



READINESS TO LEARN IN MINORITY FRANCOPHONE COMMUNITIES

REPORT OF PROGRAM EFFECTS IN GRADE 2



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1.0 Summary

The purpose of this report is to document the 24-month post-program impact of the Readiness to Learn in Minority Francophone Communities project (abridged titled: Readiness to Learn project¹), a demonstration project funded by Human Resources and Skills Development Canada (HRSDC). The services of the Social Research and Demonstration Corporation (SRDC) were retained to implement, manage, collect and analyze project data. The project is testing a preschool program² that combines a child care program specifically developed to meet the needs of Francophone children in minority communities with a family literacy component targeting the parents of these children. The goal of this program was to develop the child's language skills, knowledge and use of the French language, as well as knowledge and identification with the French culture. Globally, the program aimed at fostering school readiness and children's overall development.

The program was evaluated using a quasi-experimental approach with non-equivalent control groups. The methodology involved three experimental groups: a program group consisting of children enrolled in a Francophone daycare centre offering the new preschool program; a comparison group consisting of children enrolled at a Francophone daycare centre that does not offer the new preschool program; and a comparison group of children who are cared for at home or in an informal family daycare setting³. The use of the formal daycare control group was to determine the influence of a formal daycare centre on a child's development, which is a treatment in itself. The use of the comparison group not enrolled in a formal daycare centre was to determine the influence of an informal daycare on the child's development. The project has two participant cohorts; the first cohort was enrolled in 2007 and the second was enrolled in 2008.

The Readiness to Learn project took place in two phases. In the first phase, we sought to answer the following question: *Does the new preschool program, which includes a daycare component and a parent-child workshop component, have a significant impact on children's language skills, Francophone cultural identity and school readiness beyond the development that would take place in its absence, and independently of any other external factors that may come into play?* In the second phase, which is the subject of this report, we examined the question: *Does the new preschool program better prepare Francophone children raised in minority settings to succeed in tasks essential to academic achievement, such as reading and mathematics?* While the first phase of the Readiness to Learn project focused on the preschool period, the second phase focused on the formal education period (grades one and two).

Results at 24 months post-program: This report deals with data collected 24 months after the end of the intervention, which corresponds to data collected in October 2011 for the first cohort and October 2012 for the second cohort. During this period, children's mean age was seven and they were entering grade two. A mixed research methodology was used for the Readiness to Learn project. This approach favours the use of a range of tools, both quantitative and qualitative, from several sources

¹ Formerly known as the Child Care Pilot Project.

² Officially known as enriched child care services in HRSDC documents, the Social Research and Demonstration Corporation, or SRDC, in agreement with HRSDC, will henceforth refer to the program as the "preschool child care program".

³ This group also included a few children enrolled in Anglophone daycare.

selected based on research objectives, that is, to determine whether the program had the desired effect and to understand how it exerts that effect. Analyses were performed using data from child assessments and parent surveys at 24 months post-program and incorporated baseline measures to statistically control for initial differences between the groups.

The main findings of the impact study revealed positive long term program impacts for both child and parent outcomes. For child outcomes, significant impacts in favour of the Program Daycare group were observed on certain predictors of academic achievement, particularly relative to the Comparison Daycare group. Specifically, children from homes characterized by initial low exposure to French made significant gains in language skills (e.g., receptive vocabulary, use of French), whereas children from francophone endogamous homes showed overall gains on skills required for academic achievement (i.e. language skills, development of executive functions, as well as reading and mathematics skills). Of note, findings of comparisons with the Informal Care group were difficult to interpret due to the wide diversity in care environments for this group—diversity which made it impossible to obtain accurate measurements for the language environment and quality indicators.

With respect to parent outcomes, positive impacts of the Family Literacy component were observed in the French language chosen to engage in literacy activities. Looking back, parents indicated having benefited from the program both in terms of their child's school readiness and in terms of developing a sense of belonging to their child's school and to the Francophone community.

Results of the developmental trajectory on children and parent outcomes: A look back on the previous results within the Readiness to Learn project allows to draw a picture of the preschool program's effect across time. *In the short term* (from 0 to 24 months), the program's effect is clearly demonstrated on language skills for children from households characterized by initial low exposure to French (e.g., Ability to Communicate in French, Receptive Vocabulary). On the other hand, children from households with high exposure to French primarily benefited from the program in terms of their cognitive development (e.g., precursors of reading and mathematics skills).

In the medium term (36 months following the beginning of the program), findings show that parents adopted positive behaviours in terms of the frequency of literacy activities they perform with their child, as well as the language they use to perform literacy activities and communicate with their child. In turn, these changes influenced children's development, particularly with regard to the language skills (e.g., Verbal Fluency, Ability to Communicate in French, Use of French). The pattern of results therefore suggests that in the medium term, the Family Literacy component represents an important source of the program effect on the children. *The long term* impact (48 months following the beginning of the program) on the parents seems to diminish with time, whereas children's progress continues to be evident, in particular with children from francophone endogamous families (e.g., receptive vocabulary, reading and mathematics skills, and development of executive functions).

The portrait derived from the overall analyses allows us to conclude that the tested program continues to exert an important effect in terms of the development of the skills needed for school achievement (e.g., language skills, executive function, reading, and mathematics) for all children growing up in a minority linguistic setting, although the observed effects vary as a function of the initial household linguistic environment. Children considered the most vulnerable to encounter difficulties in school continue to improve in terms of language skills, without however getting ahead of the children in the

comparison groups on the direct assessment outcomes. However, children from francophone endogamous households clearly stand out with respect to overall skills required to succeed in school. These observed effects have important practical implications not only to promote school achievement in children, but also to reinforce the vitality of the francophone communities in minority settings. In terms of social policies, the results of the research correspond to the priorities identified by the federal government in the 2008–2013 Roadmap for Canada’s Linguistic Duality.

Please note that this report is the last of a series of reports prepared by SRDC during the four years of the project.

2.0 Readiness to Learn project

2.1 Project Background

The Readiness to Learn in Minority Francophone Communities project (Readiness to Learn project) is part of the Government of Canada's 2003–2008 Action Plan for Official Languages and continued under the 2008–2013 Roadmap for Canada's Linguistic Duality. The project's guiding principles include a desire to help minority Francophone communities give children a good start in life, as well as to encourage parents to participate actively in their child's education (Human Resources and Skills Development Canada, or HRSDC, 2006). At the community level, the Readiness to Learn project is intended to be a rigorous assessment of a promising intervention whose goal is to maintain and even to renew the ethnolinguistic vitality of the minority Francophone community.

The project's main contribution is the recognition of the importance of a minority linguistic context on the development of linguistic and identity-related dimensions in young children. While members of the linguistic majority may take this developmental process for granted, its true complexity is exposed within a minority-language setting. The development of linguistic and identity-related dimensions is the end result of the socialization process that spans multiple settings, including the family environment, school or preschool and other socio-institutional settings (Landry & Allard, 1997). Pioneering studies on the importance of culture to child development were conducted by Vygotsky (1978). According to this author, the culture in which a child is raised affects the development of his or her language skills and learning in general through the integration of social symbols to which he or she is exposed. Thus, the child's social environment is inseparable from the construction of his or her cultural and linguistic identity, as well as his or her overall development.

