussion and problem-solving for parenting challenges. Participants in each therapy group received weekly 90 minute sessions for 14 weeks.

Forty-six children diagnosed with an FASD and their caregivers to each treatment group (Bertrand, 2009). No information is available on recruitment in the study summary so it is not clear whether the sample is representative of children with FASD in Oklahoma, USA. Outcome measures included the Parenting Stress Index third edition – Short Form (Abidin, 1995), Eyberg Child Behavior Inventory (Eyeberg & Pincus, 1999), Achenbach CBCL for preschool or school-age children (Achenbach, 1999), and Dyadic Parent-Child Interaction Coding System II (Eyeberg & Robinson, 2002). Eyberg Child Behavior Inventory scores showed statistically significant improvement in behaviour post-intervention for both groups but no statistically significant between group difference. Parenting Stress Index scores had a statistically significant decrease for all parents in the study. The lack of control group in the study means it is possible that the post-intervention changes in behaviour could be due to maturation of the children rather than the intervention. The decrease in parental stress could be due to a placebo effect from attention rather than the intervention.

Results indicate the two parenting support interventions may help parents manage problem behaviour in the home and decrease parental stress; however, each of the interventions should be compared to a control group to confirm the findings (Bertrand, 2009). BC elementary school teachers are unlikely to be involved in providing a parental support group; however, the structure of the interventions may be relevant to the development of a professional development program for teachers. Both interventions

aimed to improve parents' knowledge and skills so they could better manage disruptive behaviour of children with FASD. It is reasonable to hypothesize that a similar intervention could be developed for teachers focusing on classroom behaviour.

2.6.3.2 Families Moving Forward Intervention

The Families Moving Forward study involved a specialized behavioural consultation intervention, Families Moving Forward, and the researchers reported its effectiveness for improving caregivers' sense of competency as well as decreasing problem behaviour of children diagnosed with FASD (Bertrand, 2009). Families Moving Forward is based on social learning theory and aims to alter parents' attitudes and responses to their children's problem behaviour through child management, parent training techniques, and the clinical wisdom of "what works." Parents were taught to use antecedent-based behaviour strategies and alter the environment to accommodate their children's disabilities. Examples of accommodations included changing the physical layout and altering how they responded to their children's behaviour. The intervention, as described in the summary, is not standardized and the frequency and content of the behavioural consultations varied for each family. Therefore, any improvements in behaviour could be due to the unique behavioural consultation and not replicable with other families.

The intervention consisted of 16 biweekly-90 minute-supportive behavioural consultations from mental health providers who had received specialized training about FASD. A total of 52 children and their caregivers were randomized to the Families Moving Forward intervention or the community standard of care control group. Children were eligible to participate if they were diagnosed through the Washington State FAS

Diagnostic and Prevention Network and had documented significant problem behaviours in their assessment. The study sample was children with FASD. Outcome measures included the Parenting Sense of Competence Efficacy Scale (Johnston & Mash, 1989), Parenting Stress Index Child Domain Scale (Abidin, 1995), Eyberg Child Behavior Inventory Problem score (Eyeberg & Pincus, 1999), and Multidimensional Assessment of Parental Satisfaction score (Ireys & Perry, 1999).

In this study, children in the intervention group had statistically significant improvements in caregivers' ratings of problem behaviour post-intervention. Caregivers in the intervention group had statistically significantly higher parenting self-efficacy post-intervention but there were no differences for child-related parenting stress. Caregivers also reported the intervention services were highly acceptable on the Assessment of Parental Satisfaction. The increase in caregivers' self-efficacy without any change in caregivers' stress suggests that, although caregivers still found dealing with their children's problem behaviour challenging, they were more confident in their parenting skills. It is possible that the post-intervention decrease in problem behaviour is partly due to a change in caregivers' perception of their children's behaviour rather an actual decrease in problem behaviour. The intervention is of limited relevance to BC elementary school teachers because parenting support is outside of their mandate; however, a similar intervention could be developed that provides teachers with behavioural consultations to help them decrease problem behaviour in the classroom.

2.6.3.3 Computerized Progressive Attention Training Program

Kerns, MacSween, Vander Wekken, and Gruppuso (2010) utilized a computerized progressive training program (CPAT) to improve attention abilities of

students with FASD. The CPAT program uses four structured tasks in a game format, each targeting one of the following facets of attention: orienting, sustained, selective, and executive. The attention tasks, or games, are presented to students using a difficulty level hierarchy; as students' speed and accuracy increase the task difficulty increases. CPAT's goal is to strengthen the three networks; vigilance, visual orienting, and executive function; that comprise the attentional system. The intervention was delivered in half-hour sessions four times per week to a total of 16 training hours.

Twelve students with FASD (8-15 years) were recruited within a BC school district for the pre- and post-intervention quasi-experimental study with no comparison group. Sample size was small and not representative of students with FASD limiting generalization. The lack of control group means the findings could be due to a phenomenon other the CPAT program. For example, a change in teaching practice or new curriculum could have lead to part or all of the observed changes.

Outcome measures included the WISC III (Wechsler, 1991) and Children's Size Ordering Task (McInery & Kerns, 2003) for working memory, Attentional Network Test (ANT-C; Rueda et al., 2004) and Test of Attentional Performance for Children (Zimmerman, Gondan, & Fimm, 2002) for attention, and the Woodcock-Johnson tests of math and reading fluency (Woodcock, 1987) for academic performance. Post-intervention, significant improvements were noted for distractibility, divided attention, and sustained attention with the largest effect size seen for distractibility. Reaction time significantly decreased on ANT-C measures and marginally significant improvement ($p=.078$) was seen on the spatial span backward WISC III test. Students also had

significant improvement on the Woodcock-Johnson math and reading tests indicating improvements in attention benefited students' academic performance.

Results indicate the CPAT program could be an effective tool to assist elementary school teachers in improving the attention abilities of students with FASD. No specialized training was required to administer the intervention and it utilizes equipment, computers, already available in most schools. Further, CPAT could be made available to all students in the classroom to avoid singling out a student with FASD for special treatment.

2.6.3.4 Neurobehavioral Model Intervention

Malbin (2006) studied the use of the Neurobehavioral Model to reduce challenging behaviour displayed by 19 children diagnosed with an FASD. The intervention involved creating a team of individuals that included the parent, teacher, social worker and other professionals as needed to develop environmental adaptations at home and school to accommodate the children's disabilities. The result is an intervention that is not standardized and varies for each child with FASD. The basis of the Neurobehavioral Model is that FASD is a brain-based disorder; therefore, accommodating neurological deficits, such as slow information processing, will reduce problem behaviour caused by a poor fit between children's abilities and their environments.

The quasi-experimental study design involved a pre-and post-assessment of a single intervention group with no control group. Outcome measures were surveys of child behaviour and stress and personal competency of caregivers and professionals developed for the study; no validity or reliability data were reported. Post-intervention,

there was a statistically significant reduction in the mean scores for child problem behaviour, caregivers' stress, and professionals' stress. Caregivers' and professionals' mean scores for sense of personal efficacy increased and changes were statistically significant.

Although the results of Malbin's (2006) study are promising, the evidence is weak. No assessment was made of the reliability or validity of the surveys developed for the study so the post-intervention changes could be due to measures with poor psychometric qualities rather than actual changes in problem behaviour, stress, or personal efficacy. Also, the lack of control group means the results could be due to maturation of the students with FASD, caregivers, and professionals. The results do warrant further investigation into the effectiveness of the Neurobehavioral Model as it is an intervention that could be implemented with the resources typically available in a BC school district.

2.6.4 Social Skills Interventions

Only two studies were found that assessed interventions to improve social skills: one was a case study (Timler, Olswang, & Coggins, 2005) and the other was a longitudinal delayed treatment design with two groups described in three separate papers (Keil, Paley, Frankel, & O'Connor, 2010; O'Connor et al., 2006; Schonfeld, Paley, Frankel, & O'Connor, 2009).

2.6.4.1 Social Communication Intervention

Timler et al. (2005) used a case study to examine the feasibility of a social communication intervention that targeted mental state verb production and social cognitive skills to improve the social communication skills of a nine-year-old girl

diagnosed with FASD. Mental state verbs are necessary to refer to another person's perspective and their effective use indicates the ability to represent theory of mind. Theory of mind is an individual's ability to determine another person's mental state even when the other person's intentions, beliefs, emotions, and desires differ from the individual's mental state. The social cognitive skills targeted were the ability to generate a number of social strategies and the ability to choose the best one for the social situation. The authors hypothesized the girl with FASD would have increased mental state verb production and improved ability to generate social strategies and select the most appropriate intervention for the social situation after completing the six week intervention.

The intervention involved the speech and language therapist working with the girl using role play of social scripts, modeling appropriate social responses, and helping her work through a checklist routine for resolving social situations. The intervention was administered twice a week for an hour at a time during the first two weeks then three times a week for two hours at a time for the remaining four weeks. Outcome measures were the girl's response to checklist items likely to elicit mental state verbs, social strategies, and making a choice between social strategies. Mental state verb production was also measured using probe sessions with false belief tasks. The girl's mental state verb production and number of social strategies increased during the intervention; however, her ability to state another person's perspective did not change. The finding suggests that, although the girl increased her vocabulary, she did not increase her ability to use the new mental state verbs.

Increasing the girl's mental state verb vocabulary may have masked her theory of mind difficulties for people with whom she communicates. This may have resulted in people concluding her inability to see someone else's perspective is due to wilful misbehaviour rather than an under-developed theory of mind. Further research studies using an experimental study design are needed to determine whether the social communication intervention is effective.

2.6.4.2 Child Friendship Training Intervention

The goal of the Child Friendship Training study was to examine the effectiveness of a parent-assisted Child Friendship Training program on social skills of children with FASD and the maintenance of effects three months post-intervention (Keil, Paley, Frankel, & O'Connor, 2010; O'Connor et al., 2006; Schonfeld, Paley, Frankel, & O'Connor, 2009). The Child Friendship Training program is based on social learning and treatment sessions using modeling, rehearsal, and performance feedback to improve children's social skills. Clinical psychology interns with additional training about FASD provided the treatment sessions. Parents used rehearsal at home, homework assignments, and coaching during play with peers to augment the treatment sessions.

For the Child Friendship Training Intervention, 100 children diagnosed with FASD and between 6 and 12 years of age were recruited through local health care providers and flyers posted at medical and community centres. The sample was children that had a diagnosis of FASD and a measurable social skill deficit on the Socialization domain of the Vineland Adaptive Behavior Scale (Sparrow, Balla, & Cicchetti, 1984). The sample was a convenience sample. Fifty-one children were randomly allocated to the intervention group or delayed treatment control group. There were no statistically

significant differences between groups at baseline indicating randomization was successful.

Study outcome measures were the Test of Social Skills Knowledge (O'Connor, Paley, & Frankel, 2003), Social Skills Rating System (Gresham & Elliot, 1990), BRIEF (Gioia, Isquith, Guy, & Kenworthy, 2000), and Hostile Attribution Measure (Dodge, 1980). Children in the Child Friendship Training group had statistically significantly improved knowledge of appropriate social skills, improved social skills, and decreased problem behaviour compared with those in the delayed treatment group post-intervention. Knowledge of appropriate social skills was maintained. At three months post follow-up, social skills had further statistically significant improvements, and problem behaviour remained low. There were no statistically significant reductions in problem behaviour at the three month follow-up or between-group differences that were statistically significant (O'Connor et al., 2006). Hostile Attribution scores, which measure whether a child attributed a story character's actions as hostile, accidental or benign, demonstrated statistically significant decreases post-intervention and remained low at three months follow-up (Keil, Paley, Frankel, & O'Connor, 2010).

Children with stronger executive functioning abilities in impulse control, problem-solving flexibility, and monitoring emotional responses had greater improvement in social skills following the Child Friendship Training intervention indicating there were within group differences in children's response to the intervention (Schonfeld, Paley, Frankel, & O'Connor, 2009). The authors concluded that the intervention showed promise for improving social skills of children with FASD; however, it needed to be tested outside of a highly controlled university setting. The

intervention would require a significant investment of resources and many BC school districts are unlikely to have access to clinical psychology interns to deliver the program. Further research would be needed to determine whether an adaptation of the program implemented by a teacher would be as effective.

2.6.5 Summary

The existing research on interventions for school-aged children with FASD is limited in its utility for elementary school teachers. The evidence is not strong because samples are generally small and not representative of the population of children with FASD. The strength of the study designs varies. Few randomized controlled trials reviewed here utilized blinding.

The quasi-experimental design (Kerns, MacSween, Vander Wekken, & Gruppuso, 2010; Malbin, 2006) and the randomized two-group longitudinal design (Bertrand, 2009) provide weaker evidence than the randomized controlled trials because the lack of control groups means post-intervention changes could be due to something other than the intervention, such as maturation of participants. The case study design used in three of the studies provides the weakest evidence (Johnson & Lapadat, 2000; Porter-Larsen, 2000; Timler, Olswang, & Coggins, 2005).

Few of the interventions could be implemented, as described, in a mainstream BC elementary school classroom with the current level of resources. The school performance interventions were implemented by a licensed clinical psychologist, licensed social worker, or speech and language pathologist. Although BC school districts do hire psychologists, social workers, and speech and language pathologists, they may only be available for consultations with teachers rather than delivery of an intervention to

students. A teacher or TA could be trained to implement the interventions but the results may not be the same. Furthermore, the intervention may require more one-to-one time than a classroom teacher is able to devote to a single student. The CPAT intervention (Kerns, MacSween, Vander Wekken, & Gruppuso, 2010) is an exception as it could be easily implemented using existing resources

Behavioural intervention research suggests altering the postnatal environment may decrease problem behaviour of children with FASD. Although evidence for the effectiveness of the interventions is weak, the literature is consistent in demonstrating a decrease in problem behaviour after altering the postnatal environment of children with FASD. All of the behaviour interventions targeted adults, such as caregivers or social workers, providing them with the knowledge and skills they needed to respond to children's behaviour differently. The results of the behavioural intervention studies suggest a professional development program that provides teaches with knowledge and skills needed to alter their responses to students with FASD and to make changes to the classroom environment could be effective.

2.7 Rational for POPFASD Professional Development Program

The literature review demonstrates that FASD is a significant issue for BC teachers and; therefore, teachers and students could benefit from an evidence-based professional development program. There are no studies on professional development programs for teachers dealing with FASD although the existing literature does suggest effective approaches. Clinicians and researchers have recommended altering teaching strategies and classroom environments to support students with FASD and increasing the structure and consistency of the classroom environment (Paley & O'Connor, 2011). In a

qualitative study examining teachers' beliefs about students with FASD, Watson and Westby (2003a) noted teachers who knew students had FASD were more likely to modify their expectations of students and alter the classroom environment to meet students' needs. Another two qualitative studies included teachers' opinions on why they felt a one or two day workshop on FASD was ineffective. In Dybdahl and Ryan's (2009) study, teachers stated they forgot the information presented in the professional development workshop because they did not know they had a student with FASD and; therefore, felt the information was not applicable to them. Teachers also felt the strategies provided during the workshop were not feasible in the classroom environment. In Ryan and Feguson's (2006) study, teachers stated the two day workshop only raised their awareness of FASD because they were not provided with realistic strategies for dealing with one or two students with FASD in a class of 28 students.

As discussed previously, behavioural interventions that sought to alter the postnatal environment of children with FASD were associated with decreases in problem behaviour. The previous discussion also noted interventions such as the phonetic-based tutoring (Johnson & Lapadat, 2000) to improve academic performance were associated with improvements, although the findings may be limited to the unique samples used in the studies. Finally, the literature review demonstrates that, at this time, there is no typical profile of neurocognitive or neurobehavioural difficulties associated with FASD; therefore, a professional development program would need to provide teachers the knowledge and skills they need to accommodate the unique strengths and difficulties of each student with FASD. The program would also need to assist teachers' understanding

that improvements in behaviour and academic performance can be achieved for students with FASD but what works for one student may not work for another.

3.0 The Intervention: POPFASD Professional Development Program

In response to the lack of evidence-based interventions for elementary school teachers, POPFASD developed a professional development program for teachers to assist in developing better strategies for integrating students affected by FASD into the mainstream classroom. The theoretical rationale for the professional development program is called the Neurobehavioral Approach. The goal of the Neurobehavioral Approach is to change the environment in which a child is situated, including the available resources, so she or he may successfully interact with the environment and continue to learn new skills and knowledge.

Minnes, Buell, Feldman, McColl, and McCreary's (2002) definition of integration, which was adapted from Berry's (1994) acculturation framework, was used for this study. Berry's acculturation framework describes how a smaller cultural group, such as those with FASD, can interact within the larger cultural group. The framework uses two hypothetical issues to determine the nature of the acculturation relationship:

1. Is it considered to be of value to maintain cultural identity and characteristics?
2. Is it considered to be of value to maintain relationships with other groups?

Minnes et al. (2002) adapted the framework by defining a cultural group as a population with a developmental disability. The two hypothetical issues then became whether the unique needs of the population are recognized and supported and whether the population maintains a relationship with the larger cultural group (Minnes et al., 2002). Figure 2 depicts how the two hypothetical issues define the four acculturation categories.

		Issue one: Are the unique needs of individuals with developmental disabilities recognized and supported?	
		Yes	No
Issue two: Do the individuals with developmental disabilities maintain relationships with the larger cultural group?	Yes	Integration	Assimilation
	No	Segregation	Marginalization

Figure 2: Options in Minnes et al.'s (2002) adapted acculturation framework.

A population is considered integrated when their unique needs are supported while they participate in the larger community (Minnes et al., 2002). The POPFASD intervention seeks to improve integration of students with FASD by recognizing their unique and varied needs and supporting them within a mainstream classroom.

The foundation of POPFASD's intervention is the Neurobehavioral Approach which is a multi-system, multi-disciplinary community collaborative project developed by Malbin (2006) and colleagues in Oregon to improve the school experience of students with FASD. As discussed in the literature review, results of this unpublished study suggest the Neurobehavioral Approach is a promising theoretical basis for a professional development program.

The value of a tailored intervention is supported by a records review of 36 students affected by FASD undertaken by Gessner, Bischoff, Perham-Hester, Chandler, and Middaugh (1998). The students were aged 3 to 18 years and situated in the public school system. The school records included IEPs, special education services utilized, medical assessments, and assessments by the special education multidisciplinary team. Gessner et al. (1998) noted there was no consistent pattern of educational deficits or service requirements; i.e., the needs of each student for support within the Alaskan school

system were unique. These results suggest that any intervention would need to be flexible to be effective.

The proposed influence of the POPFASD intervention on teachers, students with FASD, and their classmates is outlined in Figure 3.

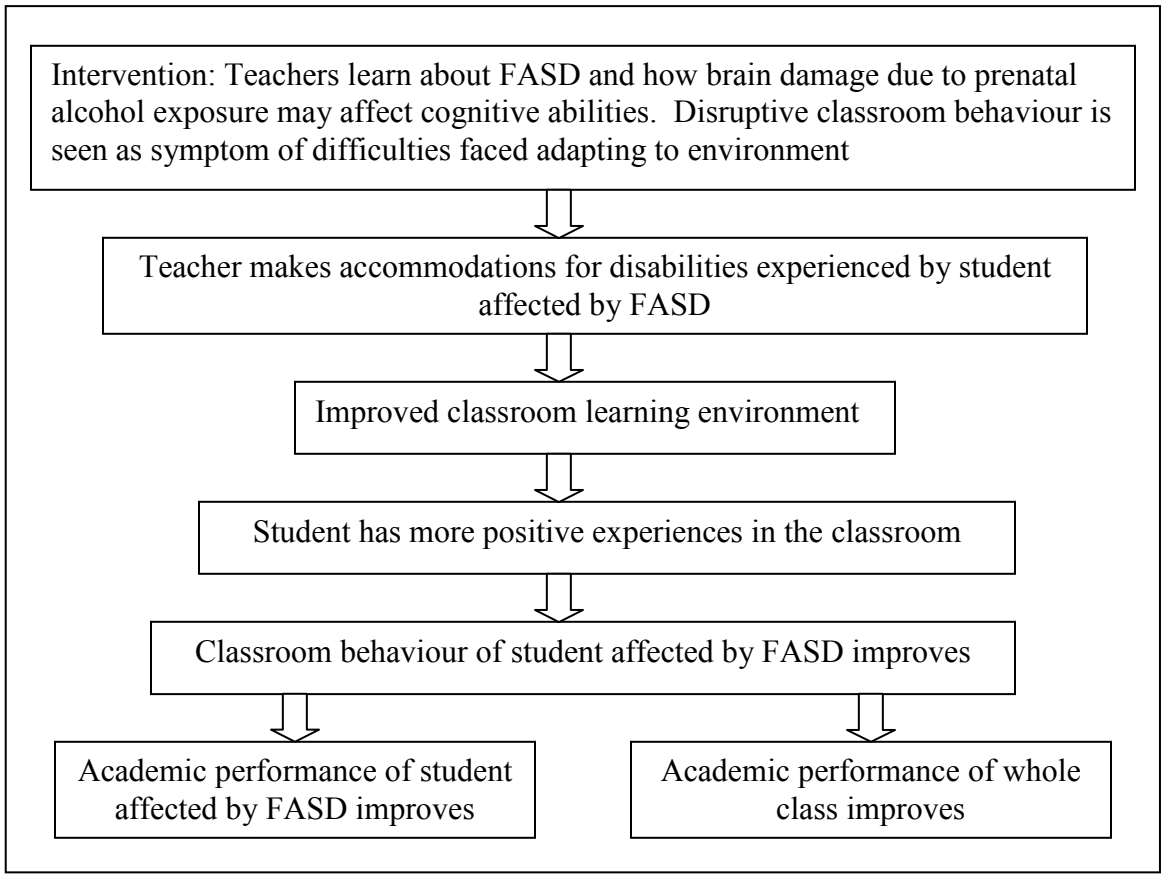

Figure 3: Proposed influence of POPFASD professional development program.

The first step in the intervention is to make teachers aware of the types of cognitive difficulties students with FASD may have and, through group discussion, theorize how those cognitive difficulties may translate into problem behaviour. The discussions about cognitive difficulties and problem behaviour are narrowed to discussing the strengths and weakness of students with FASD the teachers have in their

own classrooms. Through those discussions, each teacher develops a list of accommodations suitable for the students with FASD. Those accommodations may include changing where their desks are placed in the classroom, providing visual reminders, or giving students extra time to complete assignments. The hypothesis is that accommodating the cognitive difficulties experienced by students with FASD will improve their learning environment by creating more opportunities for them to experience success and to have positive experiences in school.

The evidence for an association between problem behaviour and FASD is weak (Brown et al., 1991; Nash et al., 2006; Steinhausen, Willms, Metzke, & Spohr, 2003); therefore, it is hypothesized that accommodating cognitive difficulties for students with FASD will lead to improved classroom behaviour. It is further hypothesized that when a teacher spends less time dealing with problem behaviour in the classroom he or she will have more time to focus on academic skills leading to improved academic achievement of students with and without FASD in the classroom.

3.1 Neurobehavioral Approach

The Neurobehavioral Approach (Malbin, 2006) focuses on the environment and the way students with FASD interact within it to develop appropriate accommodations. As illustrated by the Contextual Systems Model (Pianta & Walsh, 1996; see Figure 1), students with FASD and their environments influence each other in a bidirectional manner. Within the school system, the environment includes the teacher, other students in the classroom, social hierarchy, physical arrangement, curriculum, instruction style, and discipline procedures. The teachers have the greatest influence over environments because they determine the physical arrangement, instruction style, and discipline

procedures and may have some influence on the students' social hierarchy. As the individuals with the greatest influence over classroom environments, teachers are the ideal focus for an intervention to alter the classroom environment to better accommodate difficulties experienced by students with FASD.

The Neurobehavioral Approach involves assessing the abilities of a child within the context of a classroom and school system and exploring ways to make accommodations so the resources in the environment are more appropriate to a child's developmental level. This approach begins with considering the potential effects PAE may have had on a child's neurocognitive abilities and how those effects may be influenced by pre- or postnatal factors. The potential influences on other areas within a child's system, such as cognition or behaviour, are then examined. The Neurobehavioral Approach incorporates moving outwards in the Contextual Systems Model by looking at the effects neurological damage can have on the way a child interacts with the systems or environments he or she is situated in, particularly when the resources available to a child within an environment may be insufficient or inappropriate for his or her developmental level. Behaviours that may result from multi-directional influences of any neurological damage and the environment are considered.

The term Neurobehavioral Approach is used within the FASD field in North America; however, it is not documented in the published literature. No research has been located testing the validity or effectiveness of the Neurobehavioral Approach. In an unpublished study, Malbin (2006) described the underlying principle as recognizing a disability exists and providing the appropriate accommodations the person needs to participate in society. In the case of FASD, the physical disability is defined as changes

in brain structure and the presenting symptoms are behavioural and cognitive. Watson and Westby (2003b) describe a similar process in their article on strategies to address executive functioning impairments but they neither refer to the Neurobehavioral Approach nor do they associate the strategies with any other approach or model.

3.2 Intervention Implementation

The paucity of peer-reviewed literature on professional development programs for teachers working with students with FASD necessitated designers of the POPFASD intervention use their professional judgement and literature on professional development for student achievement to decide what was likely to be the most effective mode of program implementation. Few studies were located comparing the effectiveness of different modes of program implementation for professional development programs to improve student achievement in typically developing students or those with learning disabilities. Two reviews of professional development programs for student achievement suggest a professional development program should:

1. engage teachers as active learners,
2. be incorporated in the school context through mentoring, coaching, or in-school study groups, and
3. take place over an extended period of time (Quick, Holtzman, & Chaney, 2009; Yoon, Duncan, Lee, Scarloss, & Shapley, 2007).

According to the transfer of learning theories, change in teaching practice is more likely to occur when the program design facilitates the learning transfer process (Yammil & McLean, (2001). Design characteristics likely to improve teachers' transfer of learning are:

- focusing on general principles, in this case the Neurobehavioural Approach, to facilitate developing accommodations for any student with FASD, and
- including training situations with a high degree of correspondence to the work setting which can be accomplished through in class mentorship (Yammil & McLean, 2001).

The POPFASD intervention was developed as an interactive professional development program, tailored to the needs of individual teachers, to be delivered through workshops and mentorship.

The workshops used group discussions to encourage teachers to expand their critical thinking skills by developing their own accommodations for students rather than selecting them from a list. POPFASD staff decided on this approach because the research literature does not describe a typical phenotype of cognitive or behavioural difficulties. The goal was to provide the teachers with the knowledge and critical thinking skills to adapt their teaching practice to accommodate the unique challenges each student with FASD faced.

The POPFASD intervention actively engaged teacher participants from elementary schools in the same district in a year-long program utilizing multiple forms of professional development. Delivery of the program included five forms; didactic presentations from those with expert knowledge, interactive workshops, forming communities of practice, critical discussions, and mentorship, to ensure teachers could learn the new material regardless of learning style and be supported in changing practice. All but one of the forms, presentations, engaged teachers in active learning and the content used throughout the training was directly relevant to their current classroom

environments. The content of the program was consistent with provincial assessment standards for FASD and the BC Ministry of Education guidelines for learning disabilities and challenging behaviour (BC Ministry of Education, 2011).

The professional development program was delivered by the POPFASD team leader and teacher consultant, both of whom had the experience and skills necessary to facilitate the workshop. They had extensive experience working with vulnerable children and youth with and without cognitive disabilities. They also had extensive knowledge about FASD in the classroom and had attended conferences and workshops on FASD. Through POFASD, they each had two years experience delivering one or two day workshops to elementary and secondary school teachers about FASD.

The intervention began with a two-day workshop providing an overview of FASD within the classroom context and giving teachers opportunities to discuss how the material applied to students with FASD they were currently teaching. Emphasis was placed on the neurological basis for cognitive and behavioural challenges experienced by students diagnosed with an FASD. The Know, Learn, and Need (KLN) form (see Appendix A) and Learner Environment Instruction Curriculum (LEIC) form (see Appendix B) were introduced in the latter part of the workshop. Participants used the LEIC and KLN forms on the second day to facilitate a discussion of the strengths and weaknesses of students with FASD they were teaching.

The KLN form (see Appendix A) summarizes what the teacher knew about the student diagnosed with FASD prior to reviewing his or her school files, what they have learned, and what they need to know about the student. The learning about students may come from reviewing students' files, accessing information on FASD, accessing someone

with expert knowledge, engaging in critical discussion with peers, speaking to students' caregivers, or through some other medium. The LEIC page (see Appendix B) summarizes the developmental level of students in several areas as well as their strengths, learning styles, interests, and other pertinent information before examining the relationships between students and classroom environments. Estimation of the students' developmental level is based on teachers' professional opinions. The last part of the LEIC form provides space for the teacher to outline potential accommodations in the environment, instruction, and curriculum. The accommodations were developed by the teachers during a critical discussion on what could be done in the classroom to accommodate weaknesses of students.

Completion of the KLN and LEIC forms provided each teacher with a summary of what they knew about FASD in relation to their students, information they needed to find out, and a partial list of accommodations they could introduce to the classroom. Part of the workshop included orientating teachers to print and internet resources that could be used as references and sources of other information in the event that they wished to explore a topic in more detail. Teachers left the workshop with nascent communities of practice developed through collegial and critical discussions with their colleagues and a number of ways of acquiring resources they could utilize during the school year.

The mentor for the intervention, who was the POPFASD teacher consultant, facilitated a meeting for teachers in the intervention group that included, when applicable, caregivers, social workers, teachers, principals, TAs, and other school staff that worked with the students. The goals of the meeting were to complete the LEIC form and

establish communication within the school and between home and school to facilitate implementation of the accommodations developed by the group.

Accommodations for students with FASD are more likely to be effective if they are consistently implemented by everyone involved in the students' lives at home and school (Kalberg & Buckley, 2007). Furthermore, caregivers may have valuable information about students' cognitive abilities that can aid in the development of the accommodations. Ongoing communication with caregivers may also increase the likelihood that teachers find out about changes in students' home environments before they occur. Research suggests students with FAS may have impaired stress response systems and a change in students' routines could be a significant source of stress (Weinberg, 1993; Weinberg, Sliwowska, Lan, & Hellemans, 2008; Zhang, Sliwowska & Weinberg, 2005). Advance notice of changes allows teachers to plan for possible increases in inattentive or disruptive behaviour in the classroom.

The mentor met with teachers throughout the year to assist them with the accommodations they were making for students with FASD in their classrooms. The POPFASD mentor visited teachers in the intervention group weekly from October to April then dropped to bi-weekly visits in April through to the end of the school year. Each mentorship visit included spending an hour in the classroom observing the teacher and student with FASD and a 30 minute meeting with the teacher. Teachers chose one or two accommodations from the LEIC form to work on for each visit. The mentor would spend an hour in the classroom observing how effective the accommodation was for the student with FASD at the beginning of each visit. The mentor and teacher would then meet for 30 minutes to discuss the progress made and whether the accommodation could

be altered to better fit the classroom context. This procedure allowed the mentor to see how accommodations were working in the classroom and provide the teacher with concrete, constructive feedback. The mentorship process aimed to provide teachers with support to change their practice that decreased in intensity later in April as teachers become more confident in implementing and adjusting accommodations.

Four half-day workshops were scheduled during the year to build on the skills, knowledge, and community of practice started in the two day workshop. Each workshop included a check-in with teachers, a presentation from a professional on FASD issues in their field, and a critical discussion between the professional, mentor, and teachers. Presentation topics for the half day workshops were based on information requests POPFASD staff received during workshops they had presented in BC school districts. The critical discussions focused on issues specific to individual students and potential accommodations to improve their success in the classroom. Even if the presentation topic did not apply to the students with FASD with whom teachers were currently working with, they participated in the discussion to aid their colleagues in the development of accommodations. The four professionals scheduled to attend the workshops included a school psychologist, speech and language pathologist, occupational therapist, and educational psychologist with extensive experience assessing children for FASD. Outside of the four day workshops, teachers had the option of making one visit to another classroom to appreciate differences in students with FASD and to continue discussions to build on their communities of practice.

4.0 Study Purpose

This study aimed to assess the effectiveness of a professional development program for BC elementary school teachers working with students diagnosed with FASD. We conceptualize effectiveness as more than just statistically significant findings on predetermined measures of interest. To be an effective program for BC elementary school teachers, the program must be one that can be implemented within the current school environment with its finite monetary and staff resources. Principals, teachers, and caregivers must also believe the program affects the lived experience of students with FASD otherwise they are unlikely to support it. Specifically, we are interested in how the program affects the school experience of students with FASD described by the Contextual Systems Model. To that end, we were interested in the following questions:

1. Is the professional development program implemented as planned within a school district?
2. Do teachers think the professional development program affected the school experience of students with FASD?
3. Do principals think the professional development program affected the school experience of students with FASD?
4. Do caregivers think the professional development program affected the school experience of students with FASD?
5. Is the professional development program associated with improved classroom behaviour, as reported by teachers or observed by researchers, amongst students with FASD?

6. Is the professional development program associated with improved academic skills; specifically, reading, writing, and math, amongst students with FASD?
7. Is the professional development program associated with improved reading, writing, and math skills amongst other students in the class that do not have FASD?
8. Is the cost of the professional development program comparable to other options school districts use to deal with FASD?

5.0 Methods and Procedures

This is the first study which we know of that examines a professional development program about FASD for elementary school teachers and the objective is to document, as fully as possible, its effectiveness. Research questions one and five through eight require quantitative methods while research questions two through four require qualitative methods; therefore, an explanatory mixed methods design was necessary to capture the breadth and range of inquiry for this study (Greene, Caracelli, & Graham, 1989). A quasi-experimental design, specifically; an untreated comparison group design with repeated measures at three intervals was used to determine change in classroom behaviour and academic skills (Cook & Campbell, 1979). Outcome measures were academic achievement of all students in the classroom relative to school district normative data and behaviour exhibited by students with FASD in the classroom. Using a descriptive qualitative approach, inductive thematic analysis of semi-structured interviews undertaken with those involved in the professional development program; principals, teachers, and caregivers; explored how the intervention affected the school experiences of students with FASD.

5.1 Ethics

Ethics approval was obtained from the University of British Columbia Behavioural Research Ethics Board and the University of Northern British Columbia Research Ethics Board in March 2008 and renewed annually. Approval was obtained from the BC MCFD in August 2008 to recruit children in foster care. School District No. 57 approved the study in February 2008 for implementation within district schools. Informed consent or assent was sought from several groups in this study; principals,

teachers, caregivers, students with FASD, and students without FASD. This section describes the consent or assent process for each group.

5.1.1 Principals

Researchers attended a district-wide meeting for principals in the spring of 2008 to provide information about the study and answer questions. Following the information session, principals were sent an information package containing a consent form (See Appendix H) by mail and e-mail in the spring of 2008. Principals had one week to sign and return the consent forms if they were interested in having the study take place in their schools.

In the spring of 2010, two principals were e-mailed the consent form (see Appendix H) again. These principals had an intervention classroom in their school in the 2008/2009 school year and remained as principals in the same school for 2009/2010. Consent was renewed so the principals could provide information on the sustainability of the professional development program.

5.1.2 Teachers

Teachers were e-mailed an information package in the spring of 2008. The information package contained a consent form and postage pre-paid return envelope. The consent form (see Appendix E) contained contact phone numbers for the researchers that teachers could use to get more information about the study. Teachers also received an information session from the researchers at a staff meeting and had the opportunity to ask questions following the presentation. Extra consent forms and a drop box were available at the information sessions for teachers that chose to return their consent forms at that

time. The researchers followed up with teachers by telephone after the information session to answer any questions teachers had about the study.

5.1.3 Caregivers and Students with and without FASD

Caregivers consented to their children participating in the study and students with or without FASD assented to participating. Families received an information package in the mail containing an invitation to attend an information session, an assent form for students (see Appendix C), a consent form for parents (see Appendix D), and a postage pre-paid return envelope. The consent form contained contact phone numbers for the researchers that caregivers could use to get more information about the study. At the information sessions, caregivers heard a presentation from the researchers and had the opportunity to ask questions following the presentation. Extra consent and assent forms and a drop box were available for caregivers and students that chose to return their consent and assent forms at that time. Researchers followed up with caregivers by telephone after the information session to answer their questions (see Appendix F). An intermediary was used to explain the consent form to caregivers with literacy challenges. The intermediary was not employed by the study and was not eligible to participate in the study. The Aboriginal Education Worker was an example of someone used as an intermediary. Caregivers and students both had to agree to the student's participation in the study; however, a caregiver could consent to the student participating but not agree to participate themselves.

After consenting to participation in the study, caregivers were asked to identify whether their children had been diagnosed with FASD. A letter (see Appendix G) was mailed to parents explaining why identification of students affected by FASD was

important. A postage pre-paid envelope was included with the letter for parents to return the form identifying whether or not their children were affected by FASD.

5.2 Study Design

This mixed method study, undertaken within a post-positivist paradigm, used qualitative descriptive inductive thematic analysis nested in an explanatory quasi-experimental design (Greene, Caracelli, & Graham, 1989; Sandelowski, 2000a) with multiple units of analysis. The intervention targeted teachers, who had the greatest control over the physical and instructional environment of the classroom within the boundaries set by the Ministry of Education and the school district. The intent of the quasi-experimental methods is to measure change in classroom behaviour and academic performance. The intent of the qualitative descriptive methods is to provide a comprehensive summary of principals', teachers', and caregivers' views on the intervention. Figure 4 provides an overview of the quasi-experimental study design.

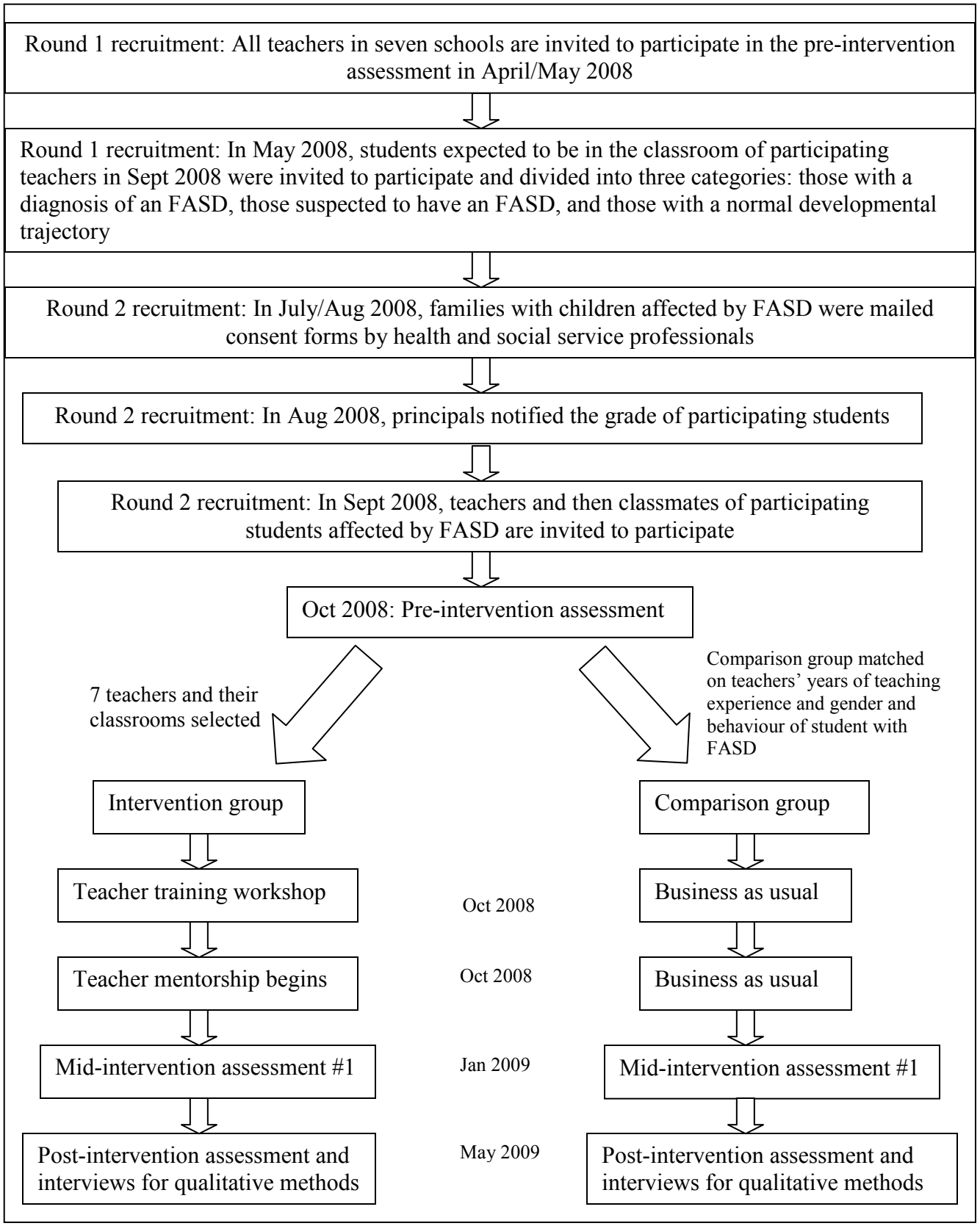

Figure 4: Overview of study design.

The strength of a mixed-methods study depends on the theoretical rationale for combining the qualitative and quantitative methods. In this study, we use Greene, Caracelli, and Graham's (1989) theoretical rationale for combining qualitative and quantitative methods for expansive study of the effectiveness of the professional development program. The qualitative and quantitative methods study different but complementary phenomenon (Greene, Caracelli, & Graham, 1989). Research questions addressing the lived experience of those involved in the professional development program use qualitative methods. Research questions focused on measurement and comparison use quantitative methods. Because the methods complement each other and explain different phenomenon they may result in different answers to the question of whether the professional development program is effective. For example, the quantitative analysis could determine that the professional development program is effective because it reduces disruptive classroom behaviour of students with FASD; however, the qualitative analysis may suggest it is ineffective because teachers find the intervention too difficult to implement in their classrooms.

5.2.1 Quality and Rigour of Qualitative Description Methods

The goal of qualitative description is to provide a comprehensive description of events using an interpretation that remains close to the data (Sandelowski, 2000b; 2010). Remaining close to the data means that the analysis does not involve interpretation of the meaning of behaviour, words, or phrases according to a conceptual or philosophical framework (Sandelowski, 2000b; 2010). For example, caregivers' perceptions of their communication with teachers is interpreted according to the themes found in the data, it is not re-presented according to the conceptual framework of power. Quality and rigour

of the qualitative description used in this study is determined using Guba and Lincoln's (1989) trustworthiness criteria: credibility, transferability, dependability, and confirmability.

5.2.2 Validity of Quasi-Experimental Methods

Validity of the study design must be considered when examining the effectiveness of an intervention. Cook and Campbell (1979) outlined potential threats to validity including: statistical conclusions, and internal, construct, or external validity.

5.2.2.1 Statistical Conclusion Validity

The study must have strong and stable statistical evidence to support causal inferences. Adequate statistical power, reliable measures, and reliable implementation of the intervention are all indicators of strong statistical evidence.

This study was expected to have adequate statistical power with an alpha of .10 to detect large effect sizes for the student academic and behaviour outcome measures according to Cohen's (1998) power calculations. Alpha (α) was set at.10 to increase the power to detect significant findings, thereby lowering the risk of type II error (Ellis, 2010); $p \leq .10$ is regarded as indicating statistical significance in this study. It was anticipated that the intervention and comparison groups would each have 21 students with FASD yielding 50% power to detect a medium effect size and 80% power to detect a large effect size. The number of students with FASD recruited for the study was much lower than anticipated; $n = 13$ with seven students in the intervention group and six in the comparison group. Consequently, the study power was inadequate at 25% to detect a medium effect size and 50% to detect a large effect size.

Determining reliable implementation of the intervention is not possible because the intervention is not standardized. The workshops, including development of the LEIC and KLN forms, were the same for all teachers in the intervention group. The accommodations used by teachers and the mentoring were different for each teacher in the intervention group. The content communicated during the mentor's visits to each intervention classroom depended on the needs of the teacher. Frequency and type of communication between the mentor and teachers depended on the needs of the teachers and ability of the mentor to accommodate their needs. The time mentors spent facilitating communication between home and school depended on the needs of the caregivers and teachers. The type and number of accommodations developed by the teachers in the intervention group varied depending on the strengths and impairments of each student with FASD and the classroom context. The result is an intervention that is flexible in responding to teachers' teaching style, classroom context, and strengths and impairments of students with FASD. Analysis of findings can suggest whether the professional development program was implemented as planned but the analysis does not support reliable program implementation.

Sample size is the most significant threat to statistical conclusion validity. Sufficient participants would have ensured enough statistical power to detect large and medium effect sizes. Although there may be sufficient students with FASD within the school district it was not possible to recruit enough students with a diagnosis of FASD.

5.2.2.2 Internal Validity

Selection, contamination of the comparison group, misclassification of students, and a non-standard intervention affected internal validity.

The non-equivalent group characteristics of quasi-experimental study designs affect the internal validity of the study. Neither students with FASD nor teachers were randomized to the intervention and comparison group so there are likely pre-intervention group differences. Changes in classroom behaviour or academic skills of students with FASD in the intervention group relative to the comparison group could be due to differences in the groups rather than the intervention.

Contamination of comparison classrooms is a threat to internal validity. A school participating in the study could have an intervention classroom and comparison classroom. This means the comparison group teacher may learn about strategies for working with students with FASD from the intervention group teacher. Comparison group teachers could also replicate the material covered in the workshops by accessing print or internet resources on FASD or consulting with experts on FASD. One component of the professional development program, mentorship, cannot be accessed by the comparison group teachers. To estimate the degree of contamination for the comparison group, all teachers were asked to describe strategies they used when working with students with FASD during the school year. It is possible that contamination of the comparison group may occur that was not detected through the interviews with the teachers.

There is no screening for FASD in BC elementary schools and caregivers are not required to disclose a diagnosis of FASD to their children's school personnel; therefore, it is possible that some students with diagnosed or undiagnosed FASD were misclassified. There are a number of developmental disorders with neurocognitive and behavioural symptoms similar to FASD (Chudley, et al., 2005); therefore, screening for FASD would

not have been an effective way to determine if misclassification was present in the study. Teachers and principals in the intervention and control group reported that there were no students with FASD in the non-FASD comparison group. It is possible that there were students with FASD in the non-FASD group of which teachers and principals were unaware so misclassification remains a threat to internal validity.

The most significant threat to internal validity is the non-standard intervention. The mentoring each teacher received differed in content and intensity; therefore, each classroom could be considered a unique intervention

5.2.2.3 Construct Validity

The research questions focus on the effectiveness of a professional development program for elementary school teachers working with students with FASD; therefore, the constructs chosen for measurement and analysis focus on dimensions relevant to teachers working with students with FASD in the classroom. Classroom behaviour and academic skill development in reading, writing, and math were the chosen constructs based on information requests received by POPFASD (K. Hughes, personal communication, October 2007) and qualitative research findings (Duquette & Stodel, 2005; Ryan & Ferguson, 2006). Two qualitative studies from Alaska and eastern Ontario cited strategies for managing problem behaviour in the classroom and strategies for improving skill in reading, writing, and math as teachers' top priorities for content of a professional development program (Duquette & Stodel, 2005; Ryan & Ferguson, 2006).

5.2.2.4 External Validity

The results of this study are not externally valid; therefore, results cannot be generalized beyond the study sample. Only one BC school district is involved in the

study so the findings may be influenced by policies or practices unique to the district. Neither the sample of students with FASD nor the sample of elementary school teachers is representative of all students with FASD or all elementary teachers.

5.3 Recruitment

Five populations participated in the study: principals, teachers, caregivers of students with FASD, students with FASD, and students without FASD. Recruitment took place in two phases shown in Figure 5. Phase One started with the school district and occurred from February, 2008 to May, 2008. When recruitment in phase one yielded too few students diagnosed with FASD phase two was implemented as an alternative recruitment method. Phase Two started with a local paediatrician and spanned June, 2008 to September, 2008.

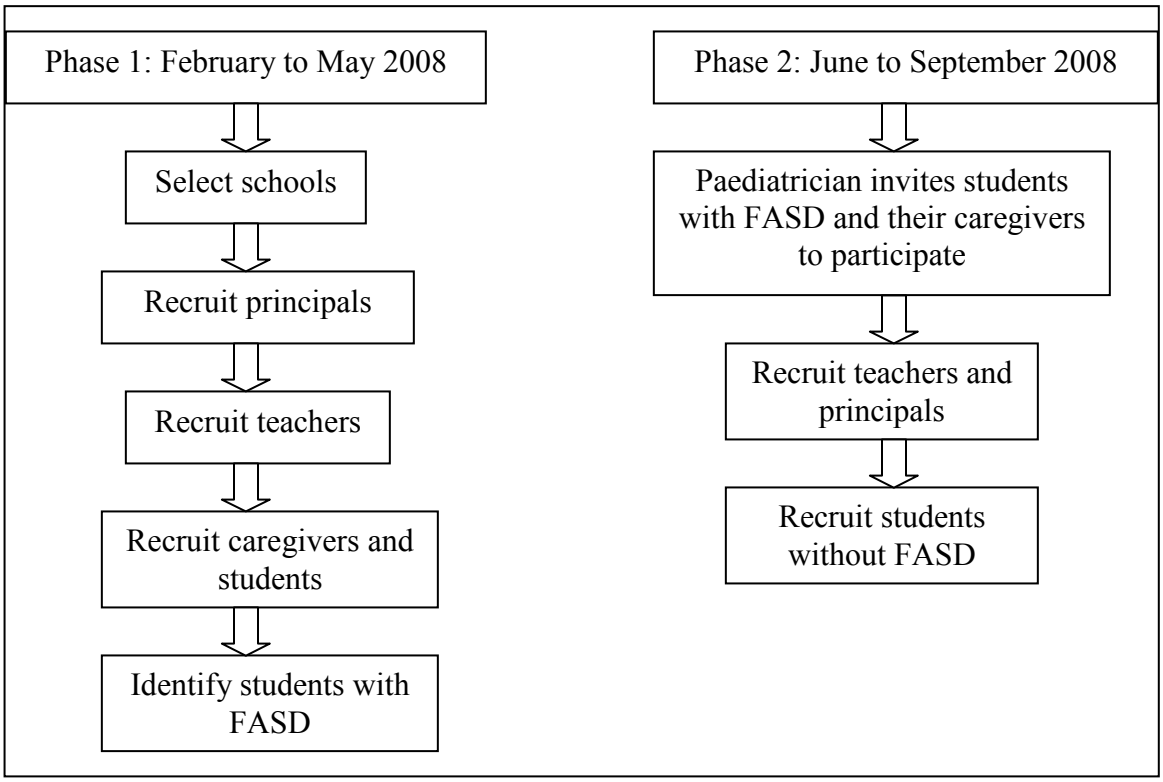

Figure 5: Comparison of Phase One and Two recruitment strategies.

Recruitment was limited by the complexity of a process that involved several layers of consent. A refusal to participate at one layer of the consent process excluded potential participants from the study. For example, if a principal chose not to participate, their entire school - teachers, caregivers, and students; were excluded from the study, even if there were individuals within the school that wanted to participate. If a teacher did not participate, no student in their classroom could participate. If the caregiver of the only identified student with FASD in a classroom or the students themselves chose not to participate, the teacher and students without FASD in the classroom could not participate.

Students with and without FASD that had the same caregiver were included in the study. Including multiple students with shared caregivers threatens the independence of the sample; however, excluding students, particularly those with FASD, would limit the sample size. Inadequate sample size is a greater threat to the validity of the study; therefore, students with the same caregiver are included in the study.

5.3.1 Phase One Recruitment

During Phase One (See Figure 5), principals were eligible for inclusion if they were in one of the elementary schools selected by officials in the school district. Schools were selected if they served a higher number of students with FASD. A higher score on the BC MCFD vulnerability index was chosen to identify students with FASD, because they are more likely to be in foster care (Streissguth & Kanter, 1997). Since a diagnosis of FASD requires evidence of neurodevelopmental impairment, schools with higher rates of behaviour difficulties, lower academic performance, and higher truancy rates were also chosen. Recruitment of teachers began after principals agreed to participate.

Recruitment of teachers took place in the schools that were selected by officials in the school district and had a principal who agreed to participate. All teachers teaching grades one to seven at participating schools were eligible for inclusion in the spring of 2008.

Students were eligible for inclusion if their teachers and principals had consented to participation. Students with FASD were eligible if they were diagnosed with FASD or waiting for an assessment. Students without FASD were eligible if they were in participating classroom. Any students with a BC Ministry of Education Level One or Level Two disability designation were excluded. Caregivers of students in participating classrooms were asked to identify if their child had FASD but no other screening took place; therefore, it is possible that in the students without FASD group there were students who had undiagnosed or unidentified FASD.

Caregivers were eligible for inclusion if they were the primary care person for participating students. Examples of caregivers included biological parent, biological relative, and foster parent. Social workers were legal guardians but not caregivers because they had limited contact with the children compared to the foster parent. Only caregivers of students with FASD were asked to engage in semi-structured interviews. A caregiver could consent to their child participating but decline participation for themselves.

After caregivers and students had been recruited, the caregivers were asked to identify if their child had been diagnosed with FASD. If no students with FASD were identified in a participating classroom the caregivers and students who agreed to

participate were thanked for their involvement and told the classroom would not be included in the study.

5.3.2 Phase Two Recruitment

Phase Two recruitment (see Figure 5) allowed for additional students with FASD to participate in the project. Phase Two recruitment began with a paediatrician contacting caregivers and eligible students with FASD and ended with their teachers and classmates receiving consent forms.

Consent forms, student assent forms, and self addressed return envelopes (see Appendices C & D) were mailed to caregivers if they had a child eligible for the study. Researchers were not provided with names or contact information for any of the families; therefore, follow up phone calls were not possible. If the parents or guardians contacted any individuals listed on the consent form, more information was provided about the study. Researchers contacted families that returned the consent and assent forms to determine the school the student attended so the principal and teacher could be recruited.

Principals and teachers of students with FASD participating in the study were e-mailed consent forms and self addressed return envelopes (see Appendices E & H) in September of 2008. Researchers followed up with phone calls to answer any questions. Once principals and teachers agreed to participate recruitment of the classmates began. If principals or teachers refused to participate, the students with FASD and their caregivers were thanked for their participation and excluded from the study.

Caregivers were sent consent forms, student assent forms, and postage pre-paid envelopes (see Appendix D) if their children were in classes with a participating student

with FASD. The consent form contained contact phone numbers for the researchers so that caregivers could obtain more information about the study.

5.3.3 Allocation to Intervention and Comparison Groups

Teachers, and their student or students with FASD, were assigned to the intervention or comparison group without randomization. Because the intervention and comparison groups would be non-equivalent, group allocation was undertaken to balance the intervention and comparison groups based on the following criteria:

- elementary school,
- teachers' years of experience,
- descriptions of students' behaviour,
- students' gender,
- students' use of psychiatric medication, and
- ethnicity of the students.

Teachers were notified of their group allocation by phone and e-mail but families were not notified.

5.4 Inductive Thematic Analysis

For the descriptive qualitative component of the study, the inductive thematic analysis followed a process adapted from Pope, Ziebland, and Mays (2000) and Waltz, Strickland, and Lentz's (1991) content analysis to analyze the interview transcripts.

5.4.1 Stage 1: Material to be Analyzed

Field notes and transcripts comprised the universe of content to be analyzed in the qualitative part of this study (Pope, Ziebland, & Mays, 2000).

The field notes, which were written after each interview, included information on the following:

- The interview
    - duration of the interview
    - date and time of the interview
    - the environment in which the interview took place
    - number and type of interruptions
- The interviewer
    - feelings regarding the information heard
- The interviewee
    - body language of the participant
    - non-verbal facial expressions of the participant

These field notes assisted in looking for any biases towards the interviewees and the information they were generating as well as providing data for the analysis process. The writing and analysis of the field notes assisted with reflexivity in the analysis process (MacBeth, 2001).