The importance of the social environment is highlighted by research results showing that children's exposure to French in a number of different settings strengthens their identification with and sense of belonging to the Francophone community (Landry & Allard, 2000). Exposure to French in all social contexts is especially important for a child raised in a highly minority Francophone setting where, by virtue of demographic weight alone, the English language predominates in every aspect of daily life (Gilbert, 2003). For example, the study by Landry and Allard (1997) showed that in a minority Francophone setting, a strong exposure to French at home and at school from kindergarten through to the end of high school is a strong predictor of the development of a Francophone and bilingual identity, the desire and ability to integrate the Francophone community, identification with the Francophone community, and the use of French in different contexts. A more recent study supports these findings and shows that a strong Francophone identity is highly linked to the use of French in a variety of social contexts: at gatherings with family or friends, in public institutions and in the media (Landry, Deveau & Allard, 2006). In these studies, language behaviour is an important outcome of ethnolinguistic vitality and identity building.

The concept of cultural identity is not typically directly measured during childhood. According to Self theories (e.g., Erik Erikson's Theory of Personality, 1994), it is not fully crystallized until adolescence. Hence, it is difficult to directly measure the different dimensions of cultural identity in young children. It should be noted, however, that identity shaping is a dynamic process which grows out of social

structures and the linguistic and cultural interactions beginning in early childhood (Landry et al., 2006). In principle, it should therefore be possible to measure predictors of the Francophone cultural identity. *L'Association canadienne d'éducation en langue française* (ACELF) defines identity construction as a highly dynamic process in which a person defines and identifies himself or herself through their behaviours and actions in social contexts and in the natural environment in which they are raised (ACELF, 2006, p.12). According to this definition, the construction of children's identity is not only influenced by the context in which they are raised, but also by their own language behaviour. Spoken language is a fundamental part of a population's culture and a means of expressing its cultural identity (Landry & Rousselle, 2003). It is therefore proposed that spoken language can be a predictor of cultural identity in school age children.

The reality of a minority context means that children are exposed to two different cultures at a time when their cultural identity and language skills are in flux. At the child level, several authors advocate the availability of French-language daycare services and schooling in childhood as key vectors of community vitality (Commission nationale des parents Francophones, 2005; Landry & Allard, 1997; Gilbert, 2003). According to proponents of Francophone community vitality, the ideal would be for rights holder parents⁴ to enrol their children in high quality French-language daycare services and schools. However, the reality of the situation is quite different. A significant number of francophone parents enrol their children in French-immersion or English schools. According to the findings of the 2006 Survey on the Vitality of Official-Language Minorities (SVOLM; Corbeil, Grenier & Lafrenière, 2007), only 56% of children of eligible parents attend French elementary schools. This figure drops to 44% among teens. Parents choose immersion or English schools for many reasons: English is the child's mother tongue or the language best known by the child, school proximity, non-availability of a French-language school, and the good reputation of the program or school.

Several studies have shown that Francophone children enrolled in French schools obtain lower scores in reading and mathematics than their Anglophone peers. This disparity between the two groups was observed in the results of international tests like the Programme for International Student Assessment (PISA) where Francophone children enrolled in a French school in a minority linguistic setting obtained lower scores in reading than their Canadian Anglophone peers (Bussière et al., 2001; Canadian Council on Learning, 2008). The few studies on young minority Francophones indicate that this achievement gap appears at a young age. A recent study of Franco-Manitoban children aged four to six concludes that they score lower on vocabulary tests⁵ and this is particularly true of children who live in a majority Anglophone environment every day. The trend continues when these children reach Grade 3 of primary school. Children who grow up in a Francophone family and preschool environment score higher in Grade 3 reading than Francophone children living in a majoritarily Anglophone linguistic environment (Chartier, Dumaine & Sabourin, 2011).

Clearly, the minority context has a noticeable influence on francophone minorities' language behaviour in the private sphere. We estimate that close to two thirds of young minority Francophones are from

⁴ A person who holds the right to education in the minority language in Canada enshrined in the constitutional framework of section 23 of the Canadian Chart of Rights and Freedoms.

⁵ Peabody Picture Vocabulary Test – Revised, or PPVT-R, and the communication and general knowledge scales of the Early Development Instrument, or EDI.

exogamous households (67%) and most adopt English as the household language spoken (Landry, 2010). Only 20% of exogamous couples choose to raise their children ages zero to four in French (Martel, 2001). Further, the latest data from the 2006 Census indicate that almost 39% of Francophones outside Quebec speak English at home, although French remains a language that is used (Corbeil & Blaser, 2007).

A greater use of English in daily life partly explains why 62% of Francophone adults outside of Québec taking a literacy test in French score below the level of literacy proficiency deemed necessary to function in society (i.e., a literacy level greater than 3 on a scale of 5; Statistics Canada and HRSDC, 2005, Table 3.24). This percentage would no doubt be higher if all Francophone adults outside of Quebec took the test in French (65% of them chose to take the test in English despite identifying French as their mother tongue; Statistics Canada and HRSDC, 2005, p. 54). In fact, nearly all Francophone adults living in a minority community know both official languages with 39% of them believing they have a better command of English than French (Corbeil et al., 2007). According to these results, there is every reason to encourage French language acquisition among adults in minority settings, and to raise awareness with parents about the challenges of living in minority contexts and the actions that can be taken to pass down this rich cultural heritage to their children.

2.2 Acquiring a Language and Cognitive Skills in a Minority Setting

The primary cause of the above-mentioned greater difficulty Francophone children to achieving academic success is presumably the limited exposure to French both at home and at school, and in the public sphere. To ensure their full integration into society, children growing up in minority communities must, sooner or later, learn the language of the majority (i.e. English) in addition to their mother tongue. Mastering two languages yields many cognitive benefits, including better attention control, enhanced working memory and greater mental flexibility (i.e. enhanced executive functions; for a meta-analysis, see Adesope, Lavin, Thompson & Ungerleider, 2010). However, children whose mother tongue is that of the minority are at great risk of developing a form of bilingualism that tends to adversely affect child development at the linguistic and cognitive levels, that is, subtractive bilingualism (Landry, Allard & Deveau, 2009).

This form of bilingualism differs from additive bilingualism, which refers to individual who master a second language without incurring any costs in terms their cultural identity and the development of their mother tongue. Conversely, subtractive bilingualism is a form of bilingualism in which the mother tongue is not mastered well enough to withstand the acquisition of a second language without causing delays in the development of the mother tongue (Ball, 2010). The child's ability to learn (and consequently, succeed in school) may then be compromised *in both languages*, not just in French. According to Bialystok (2009), children with a limited knowledge of the language of instruction are more likely to experience academic and social problems. Weak language skills limit children's ability to benefit from what is taught in kindergarten and grade one (see also Cummins, 1979; Doherty, 1997; Hindman, Skibbe, Miller & Zimmerman, 2010), which is in itself a risk factor in academic achievement in the long term (Cummins, 1979). The variance observed in academic achievement between Francophone children living in a minority community and their Canadian peers might be explained by the higher risk of subtractive bilingualism and, by extension, a weaker knowledge of the language of instruction.

If the primary means of mastering *one* language is exposure to this language, then the primary means of developing *additive bilingualism* is exposure to the child's mother tongue. Pearson (2007) found that there is a minimum threshold of exposure to the mother tongue that must be exceeded to avoid negative consequences on language and cognitive development, and to benefit from the advantages of learning a second language. For various reasons (e.g., motivation to use and master the majority language due to its predominance in many contexts, Landry et al., 2009), this threshold is higher when the mother tongue is the minority language (Pearson, Fernandez, Lewedag & Oller, 1997; Vihman, Lum, Thierry, Nakai & Keren-Portnoy, 2006). As noted by Landry (2010), it is not possible to find equal use of English and French in a minority community. In that context, greater attention is required to develop French language skills so that they can remain on equal footing with English language skills.

These findings led us to consider the benefits of an early intervention for young minority Francophone children, with the goal of strengthening their language skills. In addition, the intervention would have to include a component targeted at parents to make them aware of the challenges of living in a minority community and the steps they could take to pass on this rich cultural heritage to their children. The many benefits of programs that modify a child's environment at the daycare centre and at home have been established in studies on other populations considered to be vulnerable (see the literature review by Reese, Sparks & Leyva, 2010; Engle et al., 2007). These effects can be maximized by having the parent and educator adopt similar approaches with the child. The results of a study by Corter and Pelletier (2005) showed that a dual-component program (parent and educator), focused on early literacy activities, had a greater impact on skill acquisition in this area than a similar program with only one of the two components. Furthermore, children whose daycare and home environments had changed as a result of adopting these strategies were more advanced in vocabulary development, early reading and numeracy. The purpose of the Readiness to Learn project is to evaluate the short, medium and long term impact of such an intervention. This project is now described in the next section.

2.3 Description of the Readiness to Learn Project

The Readiness to Learn project tests whether a two-pronged preschool program benefits children living in minority communities. The tested preschool program combines a childcare component developed specifically to meet the needs of Francophone children in minority settings with a family literacy component targeting the parents of these children. This family literacy component seeks to encourage the parents' active participation in their child's development and school readiness, as well as in the transmission of French language and culture. The project itself is one of many studies on preschooler development and on the vitality of the French language in minority settings.⁶

The program's effect on child development is examined by comparing a group of participants who were exposed to the new program (referred to as the Program Daycare group) to two comparison groups consisting of participants who *were not* exposed to the new program (referred to as the Comparison Daycare group and the Informal Care group). The program was delivered to two cohorts of participants. The first cohort began the program in fall 2007 in six minority Francophone communities (Saint John and Edmundston in New Brunswick; Orleans, Cornwall and Durham in Ontario; and Edmonton in Alberta). Program delivery to the second cohort began in fall 2008 in two communities (Orleans and

⁶ See Guimond (2003) for an overview of studies on ethnolinguistic vitality in minority settings.

Cornwall in Ontario). The study was conducted over a four year period. The children were followed from age three to age seven, when they entered Grade 2 of primary school. The length of the study allowed us to monitor the development of young minority Francophones from preschool until their education commenced. Final data were collected in fall 2011 for first-cohort families and in fall 2012 for second-cohort families.

The Readiness to Learn project includes two phases. In the first phase, we sought to answer the following question: *Does the new preschool program, consisting of a daycare component and a parent/child workshop component, have a significant impact on children's language skills, Francophone cultural identity and school readiness beyond the development that would take place in its absence, and independently of any other external factors that may come into play?* Related questions have also been examined, such as: *Who benefits the most from this program? Can the benefits of the new program be replicated with a new group of children and parents?*

In the second phase, which is the subject of this report, we sought to answer new questions: *Does the new preschool program better prepare Francophone minority children to succeed in reading and mathematics, tasks essential to academic achievement? Do these children exhibit better language skills in French compared to their Francophone minority peers who have not been exposed to the preschool program?* While the first phase of the Readiness to Learn project focused on the preschool period, the second phase focused on the formal education period (grades one and two) when child participants were aged 6 and 7.

2.4 Mechanisms Whereby the Program Has an Effect

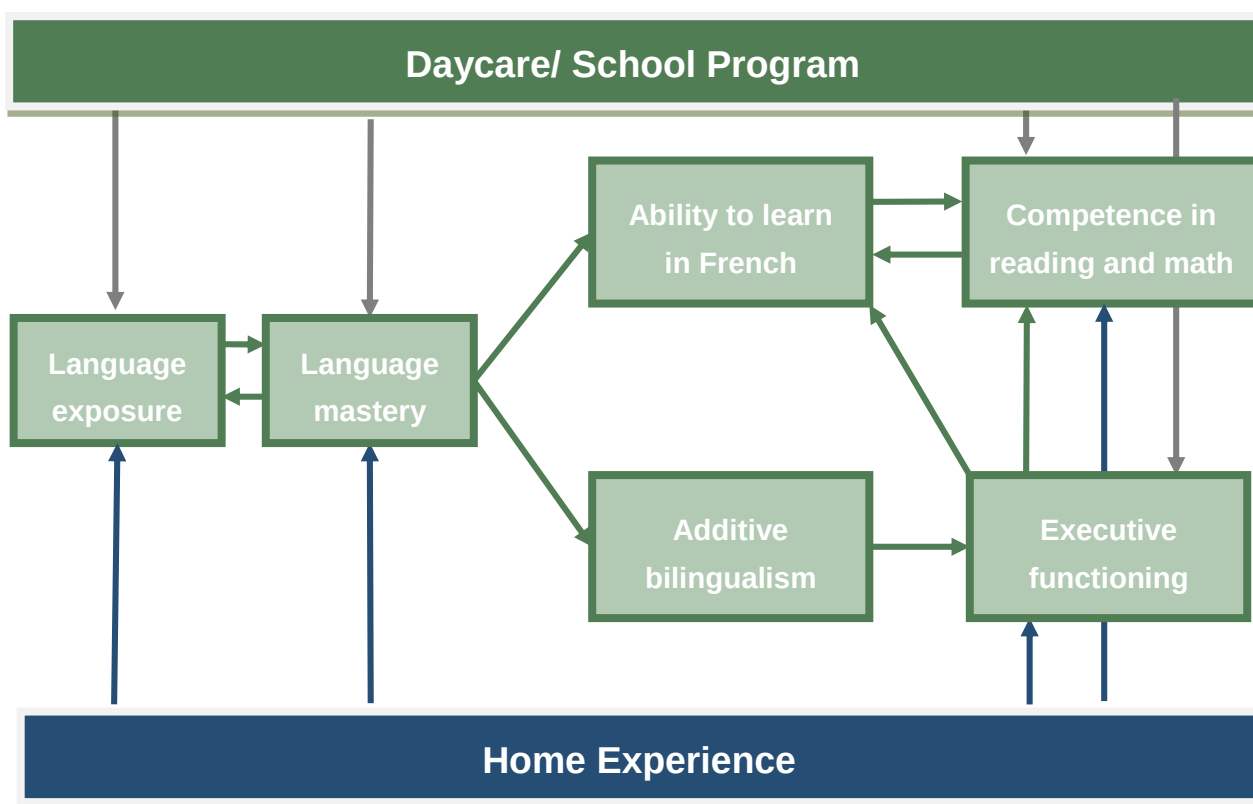
In any evaluation, it is useful to explicitly state the mechanisms through which it is believed the program will impact outcomes under study. This analysis can serve many purposes, including specifying the expected outcomes of the program and the constructs that must be measured to evaluate these outcomes.