The goal of the transcription of interviews was to achieve what Rubin and Rubin (2005) referred to as thick description of the interview data and increased familiarity with the data. All of the transcribing was completed by the doctoral student as Rubin and Rubin (2005) noted that the act of transcription assists in preparation for the next interview, forces the transcriber to pay close attention to what is said, and increases the transcriber's familiarity with the data. Transcription took place after each interview was completed, rather than after all interviews were completed, so analysis of the transcript

could assist in the evolution of the probes in the semi-structured interviews (Glaser, 1978).

The tape recording was transcribed verbatim with the exclusion of "uhmms" and "ahhs." Unless the interviewee used several "uhmms" or "ahhs" to fill a large pause they were not recorded in the transcription. Long pauses were noted as well as other information, such as laughter, sarcasm, or word emphasis that might affect the interpretation of the transcript (Rubin & Rubin, 2005). Physical gestures and interruptions noted in the field notes were added to the transcription. Square brackets with the word "interpretation" or "summary" were used to indicate whenever interpretation or summary was needed to transcribe the recording because the digital recording could not be clearly heard. Any ideas or thoughts that came during the transcription process were noted in memos. Memos described perceptions about the flow of the interview and whether any bias was detected in the way the interview was conducted (Rubin & Rubin, 2005).

Kvale (1996) argued, because transcripts are usually the main source of data in an interview project, the reliability of the transcription process should be checked. A sample of two interviews was used to determine reliability of the transcription. A second person was asked to transcribe the interview verbatim as described above. The two transcripts were compared for the following differences,

- the degree of interpretation used in the transcription and whether it was noted in the text,
- how closely the words of the interviewee were captured, and

- whether the transcription changed over the course of the interview, i.e. more interpretation or summarizing near the end.

The comparison of the two transcriptions was used to make a subjective assessment of the reliability of the transcription process.

The transcripts were all created by the doctoral student from interviews with caregivers, teachers, and principals.

5.4.1.1 Principals

Principals spend little time in the classroom with teachers; however, they were providing insight into whether teachers in the comparison group were contaminated by knowledge of the intervention, whether teachers in the intervention group mentored other staff post project, and whether there was a change in how often students with FASD were referred to the office for problem behaviour. Principals were asked to engage in a semi-structured interview (see Appendix M) if they still had a teacher from the intervention group in their school during the intervention and one year post-intervention.

5.4.1.2 Teachers

All teachers in the intervention and comparison groups were asked to engage in a semi-structured interview post-intervention (see Appendix I). Teachers in the intervention group completed an additional interview at one year follow up (see Appendix L).

The semi-structured interviews with the teachers covered three areas: perceptions of students with FASD, strategies for dealing with disruptive classroom behaviour, and, for teachers in the intervention group, insights about implementation of the POPFASD mentorship intervention. The intervention sought to change the way teachers' perceived

behaviour of students with FASD and to alter their teaching practices to accommodate students' impairments. Teachers in the intervention group were asked to describe students' behaviours and how they dealt with them to determine whether teachers thought the intervention altered their perceptions of students' behaviours. Teachers in the comparison group were also asked to describe students' behaviours and how they dealt with them to see if their approaches were similar to the strategies used by teachers in the intervention group. Strengths and weaknesses associated with the implementation of the intervention were also explored. Teachers in the intervention group were asked whether some elements, such as the workshops, needed to be altered, the intervention was relevant to their teaching practice, changes to their teaching practice were sustained, and the intervention was a good fit for their classroom, school, or district.

5.4.1.3 Caregivers

School environments are influenced by home environments and the relationships between caregivers and school staff; therefore, the perspective of caregivers is necessary to understand students' school experiences (Pianta & Walsh, 1996). In a semi-structured interview, all caregivers were asked to reflect on their children's experiences with school environments. They were also asked about their relationship with school staff, satisfaction with the school, and perceptions of their children's school experiences (see Appendix K).

All nine caregivers were invited to participate; however, one refused and one was lost to follow up.

5.4.2 Stages 2 and 3: Source of Data and Unit of Analysis

Interview transcripts and field notes were the sources of data for the inductive thematic analysis. Phrases and sentences were the units of analysis.

5.4.3 Stage 4: Sampling Plan

The sample included adults involved in the classroom experience of those students, specifically, principals, teachers, and caregivers. All principals, teachers, and caregivers in the intervention and comparison groups were invited to complete a semi-structured interview with the doctoral student.

5.4.4 Stage 5-9: Analysis Plan

Themes were developed inductively using the constant comparative analytic procedure described by Glaser (1978). Audio recordings were reviewed prior to the coding of any transcript. Transcripts and field notes were read and coded line-by-line using phrases and sentences. Codes were compared between and within transcripts to examine similarities and differences. Codes were then grouped into categories which were clustered into themes. The analysis process was concurrent with data collection so the emerging themes could inform the choice of interview probes.

5.5 Measures

5.5.1 Demographic Data

Limited demographic information was collected for this study, accordingly:

- principals' gender,
- teachers' gender and years of experience,
- caregivers' relationship to students with FASD, and
- age and gender of students with and without FASD.

5.5.2 Executive Function

Executive function influences social and academic skills amongst students with FASD (Schonfeld, Paley, Frankel, & O'Connor, 2006; Rasmussen, 2005; Watson & Westby, 2003b); therefore, executive function was assessed to describe the abilities of the students with FASD in the study.

The methods available for assessment of executive function include: performance-based cognitive measures conducted in a controlled test situation, such as the Tower of London (Anderson, Anderson, & Lajoie, 1996), and behaviour survey measures, such as the BRIEF (Gioia, Isquith, Guy, & Kenworthy, 2000). Correlation between the two methods is weak suggesting the behavioural and cognitive measures are assessing different constructs of executive function (Toplak, Bucciarelli, Jain, & Tannock, 2009; Vriezen & Pigott, 2002). In this study, the primary aim of the intervention was to assist teachers to decrease disruptive classroom behaviour of students with FASD (see Figure 3). Using the Contextual Systems Model (Pianta & Walsh, 1996) and the Neurobehavioural Approach (Malbin, 2006), disruptive classroom behaviour was conceptualized as a symptom of a poor fit between a student's abilities and the classroom environment. Therefore, the construct of executive function most relevant to this study was the behavioural manifestation of executive function in the classroom measured by teacher report. The BRIEF teacher form was chosen as the measure of executive function because it was judged to have adequate reliability and validity for the intended test score interpretation.

Internal consistency and test-retest reliability of the BRIEF teacher form is strong (Gioia, Isquith, Guy, & Kenworthy, 2000). Internal consistency reliability coefficients were .84-.98 for a clinical sample (n=475) and .90-.98 for a normative sample (n=720) indicating questions within subscales were measuring the same construct. McCoy, Raver, Lowenstein, and Tirado-Strayer (2011) found internal consistency correlation coefficients for the working memory and inhibit subscales across African American and Hispanic children and income categories were .95-.97. None of the samples included Canadian students and the clinical sample did not include any students diagnosed with FASD. It is plausible that reliability for northern Canadian students with FASD is similar; however, interpretation of the executive function profile of the study sample must consider that reliability may be lower than expected.

To be a valid measure of executive function for this study the BRIEF must fully describe the behavioural manifestations of executive function impairments. Important behavioural manifestations associated with FASD include inattention, self-regulation, and social skills (Nash et al., 2006; Steinhausen, Willms, Metzke, & Spohr, 2003). The BRIEF teacher form has moderate to strong correlation with the CBCL TRF (Achenback, 1991; Gioia, Isquith, Guy, & Kenworthy, 2000). CBCL TRF attention problems scale correlation coefficients were .69 for BRIEF initiate, .74 for working memory, and .67 for plan/organize (Gioia, Isquith, Guy, & Kenworthy, 2000). McCandless and O'Laughlin (2007) noted the BRIEF teacher form had weak to moderate correlation with the BASC-2 hyperactivity scale (r=.26-.67) and BASC-2 inattention scale (r=.22-.88) for a convenience clinical sample (n=70; 5-13 years). Low scores on the BRIEF task initiation and response control questions were associated with poor performance on the Integrated

Visual and Auditory Continuous Performance Task (Sanford & Turner, 1995). Studies have found the BRIEF teacher form successfully distinguishes students with Tourette's Disorder or ADHD, two disorders that include difficulty with self-regulation, from non-clinical populations (Gioia, Isquith, Guy, & Kenworthy, 2000; McCandless & O'Laughlin, 2007). Schonfeld, Paley, Frankel, and O'Connor (2006) found BRIEF teacher form scores, specifically the behaviour regulation index and metacognition index, predicted teacher ratings on the Social Skills Rating System (Gersham & Elliott, 1990) for children with FASD (n=98, 6-11 years).

Results indicate the BRIEF teacher form has adequate reliability and validity to describe the executive function of students with FASD in this study; however, the normative data does not include Canadian students or students with FASD so percentile scores should be interpreted with caution.

5.5.3 Fidelity of the POPFASD Intervention

Fidelity is the extent to which those administering the intervention treatment adhere to the intended program. There are five criteria to consider in an assessment of fidelity:

1. adherence,
2. duration,
3. quality of delivery,
4. program differentiation, and
5. participant responsiveness (O'Donnell, 2008).

The first two criteria, adherence and duration, are concerned with the structure of the intervention. Adherence is whether the intervention is implemented as planned while

duration is the number, length, and frequency that components, such as workshops or mentoring, are implemented. Quality of delivery and program differentiation are concerned with the process of implementing the intervention. Quality of delivery is whether the implementer uses the techniques, processes, or methods prescribed for the intervention. Program differentiation is whether the intervention components that separate the intervention group from the comparison group are present or absent during implementation. Participant responsiveness, which applies to the structure and process of intervention implementation, is whether participants are engaged in the activities and content of the intervention. It is these criteria, as defined in O'Donnell (2008), which are considered in assessing the fidelity of the POPFASD intervention.

Assessing fidelity of the POPFASD intervention is constrained by the design of the intervention: the workshops are standardized but the mentoring is not. Adherence of the mentorship process cannot be assessed because it was intended to be implemented as an individualized intervention; therefore, there was no standardized content. The number, length, and frequency of mentoring sessions were assigned minimum levels but the mentor and mentee could adjust the duration according to the needs of the mentee. There were no prescribed techniques, processes, or methods to be used by the mentor; therefore, mentorship quality of delivery could not be assessed. Program differentiation and participant responsiveness were assessed using the Classroom Strategies Interview (see Appendix I) and the mentors' notes. This semi-structured interview was administered to teachers in the intervention and comparison groups by the doctoral student. Teachers were asked to describe the classroom behaviour exhibited by the student or students with FASD in their classroom and how they dealt with it. Teachers

were also asked to list what resources, human, print, or internet, they utilized when deciding how to deal with disruptive classroom behaviour. The mentor's notes provided information on the classroom strategies that were discussed during each meeting and the progress the mentee made on implementing new strategies during the year. Interviews with teachers in the intervention group and the mentor's notes provided information about the extent to which teachers engaged in the mentoring process and tried implementing new strategies in the classroom. Interviews with the teachers in the comparison group provided information about whether they had access to mentorship through a different source in the school district.

Standardized full day and half day workshops were administered to all teachers in the intervention group and could be assessed for fidelity. Review of the schedules, handouts, power point files with speaking notes, video clips, and worksheets completed determined the extent to which the workshops adhered to the prescribed duration and components. Through observation, it was determined that the workshops were interactive and adhered to the Neurobehavioral Approach. The Classroom Strategies Interview (Appendix I) indicated whether teachers in the intervention group were engaged in the workshops and whether comparison group teachers attended FASD workshops offered by an agency other than POPFASD.

5.5.4 Measuring Effectiveness of Intervention

Two constructs were examined to determine the effectiveness of the teacher mentorship intervention for students with FASD: classroom behaviour and academic achievement. Academic achievement was measured for all students in the study while classroom behaviour was only measured for students with FASD. For a measure to

provide accurate information its reliability and validity must be assessed for the intended purpose. The measures selected for this study (listed in Table 5) were chosen because they are standardized, valid measures for the constructs being studied. The goal of the Neurobehavioral Approach is to accommodate the cognitive difficulties of students with FASD in the classroom. The hypothesized outcome of using the Neurobehavioral Approach is a reduction in disruptive classroom behaviour that may be a consequence of a mismatch between the students' cognitive abilities and their environments. In addition, it was hypothesized that accommodating students' cognitive difficulties would increase their success with academic skills. Therefore, reliable and valid measures for this study should consistently measure change in the classroom behaviour of students with FASD and change in academic skill.

Table 5: Outcome measures used during assessments

	Outcome measures	
Construct	Students with FASD	Students without FASD
Academic	CBM[1]	CBM[1]
Behaviour	1) BASC-2 TRS[2] 2) BASC-2 POP[3]	Not measured

[1] CBM: Curriculum Based Measurement (Fewster & MacMillan, 2002)
[2] BASC-2 TRS: Behavior Assessment System for Children Teacher Rating Scale (Reynolds & Kamphaus, 2004)
[3] BASC-2 POP: Behavior Assessment System for Children Portable Observation Program (Reynolds & Kamphaus, 2004)

The outcome measures listed in Table 5 were administered pre-, mid-, and post-intervention.

Construct validity is the overarching construct for assessing the validity of measures by making an evaluative judgement about whether the inferences and actions

made based on the test scores are appropriate and adequate given the empirical evidence and theoretical rationale for the test (Messick, 1989). Four aspects should be considered when making the evaluative judgement including:

1. assessing the plausibility of the proposed interpretation or use of test scores,
2. developing a rationale for the proposed interpretation and considering possible competing interpretations,
3. considering consequences of the test usage, and
4. making construct validity an integrated and unified evaluation of the interpretation of the test scores (Kane, 2001).

As previously discussed, there are several threats to the internal and external validity of this study which need to be considered in the interpretation of the study findings. The study design used non-equivalent intervention and comparison groups; therefore, change in the intervention group relative to the comparison group could have been due to pre-existing group differences. The sample was not randomly selected from the population of students with FASD so interpretation of the test scores could not be generalized. The small sample size limited the ability of inferential statistics to detect significant change in test scores. Given the lack of external validity, the interpretation was limited to the study sample. Furthermore, threats to internal validity, such as the non-standard components of the POPFASD intervention, meant interpretation of findings for the study sample were described in the context of limitations in the study design. Failure to consider the study limitations in the interpretation would mean attributing change, or lack thereof, in test scores to the intervention when cause may have been a flaw in the study design. Issues of

reliability and validity of individual outcome assessment tools are discussed in this section.

5.5.4.1 Academic

The intent of using the academic measure was to determine whether the academic skill of students with and without FASD in the intervention classrooms improves relative to comparison group students. The proposed interpretation assumed that the measure:

1. was reliable so changes in test scores were reflective in changes in academic skill,
2. was reflective of ability to complete grade appropriate curriculum,
3. was sensitive to academic skill improvement within a school year, and
4. accurately assessed academic skills of elementary school students, including those with FASD, in northern BC relative to their peers.

The Curriculum-Based Measurement (CBM) (Fewster & MacMillan, 2002) was selected for the academic measure because research evidence, outlined below, suggested the CBM reading, writing, and math may be adequate tools for assessing academic skills in this study.

5.5.4.1.1 Curriculum-Based Measurement for Math

Reliability of the CBM math for elementary students is strong although alternate form reliability estimates indicate there is potential for variability in student performance (Foegen, Jiban, & Deno, 2007). Internal consistency of basic math skills was .94 or greater for grades two to four (Fuchs et al., 1994) and .97 for grades five and six (Fuchs, Hamlett, & Fuchs, 1999). Test-retest reliability scores were also high. Epstein, Polloway, and Patten (1989) found two week test-retest reliability of addition and subtraction skills to be .85 and .80 respectively, for students 9-12 years in special

education classrooms. Fuchs, Hamlett, and Fuchs (1998) found alternate form reliability scores ranged from .73-.93 for basic math skills in grades two to six. The alternate form reliability testing indicates CBM math results may be affected by variance in student performance though the potential impact would be low.

Validity research on the CBM math has focused on criterion validity which, though moderate, is similar to the criterion validity of commercially available achievement tests (Foegen, Jiban, & Deno, 2007). Fuchs, Hamlett, and Fuchs (1998) found correlation coefficients for grades two to five for basic math skills ranged from .77-.87 for the Wide Range Achievement Test (Jastak & Wilkinson, 1984) and .55-.93 for the Stanford Achievement Test (Harcourt, Brace, & Company, 1996). Foegen et al. found CBM math correlation coefficients for basic skills were .47-.66 for teachers' ratings, .52 for math grades, and .51 for semester grade point average. Fuchs et al. (1994) found correlation with the Comprehensive Test of Basic Skills (MacMillan/McGraw-Hill, 1989) ranged from .74-.81 for grades two to four. In this study, percentile scores are used to measure change over time rather than rank students or determine their placement in general or remedial math programs; therefore, the moderate criterion validity is adequate for this study.

Research examining student growth with the CBM math is limited but indicates the measure is sensitive to students' progress during the school year, although, variance may be high. Fuchs, Fuchs, Hamlett, Walz, and Germann (1993) found the slope of positively accelerating means across grades ranged from .20-.77 for grades one to six. For some grades the variance was low, standard deviation of .10 for a weekly slope of .53 for grade one, and in others it was higher; standard deviation of .38 for weekly slope of

.48 for grade six (Fuchs, Fuchs, Hamlett, Walz, & Germann, 1993). Fuchs et al. (1994) noted weekly slope values ranged from .25-.70 for CBM math progress monitoring. In grades two to four. These two studies indicate the CBM math is an adequate measure for monitoring students' progress and responsiveness to the intervention.

5.5.4.1.2 Curriculum-Based Measurement for Writing

The CBM writing measure is strong on three reliability measures: interscorer, test-retest, and alternate form (McMaster & Espin, 2007). Correlation coefficients for CBM total words written (TWW) and words spelled correctly (WSC) are greater than .90 for elementary school students (Marston, Deno, & Tindal, 1983; Tindal, Marston, & Deno, 1983; Tindal & Parker, 1991). Marsten and Deno (1981) found one week test-retest reliability coefficients for students with learning disabilties in grades one to six were .64-.91 for TWW and .62-.81 for WSC. Alternate form reliability coefficients for TWW and WSC range from .72 (Tindal, German, & Deno, 1983) to .96 (Marsten & Deno, 1981) for general education students in grades one to six. Coefficients for students with learning disabilities or low achievement were .51-.71 for TWW for students in grades one to five (Shinn, Ysseldyke, Deno, & Tindal, 1982) and .55-.85 for WSC for students in grades three to six (Fuchs, Deno, & Marston, 1982). Reliability of the CBM writing is weaker for students with learning disabilities or low achievement (Shinn, Ysseldyke, Deno, & Tindal, 1982) which is problematic for this study because students with FASD could be placed in either category. Caution should be used in interpreting CBM TWW and WCS scores for students with FASD, especially for small sample sizes, due to the increased variance.

Criterion validity research has found the CBM TWW and WSC measures to be moderately correlated with commercially available achievement tests (Deno, Mirkin, & Marston, 1980) and weakly correlated with teacher ratings or grades (Fewster & MacMillan, 2002; Parker, Tindal, & Hasbrouk, 1991). Deno, Mirkin, and Marston (1980) noted correlation with the Test of Written Language (Hammil & Larson, 1978) was .41-.82 for TWW and .45-.88 for WSC for students in grades three to six. Correlation with the Developmental Scoring System (Lee & Canter, 1971) was .65-.88 for TWW and .67-.84 for WSC for students in grades three to six. Fewster and MacMillan (2002) found correlation between grade six and Seven WSC scores and grade 8-10 English and social studies grades ranged from .16-.34 indicating weak predictive validity. Though criterion validity, including predictive validity, is moderate to weak, the CBM writing reliably differentiates students' grade level, whether they have a learning disability, and placement in special education, remedial, general, or honours classes (Fewster & MacMillan, 2002; Shinn, Ysseldyke, Deno, & Tindal, 1982). The moderate to weak criterion validity indicates there are facets of writing the CBM writing measure does not capture. No significant change in CBM TWW or WSC scores post-intervention could mean there was no effect or the intervention affected a facet of writing not captured by the CBM; therefore, though CBM TWW and WSC are adequate measures for this study the results must be interpreted with caution.

5.5.4.1.3 Curriculum-Based Measurement for Reading

Reliability of the CBM words read correctly (WRC) measure is strong. Wayman, Wallace, Wiley, Tichá, and Espin's (2007) literature review found studies reported test-retest and reliability to be greater than .90, alternate form reliability to be greater than or

equal to .80, and inter-rater agreement equal to .99. Hosp and Fuchs (2005) found test-retest reliability coefficient for WRC to be .92-.97 for general and special education students in grades one to four. Daly, Wright, Kelly, and Martens (1997) found the test-retest coefficient for general education grade one students to be .94. Alternate form reliability for general and special education students has been found to be .88-.98 for grades three to seven (Morgan & Bradley-Johnson, 1995) and .80-.91 for grades one to three (Hintze & Silberglitt, 2005). Regression modeling of WRC scores noted individual differences accounted for 42-62% of variance while grade or reading group accounted for 15-36% of variance (Hintze, Owen, Shapiro, & Daly, 2000; Hintze & Pelle Petitte, 2001). Percent variance due to individual difference is higher in the study with a smaller sample size; N=12 versus N=80 (Hintze, Owen, Shapiro, & Daly, 2000; Hintze & Pelle Petitte, 2001). These findings indicate that while reliability of the CBM WRC is strong, monitoring progress in small samples, i.e. fewer than 12 students, should be done with caution because improvement may be difficult to discern from individual differences in performance.

Extensive research has been done to assess the validity of the CBM WRC measure. Criterion validity studies comparing CBM WRC to commercially available achievement tests noted moderate to strong correlation coefficients. Coefficients of .71-.91 were found for the subscales of the Woodcock Reading Mastery Test-Revised (Woodcock, 1987) with general and special education students in grades one to four, .80-.91 for the Stanford Achievement Test (Gardner et al., 1982) with special education students in grades four to eight (Fuchs, Fuchs, & Maxwell, 1988), and .73-.93 for the Comprehensive Reading Assessment Battery with low achieving grade one students

(Fuchs, Fuchs, & Compton, 2004). The commercially available tests assessed a number of facets of reading including comprehension, word fluency, passage comprehension, and word identification indicating the CBM WRC is a strong, comprehensive measure of reading. Kranzler, Brownell, and Miller (1998) used regression analysis to examine the role of cognitive ability and speed and efficiency of cognitive processing on CBM WRC scores and found it accounted for only 11% of score variance. Since speed and efficiency of cognitive processing may be decreased in students with FASD (Burden, Jacobson, & Jacobson, 2005) this is an important consideration. Several studies have also noted that the CBM WRC is sensitive to weekly improvements in reading comprehension for general and special education and low achieving elementary school students (Hintze, Daly, & Shapiro, 1998; Hintze & Shapiro, 1997; Hintze, Shapiro, & Lutz, 1994; Powell-Smith & Bradley-Klug, 2001). The validity research on CBM WRC indicates it is a strong measure for assessing the reading comprehension of elementary school students, including those with FASD.

5.5.4.1.4 Summary

Research on the reliability and validity of the CBM indicates it is an adequate measure of academic skills for students with FASD; however, there are limitations to the reliability and validity arguments that need to be considered. All reliability and validity research, with the exception of Fewster and MacMillan's (2002) study, has been done with samples from the USA that are not representative of the national population of elementary school students (Foegen, Jiban, & Deno, 2007; McMaster & Espein, 2007; Wayman, Wallace, Wiley, Tichá, & Espin, 2007). Further, though it is likely that there were students with FASD included in some of the studies they were not identified or

analyzed as a separate group. The limited use of Canadian students, particularly those with FASD, means that there may be important influences on reliability and validity of the CBM that has not been addressed in prior research. For example, the heterogeneity of students with FASD may mean that, within that population, reliability of CBM measure is lower. Normative CBM scores are available for the school district in which our study takes place so percentile scores are representative of students' academic performance relative to their peers. Finally, small sample size, as in this study, means individual variance may mask improvement in academic performance or show improvement when there is none. Therefore, although the CBM is an adequate measure for this study, caution must be used in interpreting the results.

5.5.4.2 Behaviour

Behaviour was constructed as change in classroom behaviour and assessed using two different measures; the Teacher Rating Scale (TRS) and Portable Observation Program (POP) from the BASC-2 (Reynolds & Kamphaus, 2004). To be a reliable and valid measure of change in behaviour, the BASC-2 must be:

1. reliable so changes in test scores reflect changes in behaviour,
2. reflective of students' classroom behaviour,
3. sensitive to changes in students' classroom behaviour within a school year, and
4. an accurate assessment of the classroom behaviour of students with FASD in a major urban centre in northern BC.

5.5.4.2.1 BASC-2 TRS

The BASC-2 TRS (Reynolds & Kamphaus, 2004) was selected to measure classroom behaviour of students with FASD. The BASC-2 TRS focuses on positive and negative attributes of student behaviour and provides a thorough assessment of adaptive behaviour (Reynolds & Kamphaus, 2004). The BASC-2 TRS is a standardized tool found to be a reliable and valid measure of behaviour for students without FASD and an effective tool for progress monitoring (Reynolds & Kamphaus, 2004). The BASC and BASC-2 have been used in over 100 studies including evaluations of the Head Start Project in the USA (Reynolds & Kamphaus, 2004). The BASC-2 TRS has also been used to measure behaviour of a student with FASD in a case study examining the use of a tutoring intervention (Johnson & Lapadat, 2000). The BASC-2 student, teacher, and parent report forms were used to measure the student's self-esteem pre- and post-intervention. The student reported her self-esteem increased on the BASC-2 student form while her mother perceived that her daughter's self-esteem decreased on the BASC-2 parent report form. The authors reconciled the conflict by stating they believed the intervention was too short for the student's mother to perceive an increase in her daughter's self-esteem (Johnson & Lapadat, 2000). No other studies were located that used the BASC-2 for students with FASD.

Reliability of the BASC-2 TRS in USA samples without diagnosed FASD was high (Reynolds & Kamphaus, 2004). Correlation coefficients for internal consistency ranged from .88-.97 for the composite scales used in this study (Reynolds & Kamphaus, 2004). Test-retest correlation coefficients were .84-.94 for intervals of 8-65 days on the composite scales (Reynolds & Kamphaus, 2004). Inter-rater reliability was weak to

moderate (r=.45-.68) for the composite scales (Reynolds & Kamphaus, 2004). The low inter-rater reliability of the BASC-2 TRS has two implications for this study. First, it is important that the same teacher assess the behaviour of an individual student with FASD throughout the study to ensure changes in scores are due to a change in behaviour rather than a change in the teacher that completes the BASC-2 TRS. Second, the BASC-2 TRS is sensitive to different perceptions of behaviour. This means a change in BASC-2 TRS scores in this study could be due to a change in teachers' perceptions of a student's behaviour rather than a change in the student's behaviour.

Validity of the BASC-2 TRS has been examined using factor analysis (construct validity), correlations with other instruments (criterion-related validity), and the score profiles of selected clinical groups (differential validity). Factor loading correlations for the Externalizing Problems and School Problems composites scales has been high (.74-.91) while the correlations range from .41 to .85 for the Internalizing Problems composite and .93-.90 for the Adaptive Skills composite indicating construct validity of the composite scales is variable (Reynolds & Kamphaus, 2004).

Criterion-related validity has been high as the correlations between the composites scales from the Achenbach System of Empirically-Based Assessment Teacher Report Form and the BASC-2 TRS for internalizing behaviour, externalizing behaviour, and total problem behaviour ranged from .74-.80 (Tan, 2007). Achenbach's (2001) CBCL has been used in several studies of children with FASD (Coles, Kable, & Taddeo, 2009; Dixon, Kurtz, & Chin, 2008; Franklin, Jirikowitz, & Astley, 2008). The BASC-2 TRS can differentiate between the following clinical groups; attention-deficit/ hyperactivity disorder, bipolar disorder, depression disorders, emotional/behavioural

disturbance, hearing impairment, learning disability, mental retardation or developmental delay, motor impairment, pervasive developmental disorders, and speech or language disorder (Tan, 2007). These findings indicate the BASC-2 TRS can provide a reliable measure of classroom behaviour.