The theoretical model in Figure 2.1 illustrates how the two program components are presumed to influence relevant developmental dimensions for Francophone children living in a minority context. We identify the principal vectors by which the effect of the program influences positively on children's outcomes in green (i.e., the daycare program) and blue (i.e., the family workshops). These vectors represent the two settings in the child's life directly targeted by the tested program. Specifically, we are putting forth the following mechanisms:

1. The tested intervention increases exposure to the French language of children from Francophone families in minority communities by means of a quality program at the daycare centre and at home, through family workshops.
2. A greater exposure to the French language results in greater mastery of the language. This outcome is more significant in children from exogamous homes and Anglophone endogamous homes.
3. A greater exposure of French to children promotes additive bilingualism.

4. Additive bilingualism promotes the development of executive functions, especially self-control (and working memory (for a meta-analysis, see Adesope et al., 2010).
5. The development of executive functions (in particular self-control) and a good mastery of the French language determines, in part, a child's ability to learn in that language.
6. A greater development of executive functions, such as self-control, and a greater ability to learn in French are predictive of better academic achievement in mathematics and literacy in grade 1 and in subsequent grades.

Figure 2.1 Theoretical Model of Academic Achievement in Young Minority Francophones



The following section presents greater details of the underlying empirical foundations of the theoretical model displayed in Figure 2.1.

2.5 Academic Achievement

The long term objective of the Readiness to Learn project is to have a positive influence on the academic achievement of minority Francophones. This is accomplished by better preparing them for school, thereby fostering their growth and well-being not only during childhood, but also once they reach adulthood. Academic achievement is a cumulative process in which children acquire new skills and learn to further develop those that they already possess (Duncan, Dowsett, Claessens, et al., 2007).

It translates into the quality and quantity of what the child learns in relation to the objectives of the school program or curriculum.

Children's academic achievement is generally established through teacher assessments, report cards or results of school tests (whether standardized or not) (Duncan et al., 2007). It is measured by examining the child's performance in many areas, such as reading, writing, mathematics and sciences, cognitive skills and repeating grades (Pagani, Fitzpatrick, Archambault & Janosz, 2010; Reynolds, Temple & Ou, 2010). Some provincial governments in Canada systematically test the academic achievement of all children in the province in core subjects in grades 3, 6 and 9. This is true for Ontario, Alberta and New Brunswick. These provincial tests are another source of information on children's academic achievement and provide provincial standards on the subject.

In most studies, a reliable assessment of academic achievement is typically established using direct and indirect measurements administered starting in third grade (Duncan et al., 2007).⁷ Since there is no intention to track the children from the Readiness to Learn project after the beginning of grade two, we plan to infer the long term impacts of the program using predictors of academic achievement measured at the beginning of grade two (basically, the equivalent of an assessment at the end of grade one). The meta-analysis done by Duncan et al. (2007) proved relevant in identifying the elements of school readiness that help predict a child's academic achievement later in life. The conclusions of this meta-analysis are based on six longitudinal studies conducted in the United States (4), Canada (1) and Great Britain (1). According to their meta-analysis, the best predictors of academic achievement are, in order of importance: mathematics skills, reading skills and attention skills when children begin school.

The study by Duncan et al. was reproduced by Canadian researchers Romano, Babchishin, Pagani and Kohen in 2010. They conducted the first Canada-wide study on predicting academic achievement using longitudinal data gathered from 1,521 children through the National Longitudinal Survey of Children and Youth (NLSCY). They studied the influence of children's reading and numeracy skills, attention skills, and affective social competence at kindergarten age on the children's academic achievement in reading and mathematics by grade three. The results of the study by Romano et al. support the findings of the Duncan study, namely that: 1) the best predictor of academic achievement is the child's skill level in mathematics measured in kindergarten; and 2) the child's reading skills and attention skills in kindergarten also predict the child's future academic achievement.

Finally, a study conducted by Pagani and his colleagues (2010) examined the link between elements associated with school readiness (i.e., children's cognitive skills, attention skills and affective social competence in 4 year-old kindergarten) and overall academic achievement, as well as performance in mathematics and reading at the end of grade two. This study was based on data gathered through The Quebec Longitudinal Study of Child Development (QLSCD; *Institut de la statistique du Québec*, 1998-2010). Pagani and his colleagues (2010) observed that cognitive skills, measured by children's knowledge of numbers and breadth of vocabulary, as well as their attention skills in 4 year-old kindergarten, predict their academic achievement by the end of grade two.

⁷ According to some developmental models, it is not possible to diagnose a learning problem until grade three. That is when a gap can be detected between a child's IQ and academic achievement. Note that this model has major limitations (see Siegel, 1989; Siegel, 2003).

To summarize, these studies consistently show that the best predictors of academic achievement are children's mathematics skills, reading skills and attention skills when they begin school. These key predictors of academic achievement remain the same in grades one and two. Furthermore, longitudinal studies show a strong correlation between children's performance in grade two and their performance in grade three (between 0.85 and 0.98 according to Wagner et al., 1997). If the program tested by the Readiness to Learn project enhances school readiness, and eventually academic achievement, then we expect that the program will have a positive impact on one or more of the predictors of academic achievement.

2.6 Correlates of Academic Achievement

To determine whether the preschool program has a real positive effect on the academic achievement of participating children, we must first identify the main factors that affect the academic achievement of children in minority communities, so we may then be able to distinguish the unique contribution of the tested program from that of other sources of influence. Research has shown a number of factors likely to influence children's academic achievement; some are child specific (e.g., attention skills), other are close to the child (e.g., parents' characteristics), and finally, others are more distal (e.g., the characteristics of the community in which the child lives). Furthermore, the importance of these factors and the valence (positive or negative) of their effect on academic achievement varies.

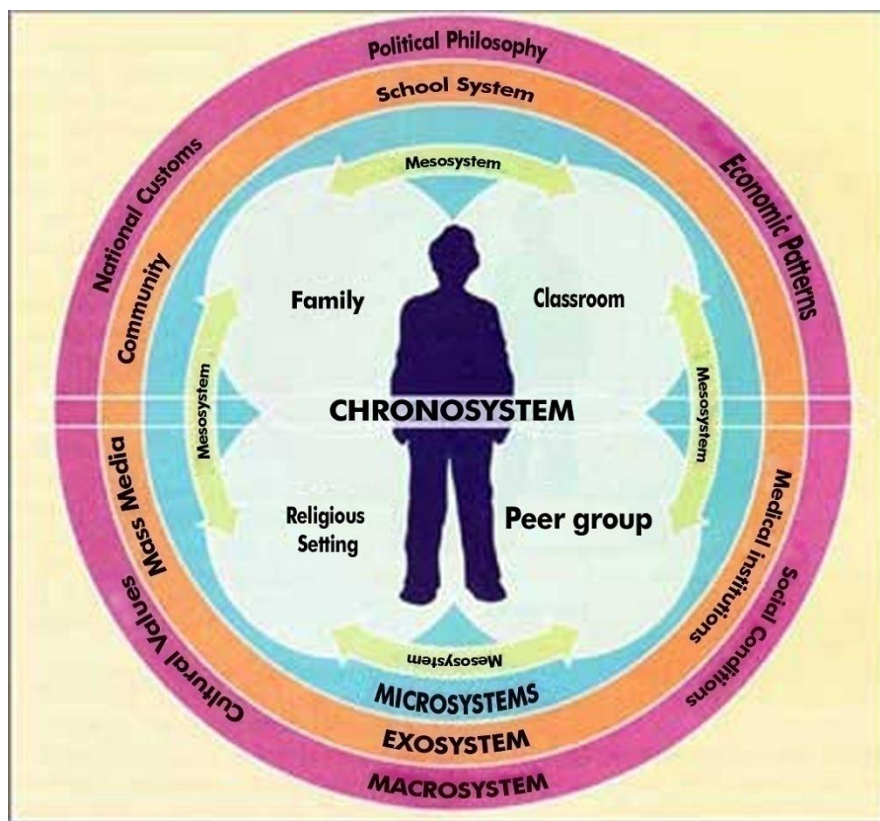
The ecological model developed by Bronfenbrenner (1979) has proven useful in depicting a coherent portrait of the factors influencing children's academic achievement. This researcher was the first to express in words and images the entire system of influences that shapes child development. His model is based on three premises:

- the child is at the centre of the model;
- the child's experiences (considered to be "drivers" of development) hold a central position; and
- the nature of the relationships between the child's different environments is fundamental.

Bronfenbrenner's model consists of five systems (refer to Figure 2.2):

- *Microsystem*: the child's immediate environment (family, school, type of child care, peers, neighbourhood).
- *Mesosystem*: the interactions between the immediate environments (e.g., between home and school).
- *Exosystem*: the external environment that affects the child indirectly (e.g. parents' work).
- *Macrosystem*: the broader cultural context (western culture versus eastern culture, national economy, political culture, subculture).
- *Chronosystem*: the structure of events affecting the environment and life transitions.

Figure 2.2 Bronfenbrenner's Complete Ecological Model (1979)



Source: From UW-Extension ABC Project, Appendix B (November 2004).

In the context of the second phase of the Readiness to Learn project, where the focus is on young children in minority language settings, three systems of Bronfenbrenner's model are of particular importance. First, the microsystem, via the family characteristics and school setting characteristics⁸ influence children's academic achievement. In terms of family characteristics, we distinguish between contextual variables and family processes (this division is based on the National Longitudinal Survey of Children and Youth, or NLSCY; Statistics Canada and HRSDC, 2006). Contextual variables refer to "factual" data known to be important to children's academic achievement (e.g., family composition). Next is the mesosystem, which include ties between the home and the school, which also plays a role in academic achievement. Lastly, the macrosystem is among the influences of interest for the project because it consists of the community in which the child is raised, and in particular, its linguistic characteristics.

In the following sub-sections, we will be presenting the main correlates to the development of reading and mathematics skills, beginning with the child's characteristics, then moving on to the contextual

⁸ By contrast, the child's daycare was one of the main settings of influence during the first phase of the project.

variables and family processes derived from the family environment, and then the link between the family and the school setting, and finally, community factors.

Characteristics of the child

A large body of research has shown that children's attention skills are a predictor of academic achievement as the child grows. ***These attention skills can be conceptualized by certain cognitive skills known as executive functions.*** According to many expert researchers in the field (Diamond, Barnett, Thomas & Munro, 2007; Monette & Bigras, 2008), executive functions include three types of highly interrelated skills: (1) *self-control* (e.g., resisting the temptation to strike out at someone to get revenge, concentrating on a task to be performed despite distractions), (2) *working memory* (e.g., connecting two ideas, following a conversation while retaining what you want to say, performing mental calculations) and (3) *cognitive flexibility* (e.g., easily changing the focus of attention, adjusting to changing requirements and modifying the frame of reference). Complex tasks generally require all three aspects of executive functions.

Blair & Diamond (2008) maintain that the development of executive functions should foster children's self-control, school readiness and academic achievement.⁹ In fact, these cognitive skills assist children in being disciplined in the classroom and focusing their attention. Of the three aspects of the executive functions, self-control is considered to be the most predictive of academic outcomes (Blair & Razza, 2007). For example, research has shown that this aspect promotes perseverance, which in turn predicts academic achievement (e.g., Duckworth & Seligman, 2005). Research has also shown that self-control is an important correlate for math and literacy skills in grade one and in subsequent school years (Blair & Razza, 2007; Gathercole et al., 2004; McClelland et al., 2000). Some researchers have pointed to the fact that executive functions are affected by contextual factors (e.g. the child's emotional state, the environmental context). Hence, Monette & Bigras (2008) made a distinction between focusing attention in a neutral context and in an emotional context, the second context requiring greater focus due to the additional aspect.

Finally, certain health issues and learning problems, attention deficit disorders and language problems are associated with difficulties in school and tendencies to drop out (Aram & Hall, 1989).

The microsystem: family environment

The ***contextual variables of the family environment*** are among the factors contributing the most to children's academic achievement (Sanders & Morawska, 2006). They include culture, income, family composition, the parents' level of education, the mother's age at birth of the child, and languages used at home. Studies have shown that ethnic minorities, low-income families and single-parent families tend to get less involved in their children's education than middle class white families. It follows that

⁹ The ability to self-regulate is closely linked to self-control, one of the three dimensions of the executive functions. These two similar constructs can be measured by examining a child's degree of attention and concentration in completing a task, the ability to suppress inappropriate behaviour such as aggressive gestures, and the ability to resist temptation (Kurdek & Sinclair, 2000; McClelland, Morrison & Holmes, 2000).

there is a lower chance of success for the children from poorer homes (Deslandes & Bertrand, 2004; Lee & Bowen, 2006; Pettit et al., 1997).

The parents' level of education is another important factor in a child's academic achievement (Haveman & Wolfe, 1995). Klebanov, Brooks-Gunn and Duncan (1994) have shown that the mother's education level and family income are important factors in setting up a physical environment that encourages learning, but that only education has proven to be an important factor in the practices of "loving" parents. A series of studies by Davis-Kean (2005) concluded that parents' education influences their child's academic achievement not only through their social success, but also through their beliefs and their behaviour toward their child. Finally, the family language environment is also associated with the child's academic achievement (Chartier et al., 2011). In a minority context, the languages most often spoken in the home by the parents and the child are connected to the passing on of a language and the vitality of French in the home (Forgues & Landry, 2006).

Family processes such as family functioning, parenting style, parental involvement in the home, as well as the parents' expectations and aspirations regarding the child's education, are all sources of influence on the child's academic achievement. Family functioning affects the quality of relationships within the family, in terms of the quality of communications, agreement between members and support available within the family. Family functioning is associated with children's vocabulary acquisition (Desrosiers & Ducharme, 2006).

Parenting style influences a child's social, intellectual, moral and emotional development (Bornstein & Bornstein, 2007). Parenting styles have two components: *sensitivity* which measures to what degree the parent listens to the child and is able to respond to the child's needs and interests; and *control* (or *strictness*) which refers to the degree of supervision and discipline, and the degree to which the parent demands from the child obedience and self-control (Canadian Council on Learning, 2007). There is a clear link between the quality of the parent-child relationship, the parent's sensitivity during early childhood and academic achievement (Centre of Excellence for Early Child Development, 2007; Harvard Family Research Project, 2007; Pettit, Bates & Dodge, 1997). Sensitivity can have a particular impact on the development of academic abilities since it affects the development of a positive self-image, and talking with a child promotes the development of his or her conflict resolution skills, which in turn can lead to calmer behaviour in the classroom, along with attention and interest in school activities (Pettit et al., 1997). Sensitivity also assists in the development of positive relationships with peers and the ability to ask the teacher for help when needed and to manage school-related tasks (Harvard Family Research Project, 2007). Studies on the subject indicate that children display better language skills and have higher IQ test scores when their parents are more encouraging and less controlling (Sanders & Morawska, 2006).