BASC-2 reliability and validity research has been undertaken with USA samples that do not include students diagnosed with FASD. Results indicate the BASC-2 TRS is an adequate measure to assess change in behaviour; however, results should be interpreted with caution as percentile scores rank northern BC students with FASD against USA students without FASD.

5.5.4.2.2 BASC-2 POP

The BASC-2 Portable Observation Program (POP) is a computerized version of the Student Observation System (SOS) (Reynolds & Kamphaus, 2004) used to assess changes in classroom behaviour of students affected by FASD. Several different classroom observation forms exist within the literature but the BASC-2 POP was the preferred instrument for this study because it is standardized, complements information obtained with the BASC-2 TRS, and assesses both negative and positive behaviours in the classroom. While BASC-2 TRS scores may be influenced by a change in teachers' perceptions of classroom behaviour, the BASC-2 POP is independent of teachers' perceptions.

The BASC-2 POP uses a momentary time sampling procedure over a 15 minute time span in the classroom (Reynolds & Kamphaus, 2004). A single study reported the inter-observer reliability in a non-FASD sample of elementary schools to be greater than .80 (Reynolds & Kamphaus, 2004); other studies did not report on the reliability of the

measure. Lett & Kamphaus (1997) found the BASC SOS consistently differentiated students who had no known disability, ADHD diagnosis, or ADHD and comorbid diagnosis with 73% accuracy. The BASC-2 POP has been used by the school district in which this study took place to assess classroom behaviour of students with FASD but inter-observer reliability has not been assessed. Prior to use in this study, the inter-observer reliability was determined. After completing eight hours of training, the Doctoral student and research assistant achieved inter-observer reliability greater than .80 for this study. Observations were recorded independently and simultaneously throughout the study. The research assistant in this study was blind to experimental group assignment; however, after observing classroom behaviour of students with FASD mid-intervention she determined group membership with 100% accuracy.

5.6 Statistical Analysis

The statistical analysis had two goals, first, to determine if the intervention and comparison groups were equivalent pre-intervention and, second, to determine if the intervention was associated with changes in academic scores of students without FASD or behaviour and academic scores of students with FASD.

The t-test and Friedman Test were used for the statistical analysis, although there are important limitations to the interpretation of the findings. The sample size of students with FASD was small (n = 13) limiting the power to detect significant effect size changes for behaviour and academic measures. A non-random convenience sample was used which violates the random sample assumption.

The t-test for dependent samples was used to compare intervention and comparison group means pre-intervention for age, executive function, behaviour, and

academic scores for students with FASD. Academic score group means were also compared pre-intervention for students without FASD. The sample means in the two groups are neither normally distributed nor are the group variances equal. Fortunately, the t-test is robust for violations of the assumptions of normality and homogeneity of variance (Glass & Hopkins, 1996). The null hypothesis was that the group means were equal while the alternative hypothesis stated that they are not.

The Friedman Test was used to measure change pre-, mid-, and post-intervention for behaviour and academic scores of students with FASD and for academic scores for students without FASD. This test was chosen because it can measure change over time in a small, nonparametric sample (Pett, 1997). As already discussed, the data violated the random sample assumption; however, it did meet the other two assumptions of the Friedman Test. The data was continuous and, within the groups, subjects were independent. The Friedman Test ranks the test scores for each data collection time then determines whether the variables are part of the same continuous distribution. The null hypothesis was that there was no difference in median test scores between the data collection times. The alternative hypothesis was that there was a difference but the Friedman Test does not indicate which median score is different, how many are different, or the direction of the change. The Friedman Test cannot do between group comparisons so the intervention and comparison groups were analyzed separately to determine if there was a significant difference in median test scores. Post-hoc analysis with Siegel and Castellan's (1988) formula (see Figure 6) determined which median test scores were significantly different. Graphical display of significant test scores indicated the direction of change.

$$\left|\overline{R_1} - \overline{R_2}\right| \geq z_{\frac{\alpha}{k(k-1)}} \sqrt{\frac{k(k+1)}{6N}} \quad \text{where,}$$

$\overline{R_1}$ = mean rank for time 1

$\overline{R_2}$ = mean rank for time 2

$z_{\frac{\alpha}{k(k-1)}}$ = critical z value for $\alpha^1 = \frac{\alpha}{k(k-1)}$

k = number of time periods

N = number of cases

Figure 6: Formula for post-hoc analysis of Friedman Test (Siegal & Castellan, 1998).

Analysis was done with SPSS version 18.0. In all analyses, children with missing data were excluded.

5.7 Cost Comparison

A cost comparison was done with two alternative options used by BC school districts. The two other often used alternatives were:

1. one time two day workshop on teaching students with FASD, and
2. a segregated classroom with one teacher for every 12 students with FASD.

The effectiveness of a one time workshop or segregated classroom has not been determined; therefore, intervention effectiveness cannot be included in the cost comparison. TAs were used by teachers in the intervention group and the two options listed above so they were not included as a separate option. Estimates were based on costs for implementation within School District No. 57. Salary for staff needed to implement any of the options was based on the highest salaries paid within the district in 2009. Travel and accommodation costs estimated for bringing personnel not available

within the school district were based on travel from Vancouver, BC. Mileage costs were based on the 2009 rate for the school district and distance to rural schools within the school district. Cost for printing and supplies were based on obtaining materials within the school district.

6.0 Results

This chapter summarizes the sample characteristics before reporting results from the qualitative then quantitative methods.

6.1 Sample Characteristics

Seven schools, seven principals, 12 teachers, nine caregivers, 13 students with FASD, and 119 students without FASD were recruited for the study. One teacher in the intervention group had two students in her classroom. Three caregivers had more than one student with FASD in the study. One caregiver had two students in the control group, another had two in the intervention group, and the third had one in the control group and two in the intervention group. All teachers and caregivers of students with FASD were invited to complete a semi-structured interview with the doctoral student and all teachers and seven caregivers did so. Two of the seven principals fit the inclusion criteria for the qualitative descriptive methods and both completed the semi-structured interview with the doctoral student.

6.1.1 Schools

Participating units included a mix of community (n = 3) and non-community schools (n = 4). Initially, 12 schools (9 community schools and 5 non-community schools) were recruited but five community schools were later excluded because they had no students diagnosed with FASD enrolled in the study. The school district defined a community school as one with a majority of students vulnerable to poverty. These schools received more funding than other schools within the district. Additional funding was used to purchase resources, such as a breakfast program, clothing exchange, and money to buy school supplies for students.

6.1.2 Principals

All of the principals approached through the school or paediatrician recruitment strategies consented to have the study take place in their school (n = 12). Five of those principals were later excluded because no students with FASD were enrolled in the study at their school (n = 4) or a teacher refused to participate (n = 1); therefore, seven principals consented to the study taking place in their school. All of the principals were Caucasian and five of the seven were female. Two of the male principals were in the comparison group and the third was in the intervention group. Distribution of intervention and control classrooms between the seven principals was as follows:

1. two control classrooms,
2. two intervention classrooms and one control classroom,
3. one control classroom,
4. one control classroom,
5. one intervention and one control classroom,
6. two intervention classrooms, and
7. one intervention classroom.

Two of the four principals that had the intervention in their school were interviewed one year after the intervention ended regarding sustainability of the intervention. The other principals were not interviewed because they had changed schools at the end of the intervention and were unable to comment on its sustainability.

6.1.3 Teachers

Twelve teachers, all Caucasian females, participated in the study. Years of teaching experience ranged from 15 to 32 with a mean of 22 years. Participation rate of

teachers approached through the paediatrician recruitment strategy was 57% (4 of 7 teachers) and when recruitment was conducted through the school, at least two teachers from each school agreed to participate. A participation rate for teachers recruited through the school strategy cannot be calculated because teachers may have wanted to participate but could not because they knew they would not have any students diagnosed with FASD in their class in the following school year. Common concerns expressed by teachers when approached through either recruitment strategy were: 1) who would implement the professional development program and 2) whether they would be required to change the physical environment of their classroom. Teachers were inclined to participate when informed the POPFASD staff would implement the professional development program and changes to the physical layout of their classroom were voluntary.

Two teachers taught intermediate level classrooms while the rest were primary class teachers. Principals described the participating teachers as innovators in the classroom. One principal described a teacher in the intervention group by stating: "she is one of those exemplary teachers that's really good with every child and is always good at figuring out things and making it work for them."

The three teachers that refused to participate through the paediatrician recruitment strategy were also female with at least 10 years teaching experience. The reasons they gave for refusal to participate were lack of interest and being busy with other initiatives in the classroom, such as supervising a student teacher.

All of the teachers were invited to participate in the qualitative description component and all did so.

One teacher in the comparison group was lost to follow up at pre-intervention when she became ill.

6.1.4 Caregivers

Nine adults were identified as caregivers for the 13 students enrolled in the study. One caregiver refused to participate in the interview yielding a participation rate of 89%. The caregivers' relationships with the students with FASD were: foster parents (n = 5), stepparent (n = 1), and grandparents (n = 3). All but one was female. Birth mother, father or both had varying degrees of involvement in the lives of the students in foster care. Involvement ranged from partial custody to visitation; however, in all cases BC MCFD was the legal guardian and the foster parent was the primary caregiver.

One caregiver was lost to follow up mid-intervention when she, and her two children, moved to a new school district.

6.1.5 Students with FASD

Two recruitment strategies yielded 22 students with FASD of which 13 were eligible to participate (see Figure 7). Nine students were excluded for a variety of reasons. Five students were excluded because their school was testing a different intervention for students suspected of having FASD and that intervention had the potential to compromise results of the study. Three students with FASD were excluded because their teachers refused to participate. One student was enrolled in the study prior to confirmation of FASD by a paediatrician and later excluded when there was confirmation the student did not have the disorder. Response rate for students with FASD can only be obtained for recruitment through the paediatrician because number of students with FASD amongst those invited to participate through the schools was

unknown. Of the 30 letters mailed by the paediatrician's office 12 were returned for a response rate of 40%.

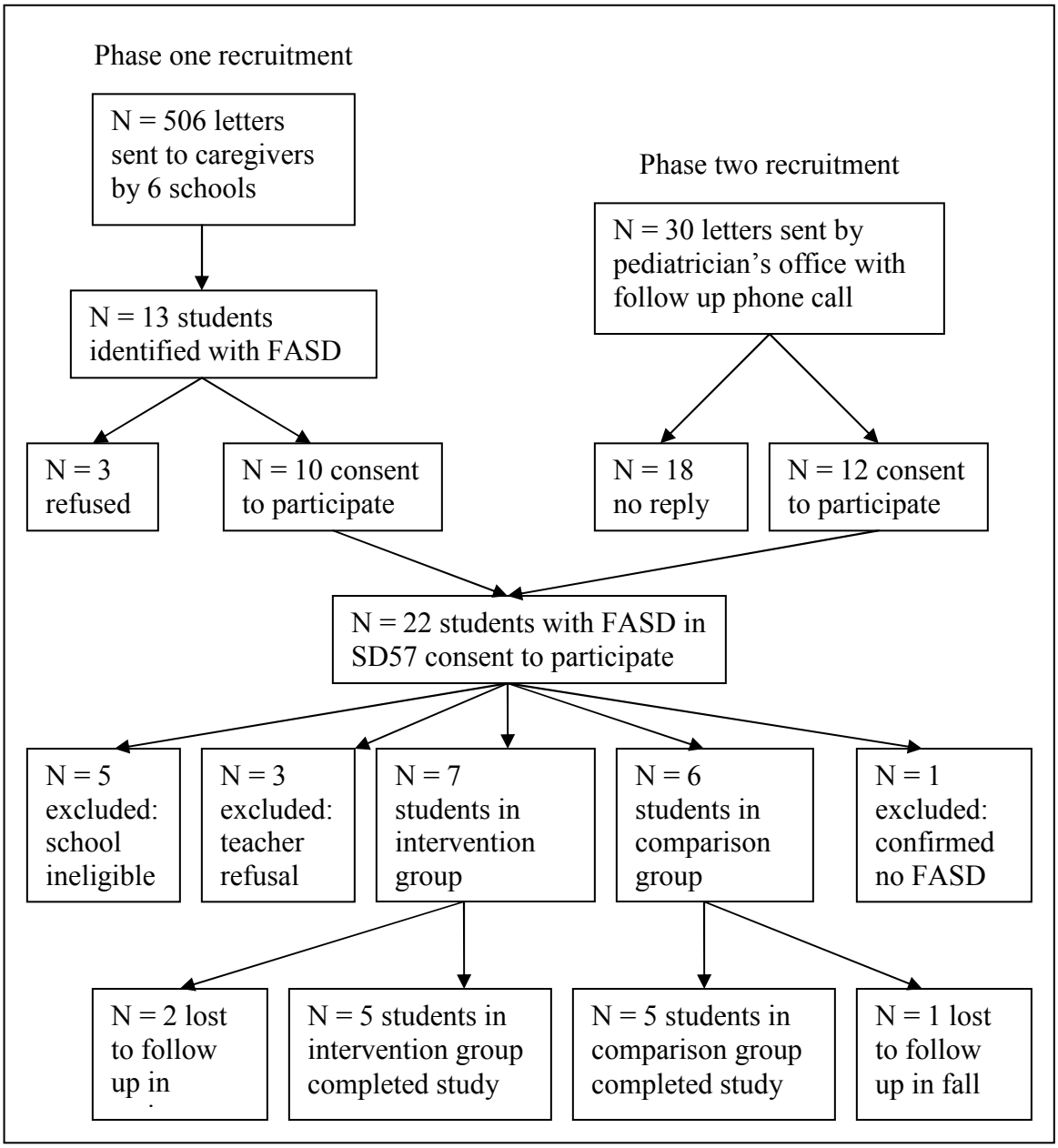

Figure 7: Flow chart for students with FASD recruited, excluded, and lost to follow up.

Two students in the intervention group were lost to follow-up because their family moved to a different school district. One student in the comparison group was lost to follow-up when his teacher became ill early in the school year and was replaced by a

succession of teachers on call. The mean age (7.8 years), gender (67% male), and ethnicity (89% Aboriginal) of nine excluded students were not statistically significantly different from the 13 students allocated to the intervention and comparison groups (age t = .51, p = .62, df = 20; gender t = -.22, p = .83, df = 20; ethnicity t = -1.53, p = .14, df = 20). For those students lost to follow up or excluded from the intervention group, informal reports of students' behaviour were similar to other students in the group; loud and disruptive or quiet and unfocused.

All participants were diagnosed with FAS by a paediatrician, family physician, or the CDBC assessment team. Mean age was 7.9 years. Sixty-two percent of the students (intervention and comparison groups) were Aboriginal (n = 8) and the remainder were Caucasian (n = 5). Sixty-nine percent were in foster care while the remainder lived with their biological families. Males comprised 77% of the sample; five in the intervention group and five in the comparison group. Fifty-four percent of participants experienced a major change in their home environments during the study; six in the intervention group and one in the comparison group. Changes included increased or new visits with a birth parent, changing foster homes, or preparing to move. Change occurred in the winter for two siblings, one from each experimental group, while change occurred in early spring for the rest of the students (n = 5).

Students had a number of strengths according to their caregivers and teachers. Some skills were academic in nature, such as reading above grade level and being able to multitask. Other strengths included being the top athlete in the class, drawing, colouring, singing, dancing, and being very forgiving (see Table 6).

Table 6: Strengths of students with FASD in intervention group as recorded on LEIC form

Student	Strengths
1	Reads well, good at gym activities, math facts, creative, artistic, and LEGO
2	Social, pleasant personality, does well one-on-one, computer, artistic, good long term memory, and puzzles
3	Strong reader, excellent fine motor skills, able to multi-task, very verbal, happy and enthusiastic, and puzzles
4	Polite, friendly, gross motor skills, colouring, and manners
5	Artistic, good imagination, puppets (gives shows at home), building with blocks, memory and awareness of changes, and eager to please
6	Athletic, math computation, outgoing, good handwriting, football, hockey, enjoys school, and strong sense of fairness
7	Friendly, "creative" stories, cleaning, technology, and curious

Intervention and comparison groups were not equivalent pre-intervention (see Table 7). High percentile scores on the BRIEF indicated significant executive dysfunction across all domains for the intervention and comparison groups. The intervention group had significantly higher mean percentile scores on the Inhibit ($v = 10$, $t = 2.22$, p = .05), Monitor ($v = 10$, $t = 2.43$, p = .07), Metacognition ($v = 10$, $t = 2.32$, p = .07) and Behavioral Recognition Index ($v = 10$, $t = 1.96$, p = .08) scales. The intervention group had two girls while the comparison group had one. Sample size was not sufficient to match for elementary school or psychotropic medications.

Table 7: Pre-intervention group differences for age and executive functions using the *t*-test

Independent variable	Intervention *u* (SD) N = 7	Comparison *u* (SD) N = 5	*t*-test statistic *v* = 10	Two-tailed p
Age	7.43 (.79)	8.80 (1.64)	-1.73[a]	.14
BRIEF				
Inhibit Percentile	87.43 (18.86)	67.40 (14.77)	2.22	.05[**]
Shift Percentile	81.71 (8.94)	64.60 (26.47)	1.39 [a]	.23
Monitor Percentile	93.86 (5.34)	69.80 (21.71)	2.43 [a]	.07[*]
Global Executive Function Percentile	89.43 (7.57)	81.40 (9.91)	1.60	.14
Metacognition Index Percentile	93.00 (2.65)	85.40 (6.99)	2.32 [a]	.07[*]
Organization of Materials Percentile	79.71 (7.74)	80.60 (12.01)	-.15 [a]	.89
Working Memory Percentile	90.71 (9.41)	89.40 (5.32)	.28	.79
Plan Organize Percentile	89.57 (10.42)	89.00 (7.04)	.11	.92
Initiate Percentile	92.00 (5.86)	88.80 (5.07)	.98	.35
Behavioral Recognition Index	84.43 (13.73)	65.60 (19.72)	1.96	.08[*]
Emotional Control Percentile	78.43 (16.82)	67.00 (17.85)	1.13	.28

[a]Equal variances not assumed
[*]significant at α=.10, [**]significant at α=.05
Notes. Data not available for male student lost to follow up from the comparison group. BRIEF = Behavior Rating Inventory for Executive Function (Gioia, Isquith, Guy, & Kenworthy, 2000).

After the study was initiated, the equivalence of classroom behaviour between the intervention and comparison groups was affected by two events. One of the comparison group students with FASD who was described as highly disruptive was lost to follow-up when his teacher became ill. The teacher became ill before the pre-intervention measures were completed so she was unable to provide a quantitative assessment of his behaviour with the BASC-2 TRS. The teacher was replaced with a succession of on call teachers

who were not in the classroom long enough to complete a BASC-2 TRS for the student. The other student who was considered disruptive in the comparison group spent approximately 80% of his school week outside of the regular classroom, which, according to his teacher, decreased his disruptive behaviour during the time he was in the regular classroom. This student began spending most of his time outside of the regular classroom during the first week of the school year; therefore, his teacher was unable to accurately recall his initial behaviour when the pre-intervention measures were conducted in October. As a result, it is not possible to determine how much these two events affected the mean percentile scores for the comparison group on the BASC-2 TRS composite scales; however, it is likely that there was a decrease in disruptive behaviour.

Pre-intervention, there were three outcome measures significantly different between the intervention and comparison group students. Students in the intervention group had higher scores on the Percent Observed Problem Behaviour ($v = 10$, $t = 2.17$, $p = .06$) on the BASC-2 POP and higher percentile scores on the Behavioural Symptoms Index ($v = 10$, $t = 2.09$, $p = .10$) and Externalizing Problems ($v = 10$, $t = 3.57$, $p = .01$) on the BASC-2 TRS indicating greater problem behaviour in the classroom (see Table 8).

Table 8: Differences in classroom behavioural and academic scores of students with FASD pre-intervention using *t*-test

Dependent variable	Intervention *u* (SD) N = 7[a]	Comparison *u* (SD) N = 5	Degrees of freedom (*v*) [a]	*t*-test statistic	Two-tailed p
BASC-2 POP					
Percent Observed Problem Behavior	52.94 (18.60)	32.63 (10.86)	10	2.17	.06*
BASC-2 TRS Percentile Scores					
Behavioral Symptoms Index	91.29 (5.56)	73.40 (18.58)	10	2.09[b]	.10*
Adaptive Skills	6.43 (3.60)	16.20 (10.92)	10	-1.93[b]	.11
Externalizing Problems	85.43 (14.51)	47.00 (23.05)	10	3.57	.01***
Internalizing Problems	43.57 (23.68)	59.60 (24.43)	10	-1.14	.28
School Problems	90.57 (7.79)	84.20 (14.36)	10	.90[b]	.40
CBM Percentile Scores					
Words Read Correctly	49.00 (28.97)	24.20 (19.91)	8	1.58	.15
Total Words Written	38.13 (37.16)	19.20 (24.47)	7	.88[b]	.42
Words Spelled Correctly	38.38 (39.55)	24.20 (28.98)	7	.62	.55
Math	57.13 (40.23)	38.13 (24.18)	6	.81	.45

[a]two students in the intervention group refused to complete CBM reading, three students in the intervention group refused to complete CBM writing, and three students in the intervention group and one in the comparison group refused to complete CBM math

[b]Equal variances not assumed

*significant at α=.10, ***significant at α=.01

Notes. Data not available for student lost to follow up in the fall. BASC-2 POP = Behavior Assessment System for Children 2nd Ed. Portable Observation Program (Reynolds & Kamphaus, 2004); BASC-2 TRS = Behavior Assessment System for Children 2nd Ed. Teacher Rating Scale (Reynolds & Kamphaus, 2004); CBM = Curriculum Based Measurement (Fewster & MacMillan, 2002).

6.1.6 Students without FASD

One hundred and nineteen students without FASD participated in the study. Sixty-one percent of the students were female and mean age of the sample was eight years (range of 6 - 12 years). Participation for each of the classrooms in the study ranged from 25-79% with a mean of 59% for students without FASD in participating classrooms.

The percentage of students without FASD in each classroom ranged from 83% to 96% with a mean of 93%. No data were collected on why families refused consent for their children. There were two statistically significant differences between the intervention and comparison group at pre-intervention for the outcome measures (see Table 9). The intervention group had significantly higher percentile scores for Total Words Written (v = 97, t = -3.48, p = .00) and Words Spelled Correctly (v = 97, t = -3.14, p = .00).

Table 9: Experimental group differences in academic percentile scores of students without FASD pre-intervention using the *t*-test

Dependent variable in percentile scores	Intervention u (SD)	Comparison u (SD)	Degrees of freedom (v)	*t*-test statistic	Two-tailed p
Words read correctly	56.84 (25.09)	50.28 (22.73)	88	-1.28	.21
Writing: total words written	59.07 (29.05)	38.67 (27.88)	97	-3.48	.00***
Writing: words spelled correctly	60.49 (29.17)	41.80 (28.53)	97	-3.14	.00***
Math	54.10 (33.81)	51.11 (28.30)	89.14	-.49[a]	.62

[a] Equal variances not assumed
***significant at α=.01

6.1.7 Summary

Pre-intervention, intervention and comparison groups were non-equivalent for students with and without FASD. For students with FASD, the intervention group had higher scores on measures of disruptive classroom behaviour. For students without FASD, the intervention group had higher writing percentile scores. Teachers in the two groups were similar for gender, ethnicity, and years of experience. Only gender was collected for principals. Gender proportion of principals was similar for the intervention and comparison groups.

6.2 Intervention Implementation Fidelity

Examination of workshop materials, principal and teacher interview transcripts, and mentorship journals indicated the intervention was implemented as planned. One instance of comparison group contamination was found.

Fidelity of the intervention workshops was acceptable. Observation of the workshops and review of schedules, power point presentations, and handouts confirmed they were implemented as planned. There was no change in the duration of the workshops. Quality of the workshop delivery was also acceptable because the workshops were interactive and adhered to the Neurobehavioral Approach. The presentations provided details on neurocognitive impairments associated with FASD and encouraged discussion on how those impairments could present as disruptive behaviour in the classroom. Case studies of students with FASD were examined to illustrate the range of strengths, impairments, and behaviour that could be expected. The two day workshop ended with teachers applying the Neurobehavioral Approach to their own students with FASD through working on the KLN and LEIC forms. Later in the year, each of the four half-day workshops ended with teachers applying new information they had learned to update their LEIC forms. The half-day workshops occurred five, six, seven, and eight months into the school year. Teachers' completion of workshop materials and participation in the group discussions indicated participant responsiveness during the workshops was high. Examples of accommodations planned by teachers during the workshops are listed in Table 10.

Table 10: Accommodations planned by teachers in the intervention group using the LEIC page

Environment	Instruction	Curriculum
Physical layout of classroom, e.g., desk placement, visual reminders	Extra time	Adapt quantity of work to student's ability
How student is approached	Hands on options	Limit homework
Clear boundaries/expectations	Chunking	Social skills components
Quiet time space	Check ins	Use alternate ways to demonstrate learning
Gadgets to decrease sensory stimuli, e.g., earphones, hooded sweater, hat	Showcase strengths	Life skills components
Recognize behaviour indicative of over stimulation and provide low stimulation task, e.g. errand	Lots of positive reinforcement	Language skills
	Demonstrate instructions	Encourage independence
	Repeat directions	
	Prepare students for transitions	

Accommodations were introduced gradually to give teachers an opportunity to adjust them as needed. The LEIC page became a reference for teachers and mentors to document progress on implementation of accommodations and included notes on which accommodations did and did not work. None of the comparison group teachers reported attending any professional development workshops on FASD indicating there was program differentiation between the intervention and comparison group.

The mentorship component proceeded as planned with some adjustments during the Christmas holidays and spring. Extra time was spent with some teachers from the intervention group around the Christmas holidays when they requested help changing the physical layout of the classroom. The intention was to reduce the visits to bi-weekly and

less in the spring; however, this was not possible when most of the students in the intervention group experienced a major change in their home environments in the late winter or early spring. The mentors maintained weekly visits to assist the teachers in coping with increased disruptive behaviour.

6.2.1 Contamination of Comparison Group

Transcripts of interviews with teachers and principals were examined to determine whether teachers in the comparison group were exposed to the intervention. Teachers in the intervention group could have shared what they learned with teachers in the comparison group through formal and informal meetings within their school and district. TAs are paid for the number of hours they spend working with students and do not typically receive paid preparation time so they were unlikely to participate in meetings where they could share strategies with teachers they do not work with in the classroom. Since no TA was shared between the intervention and comparison groups it is unlikely that contamination occurred via the TAs.

Only one instance was found of possible comparison group contamination. A teacher in the intervention group had a student with FASD from the comparison group in her classroom in the previous year and was asked to give the teacher in the comparison group suggestions about strategies she had used to manage the student's disruptive classroom behaviour. Asking previous teachers for suggestions is a resource typically used within schools so the teacher in the intervention group did provide suggestions. The teacher in the comparison group was not given a copy of the LEIC or KLN forms or provided the intensity of mentorship available through the intervention. The teacher in the comparison group neither discussed looking for neurocognitive explanations for

disruptive classroom behaviour in her interview nor did she describe the range of environmental accommodations teachers in the intervention group discussed. The student's percent of problem behaviour observed in the classroom using the BASC-2 POP increased during the year although the increase might have been due to the student's transition from a foster home to live with a biological parent.

The intervention implementation occurred as planned with the comparison group appearing minimally contaminated by exposure to the intervention. The materials used by the mentor and teachers during the workshops and mentorship process adhered to the Neurobehavioral Approach. Teachers worked with the mentors and their peers to develop accommodations appropriate for their teaching style and the unique needs of their students with FASD. The mentor's notes and teachers' responses during the Classroom Strategies interview indicated teachers' engagement in the mentorship process was high. Teachers in the comparison group did not report receiving any form of mentorship during the year indicating program differentiation between intervention and comparison groups.

6.3 Qualitative Findings

This section includes themes developed from interviews with teachers, principals, and caregivers of students with FASD. The goal was to determine how principals, teachers, and caregivers believed the professional development program affected the school experience of students with FASD.

6.3.1 Themes from Teachers' Interviews

Twelve teachers completed a post-intervention interview and three were interviewed again one year post-intervention. Interviews were an hour to an hour and a half in length

and took place in a quiet room at the schools. Seven themes emerged from analysis of the interviews with teachers. Those themes were:

1) importance of the structure, content, and process of the professional development program,
2) perceptions of classroom behaviour,
3) strategies for students with FASD,
4) using communication to improve school experience,
5) carryover and sustainability of intervention,
6) effect of change in caregiver or geography on students, and
7) challenges to intervention implementation

This section describes the themes in detail.

6.3.1.1 Importance of the Structure, Content, and Process of the Professional Development Program

Teachers in the intervention group spoke highly of the professional development program and the impact it had on their teaching practice. All components of the training including the structure, content, and process were regarded as having made important contributions to teachers' learning. One teacher in the intervention group stated that, although she had 30 years of teaching experience, the training really improved her professional knowledge. She added:

> I've never come away from any session and gone "Oh God, I wish I had just been in my room working." Like, every time I learned new things that I can incorporate and even just raising the level of understanding.

Another teacher in the intervention group stated that there was nothing in the training that could be left out; all of it played a role in changing her teaching practice.

The teachers indicated the content of the initial two day workshop and subsequent monthly meetings provided them with information that was immediately applicable in their classrooms. The interactive process provided opportunities to work through the material and examine how it applied to their students. Every workshop included time for the teachers to engage in a critical discussion of the material and how it applied to the students with FASD in their classrooms. One teacher in the intervention group said, "I found the monthly meetings were really valuable, especially the sharing between teachers. The ideas, what we can do to modify the programs, and what we can do to assist these children." Another teacher stated:

> The initial training there was a lot of information that was useful immediately…It was really nice to work with all of the different teachers who were working with the same issues and to see what was going on in their rooms. It was very supportive.

In talking about the value of the initial two day workshop, a teacher in the intervention group stated:

> Because it was two days we had time to work through the file. So, it was a lot of learning that you could apply to any child and that [file review] was very specific to the target child and you had class time to do that. That was a huge bonus and I would never change that.

Having time to plan and discuss accommodations that were immediately applicable in their classrooms was important to teachers.

Because part of the initial two day workshop was reviewing student files and using the material to complete the LEIC page (see Appendix B) the teachers had a summary profile of the student and a concrete list of accommodations to try. Teachers valued the usefulness of the LEIC tool for providing direction to the accommodation

planning process. One teacher in the intervention group described the value of completing the LEIC tool:

> What I've found in the files was very useful in terms of background but they didn't give a lot of really useful things that would work down on the ground on a day-to-day basis in the classroom. That was when I was helped by the resource binder and things. Going through and just having the LEIC page the way it was set out was good because I wouldn't have thought of all those things to include and really trying to build on strengths.

The teachers indicated the mentoring process played a significant role in the intervention by providing teachers with credible, positive support throughout the year. Credibility of the mentors was based on their teaching reputation in the school district and their knowledge of FASD. One of the teachers noted: "[Mentor] coming by was really helpful because he had good suggestions and was really supportive and not critical." The accessibility of the mentors was also valued by teachers who felt like they could contact them at any time through e-mail or phone. Visits by mentors to the classroom gave teachers the opportunity to work directly with a mentor to adjust accommodations to fit the complex classroom environment.

The year long structure of the intervention was discussed by all teachers in the intervention group. Holding the initial two day workshop in October gave teachers an opportunity to get to know students so they could complete the LEIC page. Spreading the four half day workshops over the year kept the training at the top of their priority list in the classroom by encouraging teachers to keep trying new accommodations and make adjustments to existing accommodations. As one teacher stated:

> I think that was very effective [spread over year]. Rather than trying to fit it all into the fall and then you're kind of left on your own for three to four months and then you might be floundering or falling back or forgetting this or forgetting that.

Teachers in the intervention group felt that fitting all of the material into a single training event would have been overwhelming and decreased the amount of information they remembered and incorporated into their teaching practice.

6.3.1.2 Perceptions of Classroom Behaviour

This theme is about teachers' perceptions of the behaviour of students with FASD in the intervention group and how they believed their perceptions changed through participation in the intervention. Teachers in the intervention group felt the professional development training changed their view about what constituted typical behaviour for a student with FASD. Rather than expecting highly disruptive, oppositional behaviour, teachers anticipated behaviour would range from quiet and inattentive to loud and disruptive. As described below, they also felt there was a change in what they perceived to be the motivation for the behaviour.

Post-intervention, teachers indicated behaviour of students with FASD ranged from disruptive and loud with poor impulse control to relatively quiet but unfocused. Teachers in the intervention group noted students with FASD were not always those with the most disruptive behaviour. They were; however, easily drawn into disruptive behaviour started by other students. One teacher in the intervention group commented,

> They see one [student] doing that then it's, well, how come not me? Why can't I just get up and leave or tear up my work or whatever with no consequences? It's been hard for D and he's often over at that child's desk now.

In the intervention group, there was recognition that there was no typical behaviour profile for FASD. A teacher in the intervention group commented on the heterogeneity of the behaviour when she said:

> There are three children and they are really different even though they have the same diagnosis so that really helped because you tend to think, oh well, I would

> have thought the student I had last year was typical of fetal alcohol but he's not, he's one of the children with that challenge and all four that I've worked with now have totally different kinds of things.

Teachers in the intervention group indicated they valued the understanding they gained for why a student with FASD may be unfocused or disruptive in class and how that understanding helped them deal with the behaviour differently. The training reminded the teachers to look at each student individually and consider why the behaviour was happening. Teachers repeatedly referred to the increased understanding, compassion, and empathy they felt for students that allowed them to respond to students' behaviour in ways more supportive to the students. For example, one teacher in the intervention group stated:

> It really gave me an understanding and more compassion. I remember when S first came into the classroom, I can't remember what happened, he wasn't listening and I was getting very firm with him and he just huddled up and went like this [mimes curling into a ball]. I just thought he was being a jerk, you know, "now turn around and take your fingers out of your ears" and that sort of thing but he was trying. Now we understand that so we leave it. So in that way it was extremely helpful.

Another teacher in the intervention group noted, "It made me change the way I was looking at that child and their behaviours. It just shed a totally different light." As one teacher in the intervention group described, "It reminded me to slow down, think about the child, be patient, and realize that he can't help it." Understanding why students with FASD behaved as they did and having empathy for the struggle the students had while doing their school work helped the teachers make accommodations for the students.

6.3.1.3 Strategies for Students with FASD

The intervention provided teachers with skills and knowledge so they could examine the strengths and challenges of a student with FASD and develop appropriate

strategies to accommodate his or her difficulties through changes to his or her environment, instruction, and curriculum. After completing the intervention, teachers in the intervention group reported they used more accommodations and a greater variety of strategies. In contrast, teachers in the comparison group described lack of direction in deciding what accommodations to try and identifying potentially useful accommodations only in hindsight. Teachers in the intervention group did not describe those experiences.

Strategies that were frequently cited by teachers in the intervention and comparison groups included class placement, redirecting students' focus, adapting a task to a students' skill level, and making use of TA support. When asked what strategies were most successful a teacher in the comparison group replied, "Seating. Having him close to me or close to the front so I can easily, without causing too much disruption, tap him on his shoulder or ask a direct question." A teacher in the intervention group identified alternative testing as a successful strategy when she said, "He was relatively neat but his written output was poor so we got a TA to come in for tests to administer them orally."

The wider range of accommodations identified by teachers in the intervention group included daily, detailed communication of behaviour to caregivers, picture simulations, social skills modeling, visual reminders, altering the physical layout of the classroom, and reducing sensory stimulation. The accommodations were developed at the beginning of the intervention with the LEIC tool and refined as the school year progressed. Many of the accommodations were implemented for the entire class so the student with FASD was not singled out. This was important to ensure the student with FASD did not feel they were different from the other students. For example, one teacher

in the intervention group used headphones to reduce aural stimulation and a rolling chalkboard to limit visual stimulation. Enough headphones were available for up to half the class to use at any given time. The rolling chalkboard changed positions during the week so it was not always near the student with FASD. Another teacher in the intervention group gave all her students a paper stoplight they could use to indicate their progression in a lesson or test. This allowed students, such as the one with FASD, who had slower information processing to indicate they needed more time without announcing it to the whole class.

Changes to the physical layout of the classrooms were made to reduce clutter in them and visual stimulation. Students with FASD can be easily distracted in the classroom so reducing visual stimuli, in the form of objects sitting around and displayed on the walls, improved students' ability to focus on school work. One teacher in the intervention group commented, "I'm the queen of clutter… all the physical stuff I've tried to keep that at the back of the room so everything that they're focused on is minimal." Another teacher in the intervention group described changes to desk placement to limit exposure to visual stimulation, "Now she's sitting towards the front with less stimulation around her and that has made a huge difference in her attention."

Teachers in the comparison group, but not the intervention group, identified gaps in their planning processes for students with FASD. Teachers in the intervention group planned accommodations for students with FASD based on their strengths. In contrast, teachers in the comparison group did not engage in that planning process. One teacher in the comparison group identified, in hindsight, accommodations that would have helped her student. She stated:

> I guess that would be another one, finding different ways she could show her work and her understanding. Her drawing is so phenomenal and she can show her learning and comprehension through that so making adaptations to what kind of work you're expecting from her would probably help.

Another teacher in the comparison group indicated a limited understanding of FASD hampered developing accommodations for a student with FASD in her class. The teacher stated:

> I guess I feel that there needs to be more education for teachers. Like myself, I don't know that much in terms of FASD and what the best strategies to use with kids are…It seems like we're always challenged with knowing which the best direction to take with him was.

Teachers in the intervention group did not identify this challenge in their interviews.

Teachers in the intervention and comparison groups appeared to use their TA resources differently. Three teachers in the comparison group used their TA resources to remove students with FASD from the classroom for one-on-one or small group work. One teacher in the comparison group commented, "He's not a huge disruption of the whole group, although, he is out [of the classroom] a lot so he would probably be a lot more frustrating." In contrast, teachers in the intervention group referred to the TA working with students with and without FASD in the classroom. A teacher in the intervention group described using her TA to help several students, "My TA is marvellous. She really spreads herself around while keeping an eye on E and E is the focus. She will step back and allow E to do a lot of things on her own but when its time to be redirected she'll step in." This suggests the strategies developed by teachers in the intervention group aided them in integrating students with FASD in the classroom while teachers in the comparison group with disruptive students with FASD relied on segregation. In contrast, sending TAs out of the classroom with students with FASD

impeded consistent implementation of behavioural strategies for comparison group teachers.

6.3.1.4 Using Communication to Improve School Experience

Communication between home and school aided consistent implementation of accommodations to improve the school experiences of students with FASD. The type of communication that worked best for teachers varied and, in some cases, it took effort for teachers to find a method that worked for the caregiver. Although teachers found communication between home and school improved students' school experiences, they identified barriers to establishing and maintaining that communication.

Teachers described good communication between home and school taking a variety of modes, including daily planners, e-mail, and phone calls. Teachers in the intervention group had assistance from their mentors in finding a mode of communication that worked for all parties but teachers in the comparison group indicated there were no additional resources. Daily planners carried by students between home and school are a district-wide strategy to improve communication between teachers and caregivers. Writing messages in the daily planners was a common method and valued by teachers. Some teachers adapted daily planner use to better meet their needs. One student's disruptive behaviour overshadowed his good behaviour so the teacher developed a more detailed daily behaviour report that divided the day into three hockey periods: first period including recess, second period including lunch, and third period including recess. The teacher and caregiver in the intervention group could then talk to the student about how he had won or lost each period with his behaviour using an analogy he understood; hockey. Another teacher in the intervention group struggled with getting planners

returned to school each day until her mentor worked with the caregiver to develop a visual reminder for the students to take their planners to school each day. Other teachers and caregivers found e-mail to be the best mode of communication for them. Teachers and caregivers who found a mode of communication that worked for them valued how it helped them accommodate the needs of students with FASD.

For one of the teachers in the intervention group, communication with the caregiver gave her an opportunity to plan for increased disruptive behaviour due to changes in the home environment. The child's father worked out of town most of the month and when he was home there were changes to the child's routine. When the caregiver advised the teacher her husband was coming home it gave the teacher a chance to adjust the accommodations for the student to take into account increased distractibility. Another teacher used information from the student's caregiver to better understand the context for her social skills so that she could make an informed choice for social skills accommodations at school.

Teachers in the intervention group were consistent in their desire for more communication but they also acknowledged other responsibilities at home and school disrupted communication. One teacher in the intervention group pointed out that there were only so many hours in the day to develop lessons for a class that could span four or more grade levels in academic skill, do marking, attend meetings, coordinate behaviour plans with other staff, and communicate with the caregivers and, in some cases, social workers of 20 plus students. She stated: "You know, I'm human and I'm one person and this is what I can do and that's it." Although she valued communication between home and school there were times when other activities had a higher priority. Another found

that when a family had a lot of change happening at home other concerns took priority. She stated:

> I did it [daily communication of behaviour] with two of the children and the third, there was so much turmoil in the home and constantly changing where they were living that it wouldn't work and it was just one more thing and it would never happen.

6.3.1.5 Carryover and Sustainability of Intervention

Teachers in the intervention group reported the intervention affected the school experiences of more than just the students with FASD in the intervention group. Teachers in the intervention group applied what they learned to help students without FASD in their classroom and students with and without FASD in the year following the intervention. The effects of the intervention also carried over to other teachers in the school who began using some of the strategies with their students.

Teachers in the intervention group described using strategies from the intervention to benefit students without FASD in their classrooms. One teacher in the intervention group noted: "[The intervention] helps them all out. To come back and implement it not only for your one child but to put it to work in the classroom and for other individuals it made a difference." Another teacher in the intervention group commented, "It just helps in general because you're making things a lot more visual with simpler language." Teachers in the intervention group found using the professional development training for other students with challenging behaviour, not just those with FASD, helped reduce disruptive behaviour in the classroom so they could spend more time with other students in the classroom.

During interviews, teachers in the intervention group indicated changes in teaching practice were sustained at one year post-intervention. Teachers in the

intervention group used the training with students diagnosed with FASD they had the following year, as well as, with other students in their class that struggled with disruptive behaviour. When asked if she used the training after the study was done one teacher in the intervention group stated: "Absolutely, I've probably used 75% of the things we used over the past year in some aspect or another." Another teacher in the intervention group noted:

> It was one thing to do the training last year but then to be able to leave there and come here [new school] and know you're getting a student [with FASD], and then just being able to apply all the things you had learned….it was very beneficial.

Use of the LEIC page, resource binders, picture simulations, visual reminders, and detailed behaviour reports to caregivers were examples of resources and accommodations that were used by teachers after the intervention training ended.

Dissemination of the intervention content to other teachers and TAs in the school occurred, which affected the school experiences of their students. One teacher in the intervention group described a colour-coded behaviour monitoring system she developed for her class that was adopted by the entire primary section post-intervention. Each student's name was placed on the wall and would start the school day with a green card beside it. If a student was disruptive during the day the green card would be replaced with a yellow card then a red card. If a student's behaviour improved during the day they could earn back the yellow or green card. As the teacher described, use of the system by the whole primary section gave students consistency between years:

> Now every primary class does it. We've all adopted the same system so next year kids coming in will know what to expect. There's a bit of tweaking because every teacher's a bit different over what I'd accept or what you'd accept maybe but they know how the system works.

Another teacher in the intervention group said she had shared her training with her TA and made suggestions to her such as, "[using] a quieter voice, less words, more direct instruction, more encouraging." Thus, the benefits of training were not limited to teachers in the intervention group.

Teachers in the intervention group indicated they made positive, sustained changes to their teaching practice by changing how they perceived, planned for, and responded to behaviour of students diagnosed with FASD. They took those changes with them to new teaching assignments.

6.3.1.6 Effects of Change in Caregiver or Geography on Students

The school environment does not exist in isolation of the home environment and the school experience of students in the intervention and comparison groups was affected by changes in the home environment. In the intervention group, these changes affected implementation of strategies by the teachers. Increases in aggressive behaviour following changes were noted by teachers for the male student in the comparison group and the other male students with FASD in the intervention group.

Teachers in the intervention and comparison groups reported negative academic and behavioural outcomes for all students who experienced major changes in their home environments. Changing foster homes, home visits, and moving were all accompanied by increased distractibility, aggression, talking back to school staff, and, in some cases, obsessive compulsive behaviours. After a student changed caregivers and medication his teacher noted deterioration in classroom performance. She stated:

> When he was on his medication and getting support from his [caregiver] things went really well. He went from getting A's to not being able to focus at all and can't even do sentences. He has started exhibiting some obsessive compulsive disorder like behaviours with oral fixation that are new since his meds stopped.

Changes in the home environment in the form of increased visits to his biological family without accompanying changes in medication also led to deterioration in classroom performance for another student. The teacher in the intervention group stated:

> He would be tripping people and punching and you would go to him and say this isn't right and he would argue with you. Jumping over chairs, all that kind of activity started again after he found out that he was going to be having the home visits.

In some instances, teachers described students in the intervention group becoming so distracted they even found working one-on-one with minimal stimulation difficult. A teacher in the intervention group commented, "He'll just go off looking at stuff and talking about things that are unrelated and even one-on-one in a room where there's minimal distraction [he] still can't even focus on the conversation." In the comparison group, one of the teachers also commented that a chaotic home environment prevented the student from focusing on school. She stated:

> There are a lot of issues just around home support and that sort of stuff that often supersedes the issues of actual school work. We've spent a lot of time dealing with those things like have you gotten anything to eat, do you have lunch, are you clean, stuff like that.

Teachers in the intervention and comparison groups consistently expressed their beliefs that, if the stability of the home environment was affected, the resulting stress rendered students unable to cope with the school environment.

6.3.1.7 Challenges to Intervention Implementation

Teachers in the intervention group had challenges with social workers and working with staff indirectly involved with students in the intervention group.

6.3.1.7.1 Communication with Social Workers

For students in foster care, social workers have a major impact on their home environment which then affects students' experiences at school. Social workers also decide when a biological parent regains legal guardianship of his or her child and access to information from the school. Establishing and maintaining communication with the social workers was not part of the intervention which created challenges for teachers in the intervention group when a decision made by a social worker affected the school experience of a student with FASD. As one teacher in the intervention group described: "She was changing foster homes and half the time I really didn't know who was picking her up. It was a different person that arrived each day, she didn't know and I didn't know." Post-intervention, one of the teachers in the intervention group did establish and maintain communication with a social worker with positive results. She stated:

> In the past I've shied away from that [communicating with social workers], like, this is my job and I'll do my job and they have their job but this year we've really had them in the school and gone through individual education plan things. That has really helped too; just really making sure everyone is onside with what's going on.

6.3.1.7.2 Confidentiality restrictions

Communication between school staff to ensure consistent implementation of accommodations was hampered by confidentiality concerns. Those with indirect involvement with the student in the intervention group were not privy to information about the student's diagnosis and as a result did not understand the reasons behind the accommodations in place for that student. Staff indirectly involved with the student still had contact with him during playground supervision at recess and if they were asked to supervise the class for a period of time. Lack of knowledge about the student's diagnosis

and accommodations led to problems that could have been avoided. For example: "We had a huge problem with his hat that he wore [to reduce visual stimulation from fluorescent lights] because the teacher that came in just for this one time took his hat away." Lack of communication with other school staff impeded consistent implementation of behavioural accommodations.

6.3.2 Themes from Principals' Interviews

During their interviews with the doctoral student, principals described the impact the professional development program had on teachers in the intervention group as well as the rest of the school during, and in the year following, the intervention. The interviews with the two principals were each an hour in length and took place in the principals' offices.

6.3.2.1 Impact on the Teachers

Principals saw changes in teaching practice among teachers participating in the intervention. One principal described the changes they saw a teacher make to the physical classroom environment and the way she dealt with behaviour in the classroom:

> She started looking at behaviour differently; it was no longer just bad behaviour. It was stopping and looking at what is going on in the room, what is happening, and what could be done differently. Her room has always been so full of stuff and she has been purging just loads and loads of stuff so she's changing the way her room is. Covering things up that do not have to be exposed just to make it less stimulating; those sorts of things definitely happened. She is also doing more check ins with kids, preferential seating for particular students, and I've noticed the way she pairs kids up changed. She no longer always has a high kid with a low kid. She had our two fetal alcohol kids working side by side and it was great because they felt awesome. They felt great because they were able to keep up with each other.

Changes in the teacher's practice, such as which students she paired up, also had a positive effect on the students' self-esteem.

The changes in teaching practice were sustained one year post-intervention benefiting other students with FASD. One principal described how the change in teaching practice affected the problem behaviour of some students with FASD the year following the intervention:

> Several of those students [with FASD] had huge behaviour problems last year. We just didn't know what to do with them and we were struggling. This year they did a complete turn around. One parent even phoned me and said this has been the best year ever for her child because of the strategies H was using.

As a result of the accommodations introduced by teachers in the intervention group, the students with FASD were able to experience success at school.

6.3.2.2 Impact on School

Teachers in the intervention group became a source of expert information resulting in changes that affected other students and staff. Other teachers saw the successes teachers in the intervention group were having with students with FASD and began making accommodations in their own classrooms. A principal stated, "Those strategies [from the intervention] transferred from one class to another because, of course, people were noticing some improved behaviour. She was sharing all the time what she was learning and I was sending people to H." The principal went on to describe the changes that other teachers began adopting in their teaching practice:

> People started to rethink how their classrooms were set up; visually, the over stimulation with too much stuff. So it has spread throughout the school; a better understanding of the behaviour of students with fetal alcohol as opposed to just sending them to the office because they are disruptive so it did make a huge difference that I could see.

The principal saw changes in the amount of time students with FASD in other classrooms were sent to the office because their behaviour was too disruptive for the classroom.

Another principal described how other teachers in the school began to view disruptive behaviour differently,

> I think it just made everybody think more about the reasons behind behaviours rather than just trying to deal with the [word emphasis] behaviour which was an interesting change in perspective… They don't try to be, but often teachers are reactive rather than proactive. So, if you set the stage for success and think about why a child is going to behave a certain way it is going to work a lot better than if you react every time a child does behave that way.

Changing views of disruptive behaviour was linked by principals to a reduction in reactivity to children's behaviour and an increase in proactive approaches to head off difficulties.

One of the principals also found the LEIC page useful for developing strength-based accommodations for other students in the school. She stated:

> It really targets for the teacher the things that are strengths, proactive, and successful and that's the kind of model you want to push all the time…It really works well in a meeting format because then everyone is a part of it and the teacher has something really concrete to go away with which often doesn't happen at meetings.

The approach provided more concrete strategies and made sharing easier with other staff members in meetings.

6.3.3 Themes from Caregivers' Interviews

Seven caregivers completed an interview with the Doctoral student. One interview, done by phone, was 20 minutes in length while the rest were one to two hour long in person interviews. On of the in person interviews took place in a busy Tim Hortons while the rest were done in a quiet room at the caregivers' homes. Caregivers described the importance of communication with school staff and improvements they would like to see in their children's school experiences.

6.3.3.1 Communication with School Staff

Caregivers valued communication with school staff because it made early intervention for problem behaviours possible, before they negatively affected a student's school experience. Caregivers in the intervention and comparison group appreciated the efforts teachers made but noted there were still improvements that could be made. One caregiver in the intervention group expressed a desire for communication on problems when they were developing:

> I wish that the teachers wouldn't let things go so far before they contact me about issues. Once they've gone too far it's so hard to change and redirect so I wish there was more on-going communication. Teachers talk to me but it is always when it gets too late and the problem is too big.

Another caregiver in the intervention group described how daily communication with the teacher allowed her to follow up on problem behaviour that took place in the classroom:

> We have this thing, it's on the back of his planner, and she marks puts notes and stuff there to let me know how his day was. So he can't like come back and say, "Oh my day was fine, blah, blah, blah" [laughter]. That's great, but apparently your teacher doesn't think you were behaving and doing well; you know you were disruptive. So we've been communicating that way as well.

Without frequent communication between home and school, caregivers were limited in how they could support teachers' behaviour management efforts in the classroom.

6.3.3.2 Improvements

Caregivers in the intervention and comparison groups noted that there were things that could have improved their child's school experience. Two caregivers with children in the intervention and comparison groups identified the need for additional social skills training. One caregiver in the intervention group noted, "All three of the kids have issues with friends and are loner type kids and that issue, I don't think, was really addressed until after spring break." A caregiver in the comparison group felt speech and language

training was needed for her child while another caregiver in the comparison group felt more one-on-one instructional time would help. The concerns of the first caregiver were communicated to teachers in the intervention group who developed strategies to work on the students' social skills; however, this occurred later in the year than the caregiver would have preferred. The caregivers in the comparison also communicated their desires to their students' teachers; however, the teachers in the comparison group did not have the capacity to offer speech and language training or more one-on-one instructional time.

6.3.4 Summary

Teachers, principals, and caregivers described the ways the intervention affected the school experience of students with FASD. Teachers described how the structure, content, and process of the intervention led to changes in their teaching practice and perceptions of the students with FASD. Teachers reported these changes in teaching practice had a positive impact on students' school experiences. Principals also felt the intervention resulted in changes to teaching practice that were adopted by other teachers in the school and changed the way disruptive behaviour was dealt with school-wide. Thus, principals reported the POPFASD intervention had a positive impact on school experience for more than just the students with FASD. Caregivers described the importance of communication between home and school to their child's school experience and expressed a desire for even more communication.

6.4 Classroom Behaviour and Academic Achievement of Students with FASD

Classroom behaviour and academic achievement of students with FASD was measured pre-, mid-, and post-intervention to determine if there were any changes associated with the professional development program. Within group differences of

dependent variable scores pre-, mid-, and post-intervention were analyzed with the t-test and Friedman test statistics.

The intervention group had statistically significant changes post-intervention for BASC-2 TRS Adaptive Skills ($v = 4$, $\chi^2 = 7.60$, p = .02) and School Problems ($v = 4$, $\chi^2 = 6.40$, p = .04) percentiles while the comparison group had no statistically significant change over time for any dependent variable (see Table 11).

Table 11: Friedman test statistics for behaviour and academic measure outcomes scores of students with FASD pre-, mid-, and post-intervention

Dependent Variable	N	χ^2	p
Intervention Group			
BASC-2 POP Percent Problem Behavior	5	3.60	.17
BASC-2 TRS Behavioral Symptoms Index Percentile	5	1.41	.49
BASC-2 TRS Adaptive Skills Percentile	5	7.60	.02**
BASC-2 TRS Externalizing Problems Percentile	5	2.00	.37
BASC-2 TRS Internalizing Problems Percentile	5	2.21	.33
BASC-2 TRS School Problems Percentile	5	6.40	.04**
CBM Reading Percentile	5	1.60	.45
CBM Math Percentile	4	1.50	.47
CBM Total Words Written Percentile	4	.43	.81
CBM Words Spelled Correctly Percentile	4	.14	.93
Comparison group			
BASC-2 POP Percent Problem Behavior	5	.40	.82
BASC-2 TRS Behavioral Symptoms index Percentile	5	1.60	.45
BASC-2 TRS Adaptive Skills Percentile	5	2.21	.33
BASC-2 TRS Externalizing Problems Percentile	5	2.21	.33
BASC-2 TRS Internalizing Problems Percentile	5	1.00	.61
BASC-2 TRS School Problems Percentile	5	.11	.95
CBM Reading Percentile	4	.00	1.00
CBM Math Percentile	3	2.67	.26
CBM Total Words Written Percentile	4	.13	.94
CBM Words Spelled Correctly Percentile	4	.13	.94

** significant at α=.05

Note. Students with missing data excluded from analysis. BASC-2 POP = Behavior Assessment System for Children 2nd Ed. Portable Observation Program (Reynold & Kamphaus, 2004); BASC-2 TRS = Behavior Assessment System for Children 2nd Ed. Teacher Rating Scale (Reynold & Kamphaus, 2004); CBM = Curriculum Based Measure (Fewster & MacMillan, 2002).