Parental involvement in the child's education at home is another important correlate of academic achievement. This type of involvement includes activities that take place in the home and encourage learning, such as helping with homework, making educational resources available and discussing the parent's desire to learn (Sénéchal & Young, 2008). The parent's involvement during the first few years of elementary school has a positive impact on reading skills, especially when the parent is equipped to act as a tutor (Arnold, Zeljo, Doctoroff & Ortiz, 2008; Sénéchal & Young, 2008; Weiss, Little, Bouffard, Deschenes & Malone, 2009). Regularly taking time to read with a child is associated with growth in

verbal vocabulary. It provides an opportunity for quality time between the parent and child in which the child is exposed to a language and new ideas and concepts, more varied and complex than those normally discussed in a conversation between a parent and a child (Sénéchal & Young, 2008). Furthermore, results of longitudinal studies (QLSCD and the Quebec Study of Newborn Twins) have shown that joint parent-child reading activities contribute to the child's reading performance in grade two beyond the influence of sociodemographic variables (Dionne, 2009). Evidence that written and verbal exposure to French also assist in passing on the French culture to the children (Salerno in Lafrance, 1993) is of particular interest to the Readiness to Learn project. The frequency of activities done with children that promote the development of multiple literacies is a key variable to be considered throughout the project since it contributes to school readiness and academic achievement.

Finally, the parent's aspirations and expectations regarding the child's personal growth and academic achievement have shown to be a strong influence on the child's academic achievement (Fan & Chen, 2001; Jeynes, 2005). According to Fan (2001), parents' aspirations can prove to be more than a simple expectation; they can translate into a variety of activities and positive educational behaviour throughout the child's life.

The microsystem: school

In a minority Francophone context, language is of particular importance. According to Allard (2004), many *ayant droit* parents believe that the ideal school program for their child would be one in which course material was taught in English half of the time and French half of the time, thereby promoting bilingualism. However, these parents are not considering how social and family settings affect the development of children's language skills. Landry's compensation balance model shows that school and family must work together to offset the powerful effects of an anglo-dominant setting (Landry & Allard, 1997). Choosing a French immersion program in an English school does not ensure that the children will become bilingual. Students enrolled in an immersion program do not have the same French performance level as students at French schools and tend to develop a more Anglophone identity.

According to Landry, Allard and Deveau (2007), French schools — particularly those in a school system that enables Francophone children to study in French from preschool through to the postsecondary level — have a key role to play in preserving and passing on the French language and culture. The importance of attending a French school has been proven in studies showing that where education is concerned, the development of language skills varies between anglo-dominant, franco-dominant and bilingual children. The limited knowledge of French in anglo-dominant children often delays learning for franco-dominant and bilingual children (Coghlan & Thériault, 2002).

The mesosystem: family-school interactions

Many studies support the notion that the link between the school setting and the family contributes to a child's development. Family-school communications include parent communications to the school and school communications to the parent, regarding the child's academic achievement, feeling of belonging and progress. Two-way communications imply that both the parent and the teacher are involved and engaged in the child's education.

Beyond communication, the parents' involvement in their child's school has a positive impact on academic achievement (Harvard Family Research Project, 2007; Lee & Bowen, 2006), although it is somewhat less significant than the parents' involvement at home (Stelmack, n.d.). This involvement takes the form of volunteering in the classroom or participating in fundraising activities, school meetings, performances or field trips. Study findings have shown that both types of parent involvement— at home and at school —positively impact on various aspects of the child's education, such as attendance, academic achievement, behaviour and motivation (Deutscher & Ibe, 2002) in addition to increasing the child's knowledge, skills and sense of ability to succeed in school (Deslandes & Bertrand, 2004).

On the other hand, school teaching staff and administration can adopt concrete attitudes and gestures that will encourage more parents to become engaged in their child's education in a more effective manner. Parents tend to participate more often when they feel welcome at their child's school (Ontario Ministry of Education, 2005). Parents who get involved by talking to the teacher/educator and asking questions about the child's day have children with a more extensive vocabulary, better phonological awareness and better pre-writing skills (Arnold et al., 2008). Epstein (n.d.) claims that parents who are well-informed and involved in their child's school life can have a positive impact on their child's attitude and achievement. Research shows that effective regular two-way communications between the parent and teacher foster academic achievement (Izzo, Weissberg, Kasprow & Fendrich, 1999; Weiss et al., 2009).

The macrosystem: community variables

Deslandes & Bertrand (2001) identified the educational community as one in which the partners want to see students succeed and develop their full potential, and in which the partners share a vision and common values. Members of these communities maintain healthy and caring interpersonal relationships with other members of the same community. In a minority Francophone context, a community's ethnolinguistic vitality¹⁰ helps to preserve a feeling of pride and identity, supporting integration, rather than assimilation, of the French language and culture in the majority community. This ethnolinguistic vitality is expressed in the diversity of educational institutions and access to cultural resources in the community. The presence of multiple Francophone settings fosters preservation and expansion of the ethnolinguistic identity and language (Landry et al., 2007). Empiric studies have shown that access to French only resources helps to offset the strong demographic and social influence of English on the daily lives of members of the Francophone community. Speaking in terms that are more relevant for the project, availability of resources and services in the language of education is one of the key factors influencing children's academic achievement. This availability has been identified as an element that protects the Francophone identity and preserves the French language (*Commission nationale des parents Francophones*, 2005).

2.7 This Report

This report documents the long term impact of a preschool program on child and parent outcomes. The results presented will assist in determining whether the new preschool program enabled Francophone

¹⁰ See Guimond (2003) for an overview of studies on ethnolinguistic vitality in a minority setting.

children being raised in a minority community to be better equipped for reading and mathematics, tasks that are essential to academic achievement. We are therefore examining the long term impact of the tested program on children from the combined first and second cohorts, 24 months after the end of the intervention, when the children are aged seven and begin their second year of elementary school. The findings reported in this document are based primarily on data gathered in October 2011 for the first cohort and October 2012 for the second cohort. Data were extracted from children's assessments and the parents' follow-up survey, both administered 24 months after completion of the preschool program.

Chapter 3 discusses aspects related to project methodology, such as sampling, measures and research hypotheses. In chapters 4 and 5, respectively, we describe the preliminary analyses done to ensure the validity of the study findings and the analysis strategies used. The results of the 24-months post-program impact analyses on children and parents are presented in Chapter 6 and Chapter 7 respectively. In Chapter 8, we conclude with a review of the major findings and a discussion of the overall results of phase 1 and phase 2 of the project.

The *Report of Program Effects in Grade 2* is the last report of the Readiness to Learn project. It follows a series of reports, the last of which is entitled: *Readiness to Learn in Minority Francophone Communities: Report of Program Effects in Grade 1*, submitted to HRSDC in June 2012.