Siegel and Castellan's (1988) post-hoc analysis of mean rank scores indicates that there was a significant difference between pre- and mid-intervention percentile scores for the BASC-2 TRS Adaptive Skills (mean rank difference = 1.5, z = 1.34, p = .02) and School Problems (mean rank difference = 1.60, z = 1.35, p = .02) scales but not the pre- and post-intervention percentile scores (see Table 12).

Table 12: Results for post-hoc analysis of significant Friedman test statistics for BASC-2 TRS scales for students with FASD

	Mean Rank			k	N	z
	Pre	Mid	Post			
Adaptive Skills Percentile	1.30	2.80*	1.90	3	5	1.34
School Problems Percentile	2.80	1.20*	2.00	3	5	1.35

* Significantly different from pre-intervention, p=.017

In Figure 8, it is evident that the direction of the statistically significant change at mid-intervention was a decrease in the BASC-2 TRS School Problems Scale. The School Problems Scale includes the attention problems and learning problems scales which encompass motivation, attention and learning, and cognition (Reynold & Kamphaus, 2004). Higher percentile scores indicate greater academic difficulty (Reynolds & Kamphaus, 2004). Students in the intervention group experienced a decline in School Problems mid-intervention followed by an increase post-intervention. In contrast, the mean percentile scores for students in the comparison group were stable with a slight increase post-intervention.

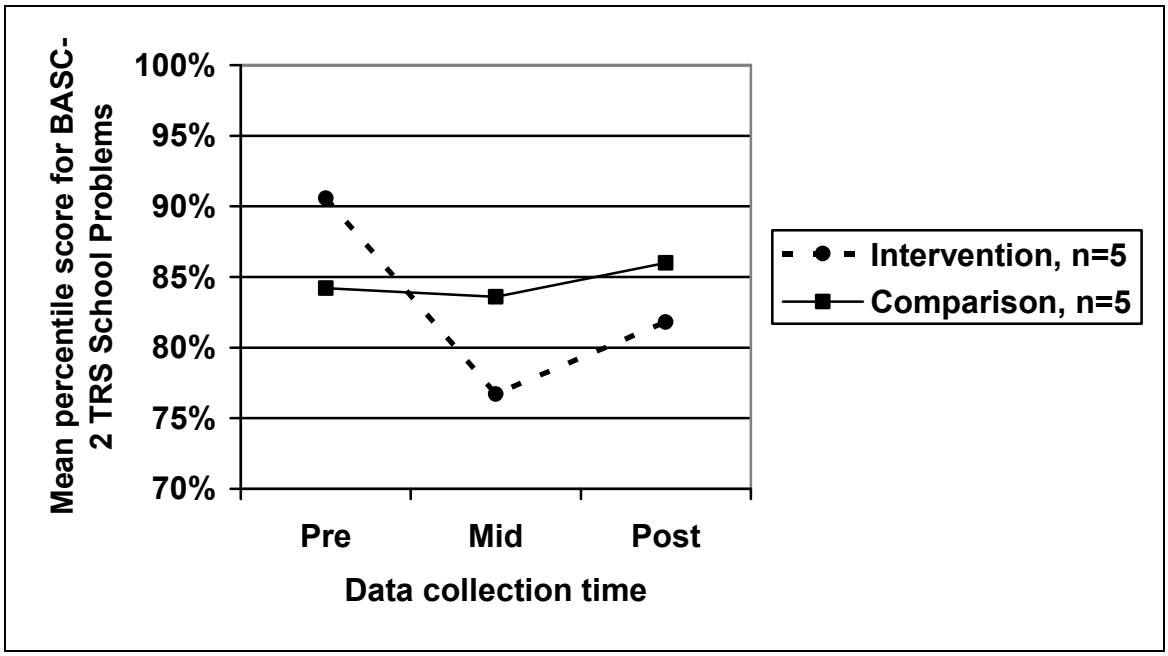

Figure 8: Mean percentile score for BASC-2 TRS School Problems Scale for students with FASD grouped by experimental group.

The Adaptive Skills Composite Scale assesses characteristics of adaptive behaviour important for functioning at school. In Figure 9, it is apparent that the direction of the statistically significant mid-intervention change is an increase in Adaptive Skill percentile score. The Adaptive Skill Scale includes adaptability, functional communication, social skills, leadership, and study skills. Low percentile scores indicate difficulties with appropriate emotional expression and comparison and other adaptive skills such as daily living, communication, and pro-social behaviour.

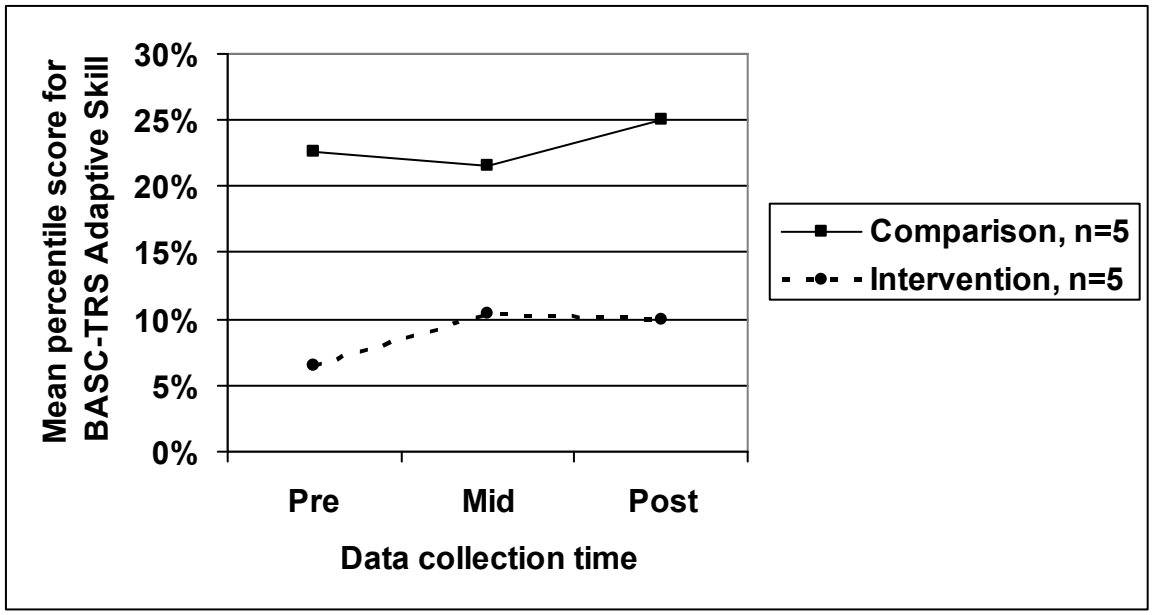

Figure 9: Mean percentile score for BASC-2 TRS Adaptive Skill Scale grouped by experimental group.

6.5 Academic Achievement of Students without FASD

Academic achievement of students without FASD was measured pre-, mid-, and post-intervention to determine if decreasing disruptive behaviour of students with FASD affected the learning environment of the rest of the class.

Classmates of the students in the intervention group had statistically significant change on all academic measures while classmates of students in the comparison group had statistically significant changes for reading and math only (see Table 13). The Friedman test statistic does not indicate which measurement time is significantly different or what the direction of the change is; therefore, post-hoc analysis is required.

Table 13: Friedman test statistics for CBM academic percentile scores of students without FASD pre-, mid-, and post-intervention

Dependent Variable	N	χ^2	p
Intervention Group			
Words read correctly	34	31.89	.000***
Total words written	38	10.36	.006***
Words spelled correctly	38	9.95	.007***
Math percentile	46	5.35	.069*
Comparison group			
Words read correctly	55	13.79	.001***
Total words written	46	1.24	.539
Words spelled correctly	46	1.27	.531
Math	46	7.25	.025**

*significant at α=.10, **significant at α=.05, ***significant at α=.01

Post-hoc analysis of mean rank CBM percentile scores shown in Table 14, indicates which test times were significantly different (Siegel & Castellan, 1988). Mid-intervention Reading percentile score were significantly different from the pre- (mean rank difference = 1.26, z = .51, p =.02) and post- (mean rank difference = .99, z = .51, p = .02) scores for the intervention group. Intervention group post-intervention scores were significantly different from mid-intervention for Total Words Writing (mean rank difference = .69, z = .49, p = .02) and Words Spelled correctly (mean rank difference = .7, z = .49, p = .02). The lack of significant change in Math scores for the intervention group in the post-hoc analysis is likely because the change is too small to detect with the adjusted alpha. For the comparison group, the mid-intervention percentile score for Reading (mean rank difference = .69, z = .40, p = .02) and post-intervention percentile score for math (mean rank difference = .54, z = .44, p = .02) were significantly different from pre-intervention percentile scores.

Table 14: Results for post-hoc analysis of significant Friedman test statistics for CBM percentile scores for students with FASD

	Mean rank			k	N	z
	Pre	Mid	Post			
Intervention group						
Words read correctly	2.51	1.25*	2.24†	3	34	.51
Total words written	1.87	1.72	2.41*†	3	38	.49
Words spelled correctly	1.93	1.68	2.38†	3	38	.49
Math percentile	2.10	2.16	1.74	3	46	.44
Comparison group						
Words read correctly	2.34	1.65*	2.01	3	55	.40
Math	2.26	2.02	1.72*	3	46	.44

* Significantly different from pre-intervention, p=.017
† Significantly different from mid-intervention, p=.017

Figure 10 indicates the direction of change for the Friedman test post-hoc analysis for students without FASD in the intervention group as shown in Table 14. The mean Words Read Correctly percentile score was significantly lower at mid-intervention. Mean percentile score for Words Read Correctly, Total Words Written, and Words Spelled Correctly significantly increased from mid- to post-intervention.

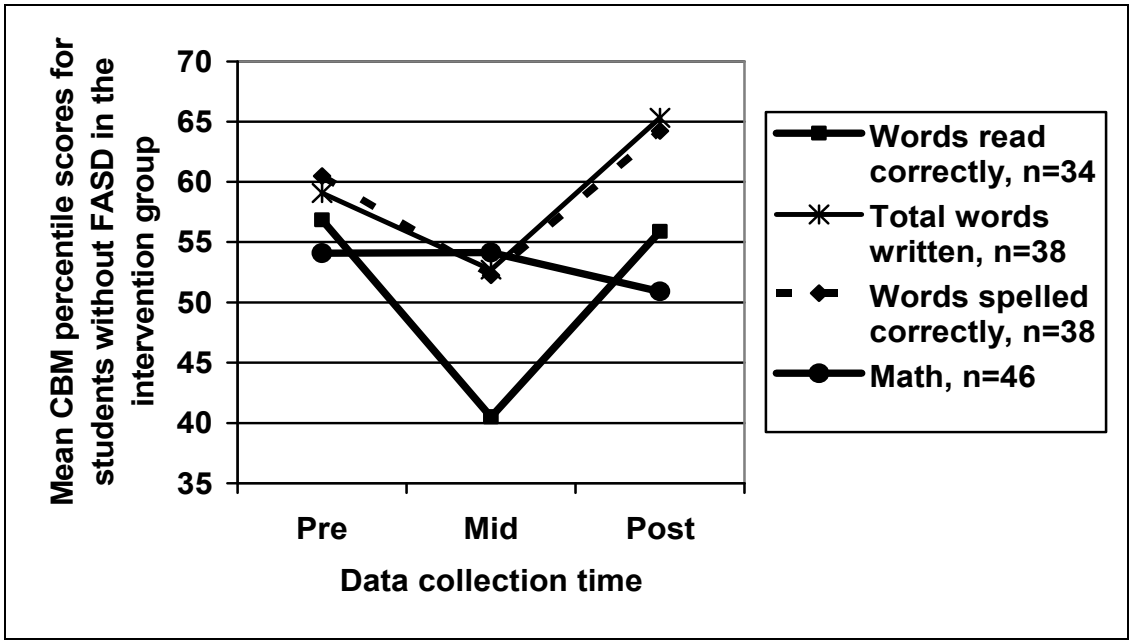

Figure 10: Mean CBM percentile scores for students without FASD in the intervention group.

According to Figure 11, the direction of changes in post-hoc Friedman analysis of the comparison group for mean CBM percentile scores is a decrease. Mean Reading percentile score at mid-intervention decreased for students without FASD in the comparison group. The mean percentile score for Math also decreased significantly at post-intervention relative to the pre-intervention score.

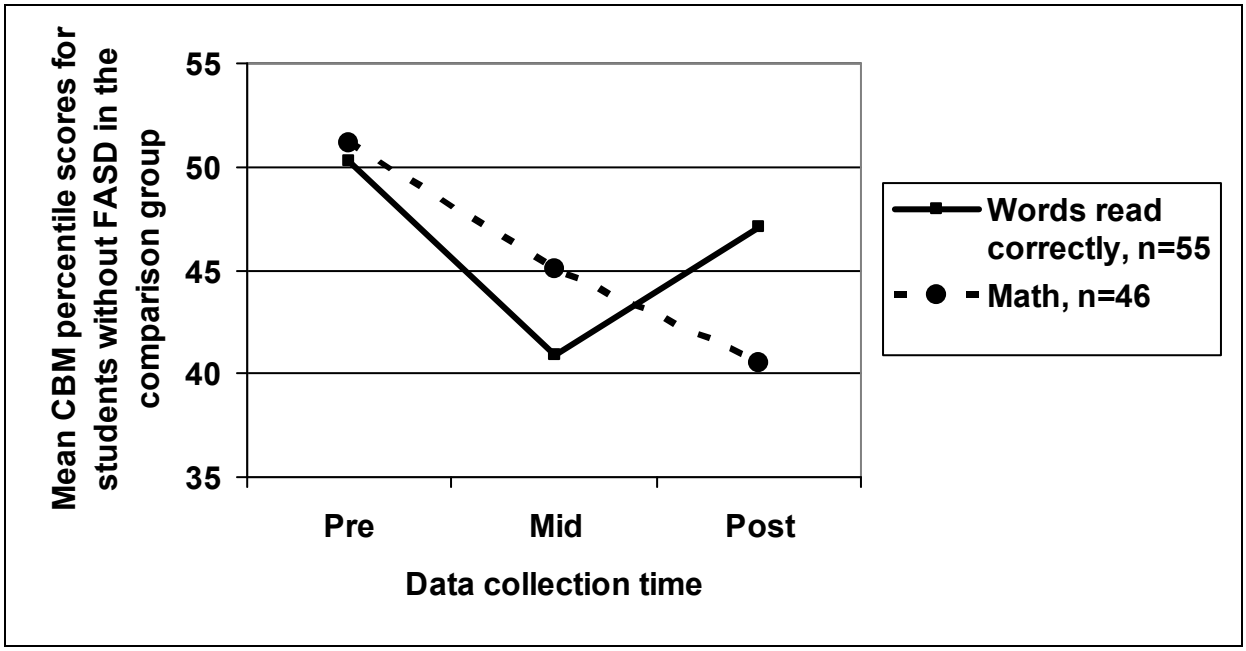

Figure 11: Mean CBM percentile scores for students without FASD in the comparison group.

6.6 Cost Comparison

Cost estimates were made for the professional development program and three alternatives that have been used within the school district. All salary estimates were obtained from the school district (L. McEwen, personal communication, February 1, 2011). Appendix N contains tables with detailed itemization of cost.

6.6.1 POPFASD Professional Development Program

POPFASD mentorship intervention costs are based on training six teachers. The mentor estimated .40 - .50 full time equivalent (FTE) was required to mentor six experienced teachers. The higher end of the estimate was used in the cost calculation because mentoring new teachers is expected to be more time intensive (S. Wakabayashi, personal communication, February 1, 2011). Travel and accommodation costs were not required for the speech and language therapist, occupational therapist, and school psychologist because a district can use their own staff for the workshops. Part of the mentor's responsibilities are organizing and implementing the two-day and half-day workshops so there are no additional travel and accommodation costs. The cost per teacher for the professional development program was $8,384.17. Up to three students diagnosed with FASD per teacher per year can benefit from the training because classrooms are limited to three Form 1701 Designated Students.

6.6.2 Two Day FASD Workshop Cost

Workshops costs were based on the two day workshop currently available to any BC school district through POPFASD. A school district could eliminate the workshop leadership salary, travel, and accommodation costs if they had staff with sufficient expertise to provide the workshop themselves; however, they would still need to pay the staff to deliver the workshop. The cost per teacher for a workshop offered to 12 teachers is $833.33 and each teacher can use the workshop training to teach up to three students diagnosed with FASD per year.

6.6.3 Cost of Segregated Classroom

Cost to operate a segregated classroom includes training and salary in the first year and salary alone for subsequent years. Teacher training, as summarized in Table 15, would cost $833.33 per teacher. Teacher salary would be $42,000-$81,000 per year depending on whether they were a first year category four teacher or a category six teacher at the top of their pay scale. The salary estimate for a category six teacher was used in Table 15. Each teacher could be expected to teach up to eight students diagnosed with FASD in a segregated classroom per year (C. Brennan, personal communication, March 16, 2011). Number of students in the classroom is based on the experience of an elementary school in the school district operating a segregated classroom for students with FASD September 2007 to June 2010.

Cost effectiveness of the intervention options cannot be compared due to lack of outcome data but the relative cost, shown in Table 15 below, and potential impact of each can be examined. Cost ranged from $833.33 for a single teacher to participate in a two day workshop to $81,833.33 for a senior, category six teacher to teach a segregated classroom. The POPFASD professional development program and two day workshop do not have ongoing salary costs while the segregated classroom does. A teacher from the POPFASD mentorship or two day workshop interventions can reach up to three students per year, and a teacher in a segregated classroom can reach up to eight students with FASD per year. The POPFASD professional development program is less expensive than some of the other intervention options available and has the potential to affect more students than a segregated classroom. No research has been done to assess the effectiveness of the segregated classroom or two day workshop.

Table 15: Summary of total cost for each intervention and cost per teacher

Intervention	Salary	Travel	Printing and Supplies	Total	Cost per staff teacher
POPFASD teacher mentorship for six teachers	$44,255	$4,650	$1,400	$50,305	$8,384.17
Two day FASD workshop for 12 teachers	$8,800	$1,000	$200	$10,000	$833.33
Segregated classroom teacher attending two day FASD training	$89,800	$1,000	$200	$91,000	$81,833.33

7.0 Discussion

Study findings suggest the POPFASD professional development program may be beneficial for teachers working with students diagnosed with FASD; however, the quasi-experimental results are limited by inadequate power.

7.1 Intervention Fidelity

Fidelity of the intervention is a significant challenge to the internal validity of this study. Fidelity of the workshops was acceptable but not the fidelity of the mentorship process. Since the effects of the two intervention components cannot be separated, it is impossible to determine whether the POPFASD intervention would have the same effect in another sample. Prior research suggests FASD workshops may only raise awareness which would increase the likelihood that changes in teaching practice could be attributed to the mentorship component (Dybdahl & Ryan, 2009; Ryan & Ferguson, 2006). The structure of the POPFASD intervention addressed the criticisms raised by Dybdahl and Ryan (2009) and Ryan and Ferguson (2006); therefore, the potential effect of the workshop component cannot be discounted. Teachers knew they had a student with FASD prior to attending the workshop so they were likely to view the information as applicable to their teaching practice. A criticism noted in Dybdahl and Ryan's study was teachers' tendency to view information about FASD as not applicable to their teaching practice because they did not believe they had a student with FASD. The workshops were administered by two teachers that understood the classroom context and were planned so that teachers left with a list of strategies that were useful in their classrooms; an outcome teachers stated was lacking in Ryan and Ferguson's study. Therefore, the effects of the POPFASD intervention could be due to the workshops, the mentorship, or a

combination of both components. Because the fidelity of the workshops was acceptable, they could be replicated elsewhere. Because each teacher received a unique mentorship intervention the effects noted in this study may not be replicable in other populations.

7.2 Effect of the Professional Development Program

7.2.1 Effect on Teachers

Teachers in the intervention group reported the professional development program led to sustained changes in their teaching practice, although they experienced challenges in implementing the program that reflect weaknesses in the POPFASD intervention.

All components of the POPFASD intervention were identified as relevant which is in contrast to prior research documenting teachers' opinions on FASD professional development. Work by Dybdahl and Ryan (2009) and Ryan and Ferguson (2006) identified full day workshops as only raising awareness about FASD rather than leading to changes in teaching practice. As discussed previously, the difference in this study may be due to the structure and content of the workshops addressing the criticisms noted in Dybdahl and Ryan and Ryan and Ferguson's studies. The difference may also reflect the importance of the mentorship process in supporting the knowledge and skills learned during the workshops.

The focus of the POPFASD intervention was on the classroom environment in the Contextual Systems Model (Pianta & Walsh, 1996) with limited involvement of adults in other parts of the school system or child/family system which affected implementation of accommodations for students with FASD for teachers in the intervention group. Teachers in the intervention group reported difficulty with consistent implementation of

accommodations or maintaining structure when other school staff had contact with their students with FASD. Changes in the home environment, initiated by caregivers or BC MCFD case workers, also affected the accommodations implemented in the classroom by teachers in the intervention group. As is discussed in the implications for practice section, the child/family system and entire school system are important to maintaining the consistent structure in the environment of students with FASD recommended by Kalberg and Buckley (2007). Not including caregivers, BC MCFD case workers, and other school staff in the workshops and mentoring process may affect efforts of teachers in the intervention group to accommodate students with FASD in the classroom.

7.2.2 Effect on Principals

Principals identified the POPFASD intervention as changing the way disruptive behaviour was perceived in the intervention classes and, in some cases, non-intervention classes; that change in perception altered the way disruptive behaviour was dealt with at a school-wide level. With fewer students with or without FASD being sent to the office for disruptive behaviour, principals spent less time dealing with behaviour in a reactive manner. Use of the LEIC page also encouraged a preventative approach to dealing with disruptive behaviour. Prior school-based FASD intervention research does not include the perspective of principals; however, conclusions can still be drawn as to how other interventions compare to the effect of the POPFASD intervention on principals. One of the four interventions described previously (Malbin, 2006) involved school staff, including principals, in developing accommodations for students with FASD according to the Neurobehavioral Approach. Malbin reported a decrease in professionals' stress and increase in professionals' self-efficacy post-intervention.

7.2.3 Effect on Caregivers

Caregivers were not directly involved in the professional development program which, as discussed later, is a weakness of the intervention. In a previous study, caregivers identified collaboration with school as something they needed to be a good parent to a child with FASD (Brown & Bednar, 2003). Caregivers in this study also emphasized the importance of collaboration with school staff. Kalberg and Buckley (2007) highlighted the importance of involving caregivers in school-based interventions. In this study, communication with caregivers occurred through involvement in a school team meeting and regular communication. Although caregivers whose children were in the intervention group appreciated the regular communication and participation in the initial meeting, in the interviews those who participated indicated it was not enough. Collaboration with caregivers, through attendance at the workshops and participation in the mentoring process, would strengthen the POPFASD intervention (Brown & Bednar, 2003; Kalberg & Buckley, 2007). This issue is further discussed in the implications for practice section.

7.3 Changes in Classroom Behaviour of Students with FASD

According to the Contextual Systems Model (Pianta & Walsh, 1996), a student's behaviour is influenced by the people and resources within his or her child/family system and school system. Three behavioural interventions discussed in the literature review involved making changes to the student's environment within the child/family system (Bertrand, 2009) or the child/family and school system (Malbin, 2006) to decrease problem behaviour. This study sought to improve the behaviour of students with FASD by altering the teaching practice of the students' classroom teachers. At mid-

intervention, classroom behaviour of students with FASD did improve; however, the student in the school system is also influenced by the child/family system. Studies examining the possible association between problem behaviour and FASD found quality of the home environment and number of foster placements influenced children's problem behaviour (Brown et al., 1991; Sood et al., 2001; Victor, Wozniak, & Chang, 2008). In this study when students with FASD experienced a major change in their child/family system, the influence was seen in a deterioration of their classroom behaviour.

7.4 Changes in Academic Achievement of Students with FASD

No change in academic achievement was found pre-, mid-, and post-intervention for students with FASD. There are four possible explanations for the lack of effect. First, the strategies used by teachers in the intervention group may not have been effective in improving academic skills. Second, as will be discussed in the quasi-experimental method limitations, the sample size may have been too small to detect a change in academic skill. Third, the intervention time frame may have been too short to detect a change in academic skill. Fourth, it is possible to interpret the lack of decrease in intervention percentile scores after major change in the home life of students with FASD as indicating success.

The strategies used by teachers in the intervention group may not have been enough to improve academic achievement of students with FASD. It is possible that a student with FASD may need other more intensive supports to improve their academic skills. Prior research reveals only four interventions targeting academic achievement of students with FASD (Adnams et al., 2007; Kable, Coles, & Taddeo, 2007; Johnson & Lapadat, 2000; Porter-Larsen, 2000). The three interventions that involved

individualized tutoring over six weeks (Coles, Kable, & Taddeo, 2009; Kable, Coles, & Taddeo, 2007), three months (Porter-Larsen, 2000), and four months (Johnson & Lapadat, 2000) were associated with improvement in the academic skills targeted. The tutoring described in the three studies is more intensive than one-to-one TA support that students with FASD might receive in BC. Our study was consistent with Adnams et al.'s (2007) study in finding of no improvement in academic achievement without one-to-one tutoring. There are too many differences in study design and cultural influences to determine how important one-to-one tutoring is; however, the hypothesis should be explored.

One of the teachers in the intervention group stated that after implementing a number of strategies for the student with FASD in her classroom; the biggest issue was getting him to complete assignments indicating that once his difficulties were accommodated he has the potential to make progress on academic goals. Unfortunately, his classroom behaviour deteriorated after he was moved to a new home in the spring and he was no longer making progress on academic goals. This teacher's experience suggests that changes may be seen in academic achievement after students with FASD have had stable and consistent structure at home and school for an extended period of time. Kalberg and Buckley (2007) recommend utilizing increased structure in the environment of students with FASD. In the Contextual Systems Model (Pianta & Walsh, 1996), the student's environment includes the child/family system and the school system. Changing a student's child/family system would represent a change or loss of structure which Kalberg and Buckley state would be detrimental to the school performance of a student with FASD. Had the POPFASD intervention included caregivers and BC MCFD

caseworkers in the workshops and mentoring process, the consistent structure recommended by Kalberg and Buckley might have been achieved with positive results for academic achievement. With the degree of upheaval that can be present in the lives of children in care, it is possible that involving BC MCFD caseworkers would result in little or no improvement to the degree of structure present in the lives of students with FASD.

Finally, maintaining the same relative skill level throughout the year could be interpreted as a success. It is plausible to predict a decrease in academic achievement when students with FASD lose their primary caregiver, begin a transition from their long-term foster home to their biological family, or begin packing to move out of the city. The failure to detect a decrease in academic achievement for students in the intervention group could be due to the extra training teachers received to accommodate students' needs.

7.5 Changes in Academic Achievement of Students without FASD

Results suggest the professional development program may affect the writing skills of students without FASD but not reading or math skills. Pre- to post-intervention, students without FASD in the intervention group had a statistically significant increase in Total Words Written (see Figure 10). These findings should be interpreted with caution as students in the intervention group had significantly higher pre-intervention writing scores which may have affected the results (see Table 9). Math scores significantly decreased pre- to post-intervention for students without FASD in the intervention and comparison groups suggesting there is no effect on math achievement (see Figures 10 and 11). Reading scores were unchanged pre- to post-intervention for students without FASD

in the intervention or comparison group suggesting there was no effect of the intervention on reading skills for students without FASD.

Teachers in the intervention group reported using what they learned from the professional development program with students that did not have FASD; therefore, it is possible that the professional development program had some influence on the writing skills of students without FASD directly and indirectly. Directly, teachers in the intervention group applied what they learned to working with students without FASD. Indirectly, teachers' efforts to decrease disruptive behaviour of students with FASD improved the learning environment for the whole class. This is the first study to examine the effect of an intervention for students with FASD on students without FASD in the same classroom.

7.6 Limitations of Quasi-Experimental Methods

The quasi-experimental methods used in this study have important limitations that affect interpretation of results. Small sample size, non-equivalent groups, homogeneity of teachers, and use of only one mentor create conditions where the results are not generalizable to other populations of students with FASD.

The classroom behaviour and academic achievement analyses used a small convenience sample, five students in the intervention group and five in the comparison group, increasing the risk for type II error and limiting statistical analysis. In this study, only large changes, such as for adaptive skills and school problems could be detected. The range of outcomes that may be attributable to the intervention are unknown. Sample size was too small to examine whether executive function skill level or gender of students with FASD influenced academic achievement or classroom behaviour outcomes. A

previous study has indicated there are gender differences in FASD impairments (Weinberg, 1993); success in an intervention involving social skills may depend on executive function skill (Schonfeld, Paley, Frankel, & O'Connor, 2006). Therefore, gender and executive function are important variables to include in analysis. Furthermore, the sample is not representative of the population of school-aged students with FASD; therefore, results of the statistical analysis cannot be generalized to other groups of students with FASD.

Home environment changes may have reduced the influence of pre-intervention differences in classroom behaviour. Students in the intervention group had statistically significantly more disruptive behaviour than students in the comparison group at pre-intervention. Ability to stay focused throughout the school year or during warmer weather may be lower for students with more disruptive classroom behaviour. Because the intervention and comparison groups had statistically significantly different characteristics pre-intervention, it is not possible to discount school fatigue as a contributing explanation for decline in behaviour and academic achievement at the end of the school year.

The sample of teachers only included those with several years experience limiting the potential effect of the POPFASD intervention. Senior teachers have a wealth of experience from teaching and attending professional development programs. Teachers used their own experience, experience of their peers, information from workshop speakers, and input from the mentor to develop accommodations for students with FASD. The collaborative work done by the teachers in the intervention group during the workshops was identified as an important piece of the intervention. Had most or all of

the teachers been inexperienced the impact of the collaborative work, and perhaps the whole intervention, could have been reduced. New teachers may also need more support from the mentors to implement changes to their teaching practice.

Using only one mentor means some of the findings may be due to unique characteristics of the mentor. Teachers in the intervention group reported that the relationship they had with the mentor was an important component of the professional development program. It is possible that a mentor with different skills or experiences could change the impact of the intervention.

This study is important because it is the first to examine the effectiveness of a professional development program for teachers on FASD; however, the limitations of the quasi-experimental methods and study sample need to be considered in the interpretation of the findings.

7.7 Cost of Professional Development Program

Insufficient evidence exists to compare the cost effectiveness of any intervention to improve behaviour or academic achievement of students with FASD; however, implementation costs can be compared to assess whether school districts could afford the POPFASD professional development program. Professional development program implementation costs were less than operating a segregated classroom for one year and there is no cost associated with the POPFASD professional development program after the teacher has completed the training. Implementation cost of a one-time workshop is the cheapest intervention option but there is no evidence to indicate it would result in any change to teaching practice (Quick, Holtzman, & Chaney, 2009; Yoon, Duncan, Lee,

Scarloss, & Shapley, 2007). Cost comparison suggests the POPFASD mentorship intervention could be an affordable intervention option for BC school districts.

7.8 Implications for Practice

Future implementation of the POPFASD intervention should consider issues related to increased involvement of caregivers and BC MCFD case workers and recruitment of mentors.

7.8.1 Inclusion of Caregivers and Case Workers in POPFASD Intervention

Implementation of the POPFASD intervention in this study focused on the classroom environment with limited involvement of individuals from the rest of the school or from the child/family system. As indicated by the Contextual Systems Model (Pianta & Walsh, 1996), a student with FASD is influenced by people in the entire child/family system and school system. In this study, case workers were not included in the POPFASD intervention and caregivers had limited involvement. As noted by the teachers in the intervention group, school staff indirectly involved with a student with FASD affected the implementation of accommodations. Caregivers and case workers initiated changes in the home environment of students with FASD that affected their classroom behaviour and academic performance.

Including BC MCFD case workers and all school staff in the workshops and ongoing implementation of accommodations would likely strengthen the intervention. Kalberg and Buckley (2007) emphasized the importance of including caregivers in the planning of school-based accommodations for students with FASD because of their influence on and long-term commitment to students' lives. Intervention research involving caregivers demonstrates accommodations initiated or supported by caregivers

can improve executive function skills (Bertrand, 2009), behaviour (Bertrand, 2009; Malbin, 2006), and social skills (O'Connor et al., 2006). When a child is in the care of BC MCFD, his or her caregivers include the foster parent and case worker. Including caregivers and case workers in part or all of the workshops and the on-going implementation of accommodations would increase consistency of accommodation implementation and communication between the child/family system and the school system. Involving caseworkers is unlikely to change their plans to transition students back to their biological parents because caseworkers' focus is on the integrity of the family. Involving BC MCFD caseworkers may lesson the impact of changing homes on students with FASD if caseworkers are able to give schools advance notice of changes to the home environment. Advance notice would help school staff plan for increased problem behaviour while the student transitions to his or her new environment. Finally, including all school staff, not just classroom teachers, would ensure accommodations are implemented consistently at school regardless of the staff person involved.

Limited involvement of caregivers and lack of involvement of case workers in this study was a weakness of the POPFASD intervention that should be addressed in future implementation of the professional development program.

7.8.2 Recruitment of Mentors

Careful recruitment of mentors would be central to the delivery of this intervention in other school districts. Mentor qualities are important to success of a mentorship program (Cothran et al., 2008) and this was reinforced by the findings from interviews with teachers in the intervention group in this study. Recruitment of mentors who have participated in the intervention as a teacher would be ideal; however, this may

not be possible in districts implementing the intervention for the first time. Targeting teachers who have been successful working with students with learning disabilities and challenging behaviour would ensure contextual knowledge and skills, although additional training on FASD would be necessary. A mentorship training program would need to be developed to ensure mentors have a solid understanding of the cognitive and neurodevelopmental impairments associated with FASD. Mentors would also need to be able to support and facilitate mentees without being prescriptive (Cothran et al., 2008). Ensuring mentors are qualified and trained will be a challenge for implementation of the POPFASD intervention.

7.9 Implications for Research: Addressing Recruitment

Study findings indicate there are issues related to recruitment of students that need to be considered in future research on the professional development program.

Recruitment was the biggest challenge and limitation of this study affecting the sample size, statistical analysis, and interpretation of findings. Challenges encountered during recruitment of students with FASD included lack of medical diagnoses and locating diagnosed students. It was anticipated that there would be sufficient students diagnosed with FASD within the school district; however, in spite of suspicion of FASD being documented in many students' school files, those students had no medical diagnosis. Recruitment through a local paediatrician who is experienced in diagnosis of FASD appeared to be a solution; however, many of the physician's patients had changed addresses making contact with their current caregiver difficult. Turnover of caseworkers within BC MCFD meant locating the right caseworker for a student in care was a difficult

and time consuming process. Such challenges negatively affected recruitment of students diagnosed with FASD for the study.

Half of the students participating in this study experienced a change in home environment or caregiver during the one year study period which indicated power calculations for future studies will need to consider the percentage likely to experience a disruptive event during the study. Findings from this study suggest a sample size 1.5 times what is needed to achieve the desired statistical power should be recruited. There are three strategies future researchers can use to address these recruitment challenges: waiting until more students have been diagnosed, broader recruitment, and involving BC MCFD in the planning and recruitment stage of the study.

Establishment of the CDBC assessment teams in 2006 increased the number of children being assessed for FASD in BC each year. With CDBC teams operating, there is a larger population of students diagnosed with FASD. Allowing more time to pass before embarking on an experimental study with students diagnosed with FASD will result in a larger population from which to recruit students.

Locating students diagnosed with FASD will remain a challenging and time-consuming task because of the mobility of their families. The mobility challenge requires a broader recruitment strategy than the strategy used in this study. The two recruitment strategies used in this study, distribution of consent forms through the local paediatrician and targeted recruitment of schools and teachers, did not yield a sufficient number of students diagnosed with FASD. Future studies should consider advertising for research participants by posting notices at agencies families are likely to access, e-mailing notices over listservs, and printing notices in relevant newsletters and media outlets. By

initiating a public recruitment campaign, future studies will be more likely to locate students who have moved since their diagnosis or whose caregiver has not notified the school of his or her child's diagnosis.

Students with FASD are known to be at high risk for foster care involvement (Streissguth & Kanter, 1997); therefore, including a representative from BC MCFD in the planning and recruitment stages of the study should help address any difficulties encountered with finding the right case worker for an eligible student. A BC MCFD representative would be familiar with the day-to-day running of the local agency and could advise a research committee about the best way to locate case workers and maintain communication with them throughout a study. Through implementation of the three strategies described in this section, future studies should be able to avoid many of the recruitment challenges experienced in this study.

7.10 Summary

Study findings support the use of the professional development program to assist elementary school teachers working with students with FASD; however, the study limitations undermined efforts to demonstrate the effectiveness of the intervention. Using qualitative descriptive methods, teachers and principals reported the intervention affected the behaviour and academic performance of students with FASD but only changes in behaviour were found to be statistically significant based on the quasi-experimental methods. Quasi-experimental findings are limited by the inadequate sample size and threats to the internal and external validity of the study. Including caregivers, BC MCFD case workers, and all school staff in the intervention would likely strengthen its effect. Results indicate a BC school district with a mix of urban and rural schools may

be able to afford the professional development program and implement it as planned. As with prior research, this study indicates alterations in the environment of a student with FASD may improve his or her behaviour.

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Appendix A: K.L.N. Form

What I **K**now	What I **L**earned	What I **N**eed to Know

Current Resources:

Major issues/Problem areas:

Appendix B: L.E.I.C. Observation/Planning Page

LEARNER **Who is this Learner?**	
Chronological Age:	
Perceived **Developmental/** **Functional Ages:** (use classroom observation; if available, include formal assessment on a separate page)	Social-emotional: _____ Physical: _____ Receptive language: _____ Expressive language: _____ Reading: _____ Writing: _____ Math: _____ Life skills: _____ Other: _____
Strengths:	
Learning Style:	
Interests:	
Other pertinent info: (eg.cultural/community/health)	

Expectations of child in the Environment	**Requirements of the child's brain to meet expectations** ⇨	**SUSPECTED PRIMARY DISABILITIES**

Poor Fit? (ie problem behaviours) If "yes", then accommodations are needed

Secondary Disabilities/Behaviours	**Setting**: What, when, where, how often?

ACCOMMODATIONS		
ENVIRONMENT	**INSTRUCTION**	**CURRICULUM**

Note: this planning sheet is designed for those who have had current training. Please view the eLearning modules on the website: www.fasdoutreach.ca and contact your POPFASD District Partner .

POPFASD Draft 18R – April 25, 2007

Appendix C: Student Assent Form

University of British Columbia
c/o UNBC Room 9-387
3333 University Way
Prince George, BC, V2N 4Z9

Student Assent Form

Date: Monday, April 28, 2008

Researchers:

Dr. Anne George	UBC Faculty of Medicine	phone (250)960-5157
Kathi Hughes and	Ministry of Education Provincial	phone (250)564-6574
Stacey Wakabayashi	Outreach Program for FASD	phone (250)564-6574
Dr. Cindy Hardy	UNBC Psychology Program	phone (250)960-5814
Dr. Peter MacMillan	UNBC Education Program	phone (250)960-5828
Erica Clark	UBC Faculty of Medicine	phone (250)960-6705

Project title: Students with Fetal Alcohol Spectrum Disorder (FASD): Adapting environments, instruction and curriculum to improve their school experience

Purpose:

You are invited to be in a research study. We want to know if a new teaching program works. The new program will help your teacher make it easier for you to learn in the classroom. We are testing the program in your school.

We want to know if the new program,

1. Helps you learn better,
2. Makes you like school better,
3. Makes your parents like your school better,
4. Make it easier for you teacher to teach you.

How the study works:

There are classrooms in seven schools in Prince George testing the new program. To find out if the program works we are doing the new program in half of the classrooms. The other half does not get the program. We will watch what happens in all of the classrooms for one year. We want to see if there are differences in the classrooms that have the new program.

To find out if the new program makes a difference we will look at behaviour, learning, and how happy people are.

We will,

1. Ask you to do a test four times during the year. The test looks at how much you are learning,
2. Ask your teacher how students in your class behave,

3. Have a person called a research assistant come into your class and watch how everyone behaves,
4. Ask some of the students in your class how happy they are at school,
5. Ask some parents how happy they are with the school, and
6. Ask your teacher how happy they are with school.

If you do not want to be in this study you will not do any of the tests. The research assistant will not watch your behaviour in the classroom. You will do other school work while students in the study do the tests.

Keeping your information private:
All of the information we get will be kept in a locked room. Only the researchers will be able to get into the room. We will keep the names of everyone in the study private.

Asking questions:
If you have any questions you can phone Anne. You can also phone Kathi, Stacey, Cindy, Peter, or Erica. Their numbers are at the top of this letter.

Things that could go wrong:
You might be better off doing other school work instead of writing our tests. The new program we are looking at might not work.

If the program works:
If the program works we can use it to help everyone learn better.

You can go to a presentation at the end of this study. At the presentation you will learn about the results of the study. When the study is done you will be told if the new program worked.

Assent
It is your choice to be in this study. You can stop being in the study at any time. If you stop things will not change at school.

When you sign your name you are agreeing to be in the study.

_____
Sign your name here Date

_____
Print your name here

Appendix D: Caregiver Consent

University of British
Columbia
c/o UNBC Room 9-367
3333 University Way
Prince George, BC, V2N 4Z9

Parent or Guardian Consent Form

Date: Monday, April 28, 2008

Researchers:

Dr. Anne George	UBC Faculty of Medicine	phone (250)960-5157
Kathi Hughes and	Ministry of Education Provincial	phone (250)564-6574
Stacey Wakabayashi	Outreach Program for FASD	phone (250)564-6574
Dr. Cindy Hardy	UNBC Psychology Program	phone (250)960-5814
Dr. Peter MacMillan	UNBC Education Program	phone (250)960-5828
Erica Clark	UBC Faculty of Medicine	phone (250)960-6705

Project title: Students with Fetal Alcohol Spectrum Disorder (FASD): Adapting environments, instruction and curriculum to improve their school experience

Sponsor:
This study was funded by the Victoria Foundation FASD Action Fund.

Purpose:
You and your child have been invited to participate in this study. The study assesses a new program that trains teachers. The program will help make the classroom environment better for students in grades 1-7 so they can learn better. We want to know if training the teachers makes things better for all students.

Our purposes are

5. For students with FASD to:
    a. Improve learning,
    b. Decrease disruptive behaviour in the classroom, and
    c. Increase satisfaction with school
6. For all students to:
    a. Improve learning, and
    b. Decrease disruptive behaviour in the classroom.
7. For parents to: improve satisfaction with their child's school experience.

We are inviting the whole classroom to participate in this study. We want to know if helping students with FASD makes the classroom environment better for everyone in the class.

Study Procedures:
You and your child are been invited to participate because he/she is in one of the classrooms selected for the study. School District No. 57 selected seven schools for this project. Each school has two classrooms participating in the study. One classroom gets the new program and the other does not. Classrooms getting the program were randomly selected so everyone had the same chance to get the new program. All the classrooms complete the same measures to see if there is a difference between the classrooms that do and do not get the new program. When the study is done the new program will be offered to teachers and students that did not get it during the study.

We want to find out if the new program helps teachers teach better. To do this we need to see if the classroom behaviour gets better and your child learns more. We also want to know if the program makes you and your child happier with the school. To do this we need to measure,

1. Learning: All students will complete the Curriculum Based Measurement (CBM) to find out if learning improves. The CBM will be used four times during the study and it takes your child about 10 minutes to complete the pen and paper test. The CBM is already used by School District No. 57 to measure learning.

2. Disruptive behaviour: Information will be collected in two ways. No time will be taken from your child's school work to collect the information.

    a. The classroom teacher will complete the Behavioural Assessment System for Children (BASC-2) to describe behaviour of children with FASD in the classroom. School District 57 already uses this pen and paper survey to look at student behaviour.

    b. A research assistant will watch classroom behaviour four times during the study. The research assistant uses the BASC-2 Student Observation System (SOS) to describe the behaviour of children with FASD in the classroom.

3. Student satisfaction: Some of the children will complete a 30 minute interview at the end of the study. The interview is about how satisfied they are with their school experience. The interview will be done with a research assistant. All of the interviews will be tape recorded.

4. Parent/guardian satisfaction: Some of the parents/guardians will complete a 30 minute interview at the end of the study. The interview is about how satisfied you are with your child's school experience. The interview will be done with a research assistant. All of the interviews will be tape recorded.

If you do not want your child to be in this study he/she will not do any of the measures. The research assistant will not watch his/her behaviour in the classroom. Your child will do other school work while students participating in the study are doing the measures.

If you do not return this consent form a researcher will phone you to see if you have any questions.

Confidentiality:
The computer and all information (surveys, tests, classroom observation forms, audio tapes) collected for this study will be kept in a locked office at UNBC. Only the researchers will have access to the office. All students, teachers, and parents in the study will be identified by code numbers. No names will be put in the computer.

When results from the study are reported the seven schools will be identified. No names (parent, teacher or student) will be used. It will not be possible to find out who participated in the study. The information collected for this study will be destroyed when the final report is done.

Contact for information about the study:
The Principal Investigator for this study is Dr. Anne George from the UBC Faculty of Medicine. If you have any questions about this study you can contact Dr. Anne George at 250-960-5157. You can also contact any of the other researchers (Kathi Hughes, Stacey Wakabayashi, Dr. Cindy Hardy, Dr. Peter MacMillan, or Erica Clark) whose numbers are the top of the letter.

Contact for concerns about the rights of research subjects:
If you have any concerns about your treatment or rights as a research subject, you may contact the Research Subject Information Line in the UBC Office of Research Services at 604-822-8598 or if long distance e-mail to RSIL@ors.ubc.ca.

This study is part of Erica Clark's thesis for her PhD with the UBC Faculty of Medicine. At the end of the study Erica will write a report that will explain whether or not the program worked. The report will be given to School District 57 and the Ministry of Education. The report will help them decide whether or not they want to use the program in more schools.

Potential Risks:
The time your child spends doing the measures (40 minutes total) may be better spent focusing on his/her schoolwork. Care has been taken to select a test that is quick to keep the amount of time away from school work at a minimum. There is a risk that disruptive behaviour in the classroom may increase and learning for your child may decrease during the study. Learning and behaviour are being monitored during the study so teachers can deal with any problems quickly.

Potential Benefits:
If the program works, School District No. 57 and the Ministry of Education can use it in other schools. The program will make it is easier for everyone to learn and focus on their schoolwork.

You can go to a presentation at the end of this study. At the presentation you will learn about the results of the study. The results will also be written in reports and published.

Consent:
Your child's participation in this study is voluntary. Your child can stop participating at any time. The health, social and education services your child receives will not be affected. If you stop participating in the study your child's information will be destroyed.

Your signature below indicates that you have received a copy of this consent form for your own records.

I agree to my child _____(print name) participating.

☐ **Yes** ☐ **No** (check one)

I agree to participate in the study.

☐ **Yes** ☐ **No** (check one)

_____
Signature of Parent or Guardian Date

_____
Printed Name of the Parent or Guardian signing above

Appendix E: Teacher Consents

University of British Columbia
c/o UNBC Room 9-387
3333 University Way
Prince George, BC, V2N 4Z9

Teacher Consent Form

Date: Wednesday, April 9, 2008

Researchers:

Dr. Anne George	UBC Faculty of Medicine	phone (250)960-5157
Kathi Hughes and	Ministry of Education Provincial	phone (250)564-6574
Stacey Wakabayashi	Outreach Program for FASD	phone (250)564-6574
Dr. Cindy Hardy	UNBC Psychology Program	phone (250)960-5814
Dr. Peter MacMillan	UNBC Education Program	phone (250)960-5828
Erica Clark	UBC Faculty of Medicine	phone (250)960-6705

Project title: Students with Fetal Alcohol Spectrum Disorder (FASD): Adapting environments, instruction and curriculum to improve their school experience

Sponsor:
This study was funded by the Victoria Foundation FASD Action Fund.

Purpose:
You have been invited to participate in a study looking whether a new program to help teachers for grades 1 to 7 works. The program helps teachers find ways to make the classroom environment a better fit for students so they can learn better. The program is for teachers and we will be measuring the effects of it on the students.

The purpose of the study is to find out if the new program,

1. Improves academic achievement for students affected by FASD,
2. Improves academic achievement for all students in the classroom,
3. Improves the satisfaction of students affected by FASD with their school experience,
4. Improves the satisfaction of parents dealing with FASD with their child's school experience, and
5. Decreases disruptive behaviour for students affected by FASD.

Study Procedures:
You have been invited to participate in this study because you will be teaching grades 1-7 at one of the schools participating in the study. School District No. 57 selected seven schools for this project. Each school has two classrooms participating in the study. One classroom gets the new program and the other does not. Classrooms getting the program

were randomly selected so everyone had the same chance to get the new program. All the classrooms complete the same measures to see if there is a difference between the classrooms that do and do not get the new program. When the study is done the new program will be offered to teachers and students that did not get it during the study.

This is a study examining the effectiveness of a new program to help teachers working with students affected by FASD. The new program has never been tested before. To test it we need to measure,

1. Learning: All students will complete the Curriculum Based Measurement (CBM) to find out if learning improves. The CBM will be used four times during the study and it takes students about 10 minutes to complete the test. The CBM is already used by School District No. 57 to measure learning. The CBM will be administered by a research assistant. You will be asked to complete the British Columbia Performance Assessment for reading, writing and math for students affected by FASD in your classroom. It will take you about 20 minutes to complete this assessment for each student.

2. Disruptive behaviour: You will complete the Behavioral Assessment System for Children (BASC-2) to describe the behaviour of students affected by FASD in your classroom. School District 57 already uses this pen and paper survey to assess student behaviour. It will take about 20 minutes to complete this survey. A research assistant will watch classroom behaviour four times during the study. The research assistant uses the BASC-2 Student Observation System (SOS) to describe the behaviour of some students in your classroom.

3. Student satisfaction: Students complete a 30 minute interview at the end of the study. The interview is about how satisfied they are with their school experience.

4. Parent satisfaction: Parents complete a 30 minute interview at the end of the study. The interview is about how satisfied you are with your child's school experience.

You will be released from the classroom to complete the student assessments. It may take you up to 2 hours to complete the student assessments. The assessments will be done four times during the study (May 2008, October 2008, January 2009, May 2009). You may spend a total of 8 hours doing student assessments during the study.

Teachers selected to receive the new program will be released from the classroom in the spring of 2008 for two days of training. During the 2008/2009 school year there may be up to four half days of additional training.

If you do not want to be in this study your classroom will not be included.

Confidentiality:
The computer and all information (surveys, tests, classroom observation forms, audio tapes) collected for this study will be kept in a locked office at UNBC. Only the researchers will have access to the office. All students, teachers, and parents in the study will be identified by code numbers. No names will be put in the computer.

When results from the study are reported the seven schools will be identified. No names (parent, teacher or student) will be used. It will not be possible to find out who participated in the study. The information collected for this study will be destroyed when the final report is done.

Contact for information about the study:
The Principal Investigator for this study is Dr. Anne George from the UBC Faculty of Medicine. If you have any questions about this study you can contact Dr. Anne George at 250-960-5157. You can also contact any of the other researchers (Kathi Hughes, Stacey Wakabayashi, Dr. Cindy Hardy, Dr. Peter MacMillan, or Erica Clark) whose numbers are at the top of the letter.

Contact for concerns about the rights of research subjects:
If you have any concerns about your treatment or rights as a research subject, you may contact the Research Subject Information Line in the UBC Office of Research Services at 604-822-8598 or if long distance e-mail to RSIL@ors.ubc.ca.

This study is part of Erica Clark's thesis for her PhD with the UBC Faculty of Medicine. At the end of the study Erica will write a report that will explain whether or not the program worked. The report will be given to School District 57 and the Ministry of Education. The report will help them decide whether or not they want to use the program in more schools.

Potential Risks:
The time you spend completing the student assessments may be better spent teaching in the classroom. There is a risk that disruptive behaviour in the classroom may increase and learning may decrease during the study. Learning and behaviour are being monitored during the study so any problems can be dealt with quickly.

Potential Benefits:
If the program works, School District No. 57 and the Ministry of Education can use it in other schools. The program will make it is easier for everyone to learn and focus on their schoolwork.

You can go to a presentation at the end of this study. At the presentation you will learn about the results of the study.

Consent:
Your participation in this study is voluntary. You may stop participating at any time without jeopardy to your employment with School District No. 57.

Your signature below indicates that you have received a copy of this consent form for your own records.

Your signature indicates that you consent to participation in this study.

_____

Signature of Teacher Date

_____

Printed Name of Teacher signing above

University of British Columbia
c/o UNBC Room 9-387
3333 University Way
Prince George, BC, V2N 4Z9

Teacher Follow Up Consent Form

Date: Monday, May 10, 2010

Researchers:

Dr. Anne George	UBC Faculty of Medicine	phone (250)960-5157
Kathi Hughes and	Ministry of Education Provincial	phone (250)564-6574
Stacey Wakabayashi	Outreach Program for FASD	phone (250)564-6574
Dr. Cindy Hardy	UNBC Psychology Program	phone (250)960-5814
Dr. Peter MacMillan	UNBC Education Program	phone (250)960-5828
Erica Clark	UBC Faculty of Medicine	phone (250)960-6705

Project title:

Students with Fetal Alcohol Spectrum Disorder (FASD): Adapting environments, instruction and curriculum to improve their school experience

Sponsor:

This study was funded by the Victoria Foundation FASD Action Fund.

Purpose:

You have been invited to participate in a follow up interview because you were one of the teachers receiving the intervention. The program helped teachers find ways to make the classroom environment a better fit for students with FASD so they can learn better. We are interested in finding out if there were any residual effects from the intervention.

The purpose of the study was to find out if the new program,

8. improved academic achievement for students affected by FASD,
9. improved academic achievement for all students in the classroom,
10. improved the satisfaction of students affected by FASD with their school experience,
11. improved the satisfaction of parents dealing with FASD with their child's school experience,
12. decreased disruptive behaviour for students affected by FASD.

Study Procedures:

You have been invited to participate in a follow up interview because you were one of the teachers receiving the intervention. If you agree to participate you will be contacted by a researcher to arrange an interview time. The interview will take about one hour and you will be asked questions about the long term effects of the intervention. You will be given a $10 gift card from Tim Hortons as appreciation for your participation. Participation is voluntary and you can choose whether or not to participate in the follow up interview.

Confidentiality:

The computer and all information (surveys, tests, classroom observation forms, audio tapes) collected for this study will be kept in a locked filing cabinet at UNBC. Only the researchers will have access to the filing cabinet. All students, teachers, and parents in the study will be identified by code numbers. No names will be put in the computer.

When results from the study are published the schools will not be identified in the report. No names (parent, student, teacher, or principal) will be used. It will not be possible to find out who participated in the study. The information collected for this study will be destroyed when the final report is done.

Contact for information about the study:

The Principal Investigator for this study is Dr. Anne George from the UBC Faculty of Medicine. If you have any questions about this study you can contact Dr. Anne George at 250-960-5157. You can also contact any of the other researchers (Kathi Hughes, Stacey Wakabayashi, Dr. Cindy Hardy, Dr. Peter MacMillan, or Erica Clark) whose numbers are at the top of the letter.

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This study is part of Erica Clark's thesis for her PhD with the UBC Faculty of Medicine. At the end of the study Erica will write a report that will describe how successful the program was. The report will be given to School District 57 and the Ministry of Education. The report will help them decide whether or not they want to use the program in more schools.