3.0 Methodology

This chapter concerns the methodological aspects used in the Readiness to Learn project. The first section presents the target population for the project while the second presents the project's experimental design. A third section explores certain threats to internal validity and the strategies introduced to counter them. The fourth section describes the study sample, specifies changes in the composition of the experimental groups and retention rates across time. The following section details the measures used in the impact analyses for the tested program. The last section examines the series of hypotheses tested in the impact analyses.

3.1 Target population

Parents and children were recruited based on specific eligibility criteria. The **first criterion** was that children in the first cohort had to be born between January 1, 2004 and January 31, 2005, and children in the second cohort had to be born in 2005. This criterion corresponded to the eligibility criterion of enrolment for kindergarten in September 2009 for the first cohort and in September 2010 for the second cohort, set by the Ontario Ministry of Education and the New Brunswick Department of Education and Early Childhood Development. The **second criterion** required that one of the child's parents be an "*ayant droit*" as defined by section 23 of the *Canadian Charter of Rights and Freedoms*¹¹. Since the purpose of the tested program was to enhance children's language skills and school readiness, this criterion ensured that the target population, that is, children entitled to attend a French-language school, was reached.

The **third criterion** related to the parents' intention to register their child in a French school. This criterion was in fact rarely applied since the children were quite young (age 3 or less) when they were enrolled and parents of children that young have generally not made a decision regarding their choice of school. However, if the parents indicated that they had chosen an English school, SRDC made a decision not to obtain the parent's informed consent since the new preschool program was designed to better prepare children for French-language school.

3.2 Experimental design

The long term outcomes of the program were evaluated using a quasi-experimental design with non-equivalent control groups. As with experimental studies in the field, a quasi-experimental design is intended to test, by means of comparison groups and pre-intervention measures (i.e., measures taken before the intervention), the causal hypothesis that an intervention has a significant effect on the variables in question beyond changes that would occur in the absence of that program and independently of other external factors that may come into play.

The methodology involves three experimental groups: a Program Daycare group, consisting of children enrolled in a French-language daycare that offers the new preschool program; a Comparison Daycare group, consisting of children enrolled in a French-language daycare that does not offer the preschool program being tested; and an Informal Care group, consisting of children whose daytime care is

¹¹ *Canadian Charter of Rights and Freedoms* available at <http://laws.justice.gc.ca/eng/Charter/page-1.html>

provided at home or at an unregulated family daycare. The Comparison Daycare group takes into account how formal daycare affects the development of preschoolers, which is a treatment unto itself. The purpose of the Informal Care group is to factor in how an informal childcare environment affects the development of preschoolers, especially with respect to the French language. Children enrolled in an English-language daycare were added to the Informal Care group for the impact analyses. Although these children were exposed to a formal daycare environment, they were not exposed to a French environment. By not classifying these children in the Comparison Daycare group, we maintained language homogeneity in the Comparison Daycare group in regards to exposure to a French-language daycare program.

3.3 Internal validity

Since random assignment was not possible, there are likely inherent differences between the Program Daycare group and the comparison groups from the outset. This makes it even more important to implement conditions to ensure the study's internal validity, thereby eliminating from the start any *plausible* alternative explanations for results. In fact, it is less advantageous to use control techniques, often statistical, after the study ends.

Under the Readiness to Learn project, several conditions were put in place to ensure the internal validity, such as:

- using a sample size large enough to achieve the statistical power needed to detect a medium effect size with a very high degree of confidence that the true value of the estimated effect falls within a specific interval (i.e., we would obtain the same results 19 times out of 20 with other samples);
- using a sampling strategy that ensures a relatively homogenous distribution of sociodemographic and community factors across experimental groups;
- taking pre-intervention measures for the anticipated program effects or outcomes and associated factors (in this case, the correlates to academic achievement);
- verifying the effects of sample attrition on group composition;
- preventing the contamination of comparison groups.

Profiles for the children, their family, and the communities before the first year of formal education can be found in the report *Readiness to Learn in Minority Francophone Communities: Report of Findings from the Preschool Phase* (Legault et al., 2014). Details of the considerations taken to maintain the study's internal and external validity can also be found in Section 3.3.

3.4 Description of the Sample by Community and by Experimental Group

The first cohort of project participants was from the minority Francophone communities of Cornwall, Orleans and Durham, Ontario; and Edmundston, New Brunswick¹². The recruitment period for this first cohort extended from May to October 2007. Participants from the second cohort live in the minority Francophone communities of Cornwall and Orleans, Ontario. The recruitment period for the second cohort took place in the fall of 2008.

The statistics reported below describe the sample for both cohorts of participants. Further information on the sampling strategy used in the context of the study can be found in the report *Readiness to Learn in Minority Francophone Communities: Report of Findings from the Preschool Phase* submitted to HRSDC on May 31st, 2011.

Total sample at enrolment: At the time of enrolment, the project involved 356 children from 352 families. As observed in Table 3.1, the communities of Edmundston and Cornwall had the highest proportion of participants (first cohort, 23.9% and 20.2%, respectively), followed by the communities of Orleans (15.5% for the first cohort and 15.7% for the second cohort), Cornwall (12.9% for the second cohort) and Durham (11.8%).

The average age of the children when they enrolled in the project was 38 months. There was a balanced number of boys (49.4%) and girls (50.6%). The mother tongue of the children in the sample (according to the most knowledgeable respondent) was mainly French (71.1%) followed by English or another language (19.4%).

The mother's age at birth of the child in question was 27.5 on average. In terms of education, 80% of these mothers had at least a college diploma, and half of them had a university degree. Average household size was four members; 8.4% of families were headed by single parents. Over half of the participating families (59.1%) had an annual income of over \$70,000; median annual income ranged from \$80,000 to \$99,999. With respect to the linguistic profile of the participating families, over half of the mothers (61.7%) and fathers (55.0%) spoke only French to their child. Most children were from Francophone endogamous homes (49.3%), followed by exogamous homes (39.2%)¹³.

Total sample at 24 months post-program: The sample described in Table 3.1 presents the participants included in the 24-month post-program impact analyses, broken down by community and cohort. This sample reflects families who were still enrolled at the end of the program and, consequently, includes participants who withdrew during the second phase of the study, for whom missing data could be imputed (see Section 4.2 for a description of analyses on missing data and attrition). At the 24-month post-program period, the sample used for impact analyses consisted of 336 children from 332 families. It included 165 boys (49.1%) and 171 girls (50.9%). The children's average age was 86.5 months, or 7 years and 2 months. The mother tongue of the children in the sample (according to the most

¹² Originally, the project included the communities of Edmonton, AB and Saint John, NB. We do not report data for these communities as they were not included in the impact analyses presented in this report. The lack of French-language daycares that could be used as counterfactuals made it impossible to properly measure the impact of the program in these two communities.

¹³ Type of homes or household type was determined by combining the mother and the father's first official language spoken (FOLS).

knowledgeable respondent) was primarily French (71.1%), followed by English or another language (19.4%).

In terms of education, 80% of the mothers had at least a college diploma, and half of them had a university degree. Average household size was four members; 15.8% of families were headed by single parents. More than two-thirds of the participating families (69.0%) had an annual income of over \$70,000; median annual income ranged from \$80,000 to \$99,999. With respect to the linguistic profile of the participating families, almost half of the mothers (49.4%) and fathers (47.2%) spoke only French to their child. Most children were from Francophone endogamous homes (50.1%), followed by exogamous homes (38.8%)¹⁴.