Potential Risks:

You may not be comfortable answering one or more of the questions. It is your choice to answer any or all of the questions.

Potential Benefits:

If the program works, School District No. 57 and the Ministry of Education can use it in other schools. The program will make it is easier for everyone to learn and focus on their schoolwork.

You can go to a presentation at the end of this study. At the presentation you will learn about the results of the study.

Consent:

Your participation in this study is voluntary. You may stop participating at any time without jeopardy to your employment with School District No. 57.

Your signature below indicates that you have received a copy of this consent form for your own records.

Your signature indicates that you consent to participation in this study.

_____

Signature of Teacher Date

_____

Printed Name of Teacher signing above

Appendix F: Telephone Script for Parents

Hello, my name is Erica Clark and I'm calling about the research project that will be taking place in your child's classroom. We want to know if a new program to help teachers work with students affected by Fetal Alcohol Spectrum Disorder makes school better for everyone. You should have received some information about this research project in the mail recently and I want to know if you have any questions. Is this a good time to talk to you?

[If no] When would be a better time for me to call you back?

Date: _____ Time: _____

Thank you for your time.

[If yes] Thank you for taking the time to talk to me.

Do you remember getting information about this research project in the mail?

[If no] Would you like me to send the information to you again? Would you like me to explain the research project to you now?

[If yes] Do you have any questions about the information? Would you like me to explain the information that was sent to you?

[If request explanation of research project]
We are looking at a new program to help teachers in grades 1 to 7. The program helps teachers make the classroom environment better for students so they can learn better. The new program teaches teachers how to help students with FASD. This should make the classroom better for all students.

The purpose of the study is to find out if the new program works. We are going to see if learning and classroom behaviour for all students improves. We are also going to see if it makes students and parents more satisfied with the school.

School District No. 57 selected seven schools for this project. Each school has two classrooms participating in the study. One classroom gets the new program and the other does not. Classrooms getting the program were randomly selected so everyone had the same chance to get the new program. All the classrooms complete the same measures to see if there is a difference between the classrooms that do and do not get the new program. When the study is done the new program will be offered to teachers and students that did not get it during the study.

We are trying to evaluate the teacher but need to look at the students to see if what the teachers are learning is working. To do this we need to see if the classroom behaviour

gets better and your child learns more. We also want to know if the program makes you and your child happier with the school. To do this we need to collect some information.

To find out if learning improves we will ask your child to complete a test called the Curriculum Based Measurement or CBM four times during the study. It will take your child 10 minutes to complete the test each time.

To find out if behaviour improves we will collect information two different ways. First, we will ask the teacher to complete a survey to describe your child's behaviour in the classroom. This survey is called the Behavioral Assessment System for Children or BASC-2 Teacher Rating Scale. Second, we will have a research assistant watch the behaviour in the classroom four times during the study. The research assistant will record what they see using the BASC-2 Student Observation System. No time will be taken from your child's school work to collect any of the information on behaviour.

To find out if students and parents are more satisfied with the school we will ask some people to do an interview with a research assistant. The interview will take about half an hour for students and about half an hour for parents. We will be tape recording all of the interviews.

If you do not want your child to be in this study he/she will not do any of the measures. The research assistant will not watch his/her behaviour in the classroom. Your child will do other school work while students participating in the study are doing the measures. If your child is sent to the office during the research project it will be counted even if your child is not participating.

Do you have any questions?

[If no]
If you think of any(more) questions later you can call me at 960-6705.

If you would like your child to participate in the study you need to sign the consent form and mail it back to me.

If you have lost the consent form I mailed to you I can mail another one to you or do it on the phone with you. Which would you prefer?

[request another consent form mailed out]
Could you please give me your mailing address?

Thank you for your time. Good by.

[request verbal consent]
I have already explained what we are doing for the study but there are a few more important things I need to tell you.

We keep all the information in this study confidential. The computer we use an all of the information we collect will be kept in a locked office at UNBC. Only the researchers will have access to the office. All students, teachers, and parents in the study will be identified by code numbers. No names will be put in the computer.

When results from the study are reported the seven schools will be identified. No names (parent, teacher or student) will be used. It will not be possible to find out who participated in the study. The information collected for this study will be destroyed when the final report is done.

The Principal Investigator for this study is Dr. Anne George from the UBC Faculty of Medicine. If you have any questions about this study you can contact Dr. Anne George at 250-960-5157. You can also contact any of the other researchers. They are Kathi Hughes, Stacey Wakabayashi, Dr. Cindy Hardy, Dr. Peter MacMillan, and I. My name is Erica Clark and my phone number is 960-6705.

If you have any concerns about your treatment or rights as a research subject, you may contact the Research Subject Information Line in the UBC Office of Research Services at 604-822-8598 or if long distance e-mail to RSIL@ors.ubc.ca.

This study is part of my thesis for her PhD with the UBC Faculty of Medicine. At the end of the study I will write a report that will explain whether or not the program worked. The report will be given to School District 57 and the Ministry of Education. The report will help them decide whether or not they want to use the program in more schools. I will not use any names in the report.

There are always potential risks and benefits to participating in a study

The risk is that the time your child spends doing the measures (40 minutes total) may be better spent focusing on his/her schoolwork. Care has been taken to select a test that is quick to keep the amount of time away from school work at a minimum. There is also a risk that disruptive behaviour in the classroom may increase and learning for your child may decrease during the study. Learning and behaviour are being monitored during the study so teachers can deal with any problems quickly.

The benefit is that if the program works, School District No. 57 and the Ministry of Education can use it in other schools. The program will make it is easier for everyone to learn and focus on their schoolwork.

You can go to a presentation at the end of this study. At the presentation you will learn about the results of the study.

Your child's participation in this study is voluntary. Your child can stop participating at any time. Your child's education will not be affected. If you stop participating in the study your child's information will be destroyed.

Do you have any questions about what I have told you?

[if no]
Do you consent to your child participating in the study?

YES NO (circle one)

Do you consent to participating in the study?

YES NO (circle one)

What is your first and last name? _____

I would like to confirm that I have the right mailing address for you:

_____

_____

_____

Is [insert number] the best number to call you at?

We would still like to get a signed copy of the consent form from you. I am going to mail you another consent form along with a self addressed return envelope. Please sign and return the consent form.

Thank you for your time. Good bye.

Appendix G: FASD Identification Form

University of British Columbia
c/o UNBC Room 9-387
3333 University Way
Prince George, BC, V2N 4Z9

FASD Identification Form

Date: [DATE]

Researchers:

Dr. Anne George	UBC Faculty of Medicine	phone (250)960-5157
Kathi Hughes and	Ministry of Education Provincial	phone (250)564-6574
Stacey Wakabayashi	Outreach Program	phone (250)564-6574
Dr. Cindy Hardy	UNBC Psychology Program	phone (250)960-5814
Dr. Peter MacMillan	UNBC Education Program	phone (250)960-5828
Erica Clark	UBC Faculty of Medicine	phone (250)960-6705

Project title: Students with Fetal Alcohol Spectrum Disorder (FASD): Adapting environments, instruction and curriculum to improve their school experience

Thank you for agreeing to participate in this study. We are looking at a new program to help teachers in grades 4 to 7. The program helps teachers make the classroom environment better for students so they can learn better. The new program helps teachers find new ways to help students with FASD in the classroom. We need to know which students have FASD so we can help the teachers find new ways to work with them. Half of the students with FASD will get the new program in September 2008 and the other half will get it in September 2009.

To find out if the new program works we need to know if it helps students with FASD. We also want to know if it helps all the other students in the class too. To find out if the new program works for students with FASD we need to know who has FASD. We are sending this letter to all parents in this study. We are asking for your help in identifying if your child has FASD.

We know that there are students in the class that have other disabilities. We do not want the new program to interfere with the plans that have already been made to help children with other disabilities. We are just including students that do not have a disability and students that have FASD.

Confidentiality:
We tell the teacher which students have FASD so they can use the new program with them. We will not tell the other students in the class who has FASD. We will not tell any parents or guardians who has FASD.

At the end of the study we will tell people if the new program worked. We will not tell anyone the names of the people in the study. We will not tell anyone who had FASD in the study.

Contact for information about the study:
The Principal Investigator for this study is Dr. Anne George from the UBC Faculty of Medicine. If you have any questions about this study you can contact Dr. Anne George at 250-960-5157. You can also contact any of the other researchers (Kathi Hughes, Stacey Wakabayashi, Dr. Cindy Hardy, Dr. Peter MacMillan, or Erica Clark) whose numbers are the top of the letter.

Contact for concerns about the rights of research subjects:
If you have any concerns about your treatment or rights as a research subject, you may contact the Research Subject Information Line in the UBC Office of Research Services at 604-822-8598 or if long distance e-mail to RSIL@ors.ubc.ca.

Potential Risks:
The new program might not help your child.

Potential Benefits:
If the program works, School District No. 57 and the Ministry of Education can use it in other schools. The program will make it is easier for everyone to learn and focus on their schoolwork.

You can go to a presentation at the end of this study. At the presentation you will learn about the results of the study.

Consent:

Your signature below indicates that you have received a copy of this FASD identification form for your own records.

It is your choice to identify if your child has FASD. You do not need to tell us if you do not want to.

My child _____(print name) has FASD.

☐ **Yes** ☐ **No** (check one)

_____
Signature of Parent or Guardian Date

_____
Printed Name of the Parent or Guardian signing above

Appendix H: Principal Consents

University of British Columbia
c/o UNBC Room 9-387
3333 University Way
Prince George, BC, V2N 4Z9

Principal Consent Form

Date: Wednesday, April 9, 2008

Researchers:

Dr. Anne George	UBC Faculty of Medicine	phone (250)960-5157
Kathi Hughes and	Ministry of Education Provincial	phone (250)564-6574
Stacey Wakabayashi	Outreach Program for FASD	phone (250)564-6574
Dr. Cindy Hardy	UNBC Psychology Program	phone (250)960-5814
Dr. Peter MacMillan	UNBC Education Program	phone (250)960-5828
Erica Clark	UBC Faculty of Medicine	phone (250)960-6705

Project title: Students with Fetal Alcohol Spectrum Disorder (FASD): Adapting environments, instruction and curriculum to improve their school experience

Sponsor:
This study was funded by the Victoria Foundation FASD Action Fund.

Purpose:
You have been invited to participate in a study looking whether a new program to help teachers for grades 4 to 7 works. The program helps teachers find ways to make the classroom environment a better fit for students so they can learn better. The program is for teachers and we will be measuring the effects of it on the students.

The purpose of the study is to find out if the new program,

1. Improves academic achievement for students affected by FASD,
2. Improves academic achievement for all students in the classroom,
3. Improves the satisfaction of students affected by FASD with their school experience,
4. Improves the satisfaction of parents dealing with FASD with their child's school experience,
5. Decreases disruptive behaviour for students affected by FASD,

Study Procedures:
You have been invited to participate in this study because you are the principal at one of the schools participating in the study. School District No. 57 selected seven schools for this project. Each school has two classrooms participating in the study. One classroom gets the new program and the other does not. Classrooms getting the program were randomly selected so everyone had the same chance to get the new program. All the

classrooms complete the same measures to see if there is a difference between the classrooms that do and do not get the new program. When the study is done the new program will be offered to teachers and students that did not get it during the study.

This is a study examining the effectiveness of a new program to help teachers working with students affected by FASD. The new program has never been tested before. To test it we need to measure,

1. Learning: All students will complete the Curriculum Based Measurement (CBM) to find out if learning improves. The CBM will be used four times during the study and it takes students about 10 minutes to complete the test. The CBM is already used by School District No. 57 to measure learning. The CBM will be administered by a research assistant. Teachers will be asked to complete the British Columbia Performance Assessment for reading, writing and math for students affected by FASD in their classroom. It will take teachers about 20 minutes to complete this assessment for each student.

2. Disruptive behaviour: Teachers will complete the Behavioral Assessment System for Children (BASC-2) to describe the behaviour of students affected by FASD in their classroom. School District 57 already uses this pen and paper survey to assess student behaviour. It will take about 20 minutes to complete this survey. A research assistant will watch classroom behaviour four times during the study. The research assistant uses the BASC-2 Student Observation System (SOS) to describe the behaviour of some students in each classroom.

3. Student satisfaction: Students complete a 30 minute interview at the end of the study. The interview is about how satisfied they are with their school experience.

4. Parent satisfaction: Parents complete a 30 minute interview at the end of the study. The interview is about how satisfied you are with your child's school experience.

Teachers will be released from the classroom to complete the student assessments. It may take each teacher up to 2 hours to complete the student assessments. The assessments will be done four times during the study (May 2008, October 2008, January 2009, May 2009). Each teacher may spend a total of 8 hours doing student assessments during the study.

Teachers selected to receive the new program will be released from the classroom in the spring of 2008 for two days of training. During the 2008/2009 school year there may be up to four half days of additional training.

If you do not want to be in this study your school will not be included.

Confidentiality:
The computer and all information (surveys, tests, classroom observation forms, audio tapes) collected for this study will be kept in a locked office at UNBC. Only the researchers will have access to the office. All students, teachers, and parents in the study will be identified by code numbers. No names will be put in the computer.

When results from the study are reported the seven schools will be identified. No names (parent, teacher or student) will be used. It will not be possible to find out who participated in the study. The information collected for this study will be destroyed when the final report is done.

Contact for information about the study:
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This study is part of Erica Clark's thesis for her PhD with the UBC Faculty of Medicine. At the end of the study Erica will write a report that will explain whether or not the program worked. The report will be given to School District 57 and the Ministry of Education. The report will help them decide whether or not they want to use the program in more schools.

Potential Risks:
The time you spend completing the student assessments may be better spent teaching in the classroom. There is a risk that disruptive behaviour in the classroom may increase and learning may decrease during the study. Learning and behaviour are being monitored during the study so any problems can be dealt with quickly.

Potential Benefits:
If the program works, School District No. 57 and the Ministry of Education can use it in other schools. The program will make it is easier for everyone to learn and focus on their schoolwork.

You can go to a presentation at the end of this study. At the presentation you will learn about the results of the study.

Consent:
Your participation in this study is voluntary. You may stop participating at any time without jeopardy to your employment with School District No. 57.

Your signature below indicates that you have received a copy of this consent form for your own records.

Your signature indicates that you consent to participation in this study.

_____

Signature of Principal Date

_____

Printed Name of Principal signing above

University of British Columbia
c/o UNBC Room 9-387
3333 University Way
Prince George, BC, V2N 4Z9

Principal Follow Up Consent Form

Date: Monday, May 10, 2010

Researchers:

Dr. Anne George	UBC Faculty of Medicine	phone (250)960-5157
Kathi Hughes and	Ministry of Education Provincial	phone (250)564-6574
Stacey Wakabayashi	Outreach Program for FASD	phone (250)564-6574
Dr. Cindy Hardy	UNBC Psychology Program	phone (250)960-5814
Dr. Peter MacMillan	UNBC Education Program	phone (250)960-5828
Erica Clark	UBC Faculty of Medicine	phone (250)960-6705

Project title:

Students with Fetal Alcohol Spectrum Disorder (FASD): Adapting environments, instruction and curriculum to improve their school experience

Sponsor:

This study was funded by the Victoria Foundation FASD Action Fund.

Purpose:

An intervention was offered in your school last year to help teachers with students affected by FASD. The intervention has been studied to find out how successful it was. You have been invited to participate in a follow up interview to find out if there were any residual effects from the intervention.

The purpose of the study was to find out if the new program:

1. improved academic achievement for students affected by FASD,
2. improved academic achievement for all students in the classroom,
3. improved the satisfaction of students affected by FASD with their school experience,
4. improved the satisfaction of parents dealing with FASD with their child's school experience, and
5. decreased disruptive behaviour for students affected by FASD.

Study Procedures:

You have been invited to participate in a follow up interview because you are the principal at one of the schools that had an intervention classroom in the study. If you agree to participate you will be contacted by a researcher to arrange an interview time. The interview will take about 30 minutes and include questions about any residual effects from the intervention. You will be given a $10 gift card from Tim Hortons as appreciation for your participation. Participation is strictly voluntary and you can choose whether or not to participate in the follow up interview.

Confidentiality:

The computer and all information (surveys, tests, classroom observation forms, audio tapes) collected for this study are kept in a locked filing cabinet at UNBC. Only the researchers have access to the filing cabinet. All students, teachers, parents, and principals in the study are identified by code numbers. No names are put in the computer.

When results from the study are published the schools will not be identified in the report. No names (parent, teacher, student, or principal) will be used. It will not be possible to find out who participated in the study. The information collected for this study will be destroyed when the final report is done.

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This study is part of Erica Clark's dissertation for her PhD with the UBC Faculty of Medicine. At the end of the study Erica will write a report describing how successful the program was. The report will be given to School District 57 and the Ministry of Education. The report will help them decide whether or not they want to use the program in more schools.

Potential Risks:

You may not be comfortable answering one or more of the questions. It is your choice to answer any or all of the questions.

Potential Benefits:

If the program works, School District No. 57 and the Ministry of Education can use it in other schools. The program will make it is easier for everyone to learn and focus on their schoolwork.

You can go to a presentation at the end of this study. At the presentation you will learn about the results of the study.

Consent:

Your participation in this study is voluntary. You may stop participating at any time without jeopardy to your employment with School District No. 57.

Your signature below indicates that you have received a copy of this consent form for your own records.

Your signature indicates that you consent to participation in this study.

_____

Signature of Principal Date

_____

Printed Name of Principal signing above

Appendix I: Teacher Interview Guide

Classroom Strategies Interview

Thank you for taking the time to meet with me. I'm interested in learning about some of the strategies you used during the year when you were faced with disruptive behaviour in the classroom.

1. What types of disruptive behaviour have you experienced in the classroom this past year?
2. What are some of the strategies you used to deal with that behaviour?
3. Which strategies did you find the most successful?
4. Which strategies did you find the least successful?
5. Did you have mixed results with some of the strategies? Why?
6. Are there any supports or resources that you find helpful when dealing with disruptive behaviour? These could be people, books, courses, etc.
7. Are there any supports or resources you do not currently have access to that you feel would help you when dealing with disruptive behaviour?
8. Is there anything else you would like me to know about your experiences dealing with disruptive behaviour in the classroom?

Appendix J: Student Interview

Student Satisfaction Interview

Hello, my name is Erica Clark and I'm talking to students, like you, about what it is like for them at school. I'm interested in what you like or don't like about school and if there is anything that makes it easier for you to be at school.

1. I'd like you to draw a picture for me of what your classroom looks like with you in it.
    a. What do you like in this picture?
    b. If you could change something in this picture what would it be?
    c. Why?
    d. What else would you change?
    e. Where are you in the picture?
    f. What is good about where you are in the picture?
    g. What is bad about where you are in the picture?
2. What is a good day at school?
    a. What do you do on a good day?
    b. Who do you see?
    c. What do you need to have a good day at school?
3. Is there anything that makes school easier for you? This could be a classmate, an adult, a safe place at school, or anything else.
    a. Why?
4. Is there anything that makes school hard for you?
    a. Why?
5. Is there anything else you would like me to know about what it's like for you at school?

Appendix K: Caregiver Interview

Caregiver Satisfaction Interview

Hello, my name is Erica Clark and I'm interviewing parents to learn more about their child's experiences at school over the past year. I'm interested in whether or not you are satisfied with how the school year has gone and if there is anything you feel your child did not get that they needed.

1. What do you like about your child's experience at school?
2. Is there anything you would like to change about your child's school experience?
3. Was there anything or anyone that really helped your child at school this year? This could be a person, having more time to complete school work, a quiet corner to work in, or anything else.
4. Is there anything you feel would improve your child's experience at school?
5. Is there anything that makes being at school difficult for your child?
6. How would you describe your experiences with the school?
7. Who do you normally deal with if you want to talk to someone about your child's experiences at school?
    a. What position do they hold?
    b. Are they helpful?
8. Is there anything else you would like me to know about the experiences you or your child have had at school?

Appendix L: Follow up Interview for Teachers in the Intervention Group

Thank you for taking the time to meet with me. I am interested in hearing about whether you have used any parts of the POPFASD intervention this year. You may recall that there were several parts to the program including,

- a two day training that covered FASD 101 and using the student's file to complete the LEIC form,
- resource books ,
- four half day trainings on psychology, occupational therapy, speech and language, and the assessment process,
- group discussions on classroom accommodations,
- Stacey Wakabayashi visiting your classroom,
- Stacey Wakabayashi facilitating communication between school and home,
- access to the POPFASD web resources, and
- opportunities for you to visit other classrooms.

1. Have you been able to use any parts of the POPFASD training over the past year?
    a. Why or why not?
    b. What parts of the training have you used?
    c. Have you adapted any parts of the training?
        i. *If yes:* What adaptations have you made?
    d. Can you describe their impact on your teaching practice?
    e. Has there been anything or anyone that has made it easier for you to use the training this year?
        i. *If yes:* Who or what?
    f. Have you experienced any challenges or barriers that made it difficult to use the training this year?
2. Do you have any students affected by FASD in your classroom this year?
    a. *If yes:* What are some of the behaviours they exhibit in the classroom?
    b. There are a lot of things that can influence behaviour of a student affected by FASD. These things may be characteristics of the child or their environment.
        i. What characteristics of the student do you feel influence their behaviour?
        ii. What characteristics of their environment (physical or social) do you feel influence their behaviour?
3. Have you had any opportunities to share your training with other teachers or staff? For example, have you made a presentation at a staff meeting or responded to questions from other teachers?
    a. Can you describe what you shared?
    b. Have you had any feedback from anyone you shared this information with?
        i. *If yes:* What was the feedback?
4. Have you had any opportunities to be a formal or informal mentor to other teachers and/or staff?
    a. Did you use any of the POPFASD training?

    b. Can you describe what elements of the POPFASD training you have used?
5. Part of the POPFASD training involved going through a student's file, reviewing assessments, and making a summary sheet called the LEIC which informed development of accommodations specific to the child. Have you been able to do that for any of your students this year?
    a. *If no:* Why?
    b. *If yes:* What kinds of disabilities do these students have?
    c. Can you describe the process you went through?
    d. Were the accommodations you developed different that what you thought you might try before doing the file review?
6. Part of the intervention involved Stacey Wakabayashi assisting with communication between the home and school. Without Stacey's role this year, how easy or difficult has it been to establish and maintain communication with families this year?
    a. What factors make it easy to communicate with the families?
    b. What are some of the challenges or barriers you face when communicating with families?

Appendix M: Principal Interview

Thank you for taking the time to meet with me. I am interested in hearing about whether there have been any residual effects from the POPFASD intervention that took place in some classrooms last year. You probably remember that there were several parts to the program including,

- a two day training for intervention teachers that covered FASD 101 and using the student's file to complete the LEIC form,
- resource books,
- four half day trainings on psychology, occupational therapy, speech and language, and the assessment process,
- group discussions on classroom accommodations,
- Stacey Wakabayashi visiting intervention classrooms,
- Stacey Wakabayashi facilitating communication between school and home,
- access to the POPFASD web resources, and
- opportunities for intervention teachers to visit other classrooms.

1. Have there been formal or informal opportunities for [*teacher name*] to share what they learned from the POPFASD training?
    a. *If yes:* Can you describe those opportunities?
    b. Can you describe any ways in which information from the POPFASD training affected your school?
2. Have any teachers asked you for information about teaching students with FASD?
    a. *If yes:* What did they want to know?
3. Have any teachers asked you for training to help them teach students with FASD?
    a. *If yes:* What did they want to be trained on, e.g. social skills, reading, math, etc.
4. Have any teachers asked for additional help teaching students affected by FASD?
    a. *If yes:* Can you describe the help they are asking for?
5. If the intervention was offered again would you encourage other teachers to participate?
    a. Why or why not?

Appendix N: Itemized Cost of Intervention Options

Table 16: Itemized cost to implement POPFASD teacher mentorship intervention for six teachers for one year

Description	Cost
A. Salary	
Mentor: Senior teacher in Teacher Qualification Service Category 4, 5, or 6 to mentor teachers and prepare and implement workshops. Salary range for the school district is $64,000-80,000 including benefits and the median value, $72,000, will be used. Mentoring six teachers requires a 0.5 full time equivalent (FTE). Cost for program is $72,000 / 2 = $36,000	
Occasional Teachers: Occasional teachers are needed for the four days teachers use to attend the two day workshop and four half day workshops. Salary cost of an occasional teacher is $300 per day. Cost for program is $300 per day x 4 days x 6 teachers = $7,200	
Occupational Therapist: Presenter for one half day workshop. Approximate cost per day is $150-$170 and median value of $160 per day will be used. Cost for program is $160 per day / 2 = $80	
School Psychologist: Presenter for one half day workshop. Approximate cost per day is $180-$200 and median value of $190 per day will be used. Cost for program is $190 per day / 2 = $95	
Speech and Language Pathologist: Presenter for one half day workshop. Approximate cost per day is $150-$170 and median value of $160 per day will be used. Cost for program is $160 per day / 2 = $80	
Education Psychologist with FASD Assessment Expertise: Consultation fee is $800 per day and full day is used for workshop plus travel. Cost for program is $800 per day	
Total Salary Cost	$44,255

Description	Cost
B. Travel and Accommodation	
Mentor: Mileage for the mentor doing weekly or bi-weekly visits to teachers. Estimated cost is $4,000	
Education Psychologist with FASD Assessment Expertise: Airfare and hotel for educational psychologist traveling to the half day workshop. Airfare estimate is $500 and one night hotel stay estimate is $150 Cost for program is $500 + $150 = $650	
Total Travel and Accommodation Cost	$4,650
C. Printing	
Cost for all printed materials is estimated as $200. Cost for program is $200	
Total Printing Cost	$200
D. Supplies	
Cost of supplies teachers need to implement accommodations for students with FASD. Estimate is $200 per teachers. Cost for program is $200 per teacher x 6 teachers = $1,200	
Total Supplies Cost	$1,200
Total Cost of Program	**$50,305**
Cost per Teacher	**$8,384.17**

Table 17: Itemized cost for two day FASD workshop for twelve teachers

Description	Cost
A. Salary	
Workshop Leader: Salary cost for a senior teacher with FASD training to lead workshop is estimated to be $400 per day. Two days are required for travel, set up, and preparation. Cost for program is $400 per day x 4 days = $1,600	
Occasional Teachers: Occasional teachers are needed for the two days teachers use to attend the workshop. Salary cost of an occasional teacher is $300 per day. Cost for program is $300 per day x 2 days x 12 teachers = $7,200	
Total Salary Cost	$8,800
B. Travel and Accommodation	
Workshop Leader: Airfare and three night hotel stay for teacher to travel to workshop is estimated to be $1,000. Cost for program is $1,000	
Total Travel and Accommodation Cost	$1,000
C. Printing	
Printing costs for workshop materials are estimated to be $200. Cost for program is $200	
Total Printing Cost	$200
Total Cost of Program	**$10,000**
Cost per Teacher	**$833.33**

Table 18: Itemized cost for one segregated classroom teacher for one year

Description	Cost
A. Salary for Segregated Classroom and Workshop	
Segregated Classroom Teacher: Salary cost for a category six teacher at the top of their pay scale Cost for segregated classroom is $81,000	
Workshop Leader: Salary cost for a senior teacher with FASD training to lead workshop is estimated to be $400 per day. Two days are required for travel, set up, and preparation. Cost for workshop is $400 per day x 4 days = $1,600	
Occasional Teachers for Workshop: Occasional teachers are needed for the two days teachers use to attend the workshop. Salary cost of an occasional teacher is $300 per day. Cost for workshop is $300 per day x 2 days x 12 teachers = $7,200	
Total Salary Cost	$89,800
B. Travel and Accommodation for Workshop	
Workshop Leader: Airfare and three night hotel stay for teacher to travel to workshop is estimated to be $1,000. Cost for workshop is $1,000	
Total Travel and Accommodation Cost	$1,000
C. Printing for Workshop	
Printing costs for workshop materials are estimated to be $200. Cost for workshop is $200	
Total Printing Cost	$200
Total Cost of Program	**$91,000**
Cost per Teacher	**$81,833.33**