Table 3.1 Participant breakdown by community and cohort at enrolment and at 24 months post-program

Community	Baseline (At enrolment)	24-month post-program evaluation (48 months)
Cornwall - Cohort 1	72 (20.22%)	68 (20.24%)
Cornwall - Cohort 2	46 (12.92%)	45 (13.39%)
Durham	42 (11.80%)	34 (10.12%)
Edmundston	85 (23.88%)	83 (24.70%)
Orleans - Cohort 1	55 (15.45%)	53 (15.77%)
Orleans - Cohort 2	56 (15.73%)	53 (15.77%)
Total	356 (100%)	336 (100%)

Sample by experimental group: At the time of enrolment, the project involved 110 children in the Program Daycare group (G1), 135 children in the Comparison Daycare group (G2) and 111 children in the Informal Care group (G3). These figures shifted to 95, 130 and 111 respectively for G1, G2 and G3 at 24 months post-program (see Table 3.2). A child's experimental group was determined by the number of hours exposed to one of the three types of child care during the first eight months of program delivery.¹⁵ This decision was made when significant fluctuations were observed in the second year of program delivery as Ontario children began attending part-time or full-time junior kindergarten.

Any change in group composition is likely to bias program impact estimates. This threat to statistical validity was controlled in two ways. Firstly, we verified whether changing groups or withdrawing from the study was associated with dependent variables or with the experimental group. Based on the results of these analyses, we proceeded with data imputation (see Section 4.2 for a description of

¹⁴ Household type was determined by combining the mother and the father's first official language spoken (FOLS).

¹⁵ Data collected during the summer months were excluded. The most reliable measurement of the average effect of program exposure relies on information collected during the school year.

attrition analyses) and included the variable “Changed group in the first year” as a covariate (see Appendix A). These two strategies assisted in maximizing the validity of the program impact estimates.

Table 3.2 Participant breakdown by experimental group at time of enrolment in the preschool program and at 24 months post-program

Study group	Baseline (At enrolment)	24-month post-program evaluation (48 months)
Program Daycare group	110 (30.9%)	95 (28.3%)
Comparison Daycare group	135 (37.9%)	130 (38.7%)
Informal Care group	111 (31.2%)	111 (33.0%)
Total	356 (100%)	336 (100%)

Retention rate

The Readiness to Learn project has an excellent retention rate, with only 38 withdrawals (10.7%) since the project’s inception in 2007. The main reason for a child’s withdrawal from the project is a family move outside the community. Note that some children continued to be tracked in cases where the move was to another community participating in the project. From that point on, these children were considered participants in the new community. The second most cited reason for withdrawal was a loss of contact with the family. After the program delivery ended, contact with participating families was maintained with the *L’il Updates* Newsletter sent four times a year and the annual data collection in October. Despite much effort, we were unable to contact certain families using the most up-to-date contact information and additional contact information (i.e., contact information of a person who knows the family well) obtained in the previous survey. These families are therefore considered withdrawals from the project.

Table 3.3 lists the reasons for withdrawal from the project during the two phases of the project, that is, from enrolment to the exit of the of preschool program (or from enrolment to the end of the program delivery at 24 months), and during the two following years, that is at 12 and 24-month post-program follow-up periods (or 36 and 48 months from enrolment in the program).

Table 3.3 Reasons for Child Withdrawal from the Readiness to Learn Project at the end of the preschool program and at the 24-month post-program period

Reason for withdrawal	Phase 1 (from enrolment to the end of the program at 24 months)	Phase 2 (during the 12 and 24-month post-program period)	Total
Move outside of a participating community	8	4	12
The child transferred to an English daycare/not enough English at the Program Daycare	3	0	3
Family lack of availability	4	0	4
Bothered by questions in the baseline survey	1	0	1
Loss of contact with the family	2	5	7
The child has a developmental problem	2	0	2
The parent no longer wishes to have their child assessed or respond to a survey	0	3	3
Refused to participate in the study's extension	0	6	6
Total number of withdrawals	20	18	38

3.5 Measures

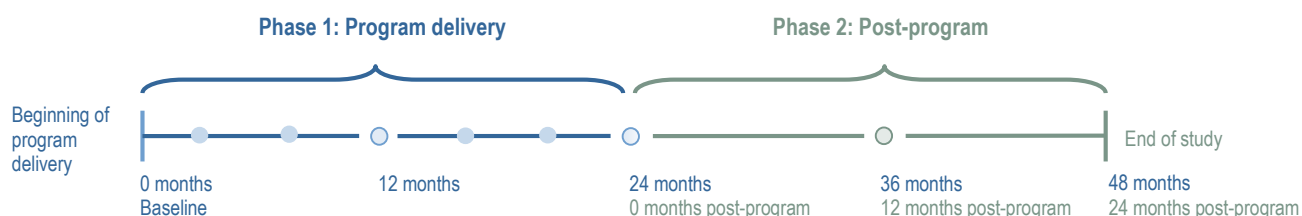
This section discusses the measures used to conduct the 24-month post-program impact analyses. The section begins with an overview of the data collection plan and response rates observed for parents' surveys and children's assessments. It then continues with a description of the measurement tools used with both the parents and children.

3.5.1 Data Collection Plan

The Readiness to Learn project took place over a four year period during which several waves of data collection were held. The project has two phases, in which the first covers the preschool period and the second phase covers the early years in elementary school (grades one and two). Figure 3.1 below illustrates the administration timeline of child assessments and parent surveys. During the first phase, data were collected regularly every four months, beginning in October 2007 for participants in the first cohort and October 2008 for those in the second cohort. Thereafter, data were collected annually during the second phase, in October 2010 and 2011 for the first cohort and October 2011 and 2012 for the second cohort. These points in time correspond to 12 and 24 months post-program respectively in Figure 3.1, the period following completion of program delivery.

Please refer to Figure 3.1 to better understand the time periods mentioned in the text in line with data collections or results of the analyses.

Figure 3.1 Schedule for project data collection



3.5.2 Response rates

Child assessments

Table 3.4 shows that 314 child assessments were completed among the 318 children across the combined cohorts who were still enrolled in the project at the 24-month post-program period, for a response rate of 98.7%.¹⁶ Table 3.4 displays the response rate for the child assessments while accounting for the missing assessments at the 24-month post-program evaluation period and the withdrawals since the beginning of the project (88.2%). The average length of time to complete an assessment was 40 minutes.

Table 3.4 Response rate for child assessments at enrolment and at the 24-month post-program period

	Baseline assessment (Enrolment)	24-month assessment period (48 months)
Children assessed	346	314
Absent	4	4
Withdrawals	6	38
Response rate	97.2%	88.2%

Parents' surveys

The 24-month post-program survey was administered to the parents by phone. Whereas the administration of the survey was captured on paper for the first cohort, survey administrators entered answers of parents from the second cohort directly in the online survey. Online surveys allows data to be entered directly in a data processing software. The survey took on average 30 minutes to complete. Of the 318 families enrolled in the project during the 24-month post-program evaluation period,

¹⁶ Note that the analyses covered 336 children since it was possible to impute data for the eighteen families who withdrew in the second phase of the project and the four children who were absent using data collected at the end of the program delivery (24 months) and at the 24-month post-program evaluation (36 months). Section 4.2 contains details on imputation of missing data.

302 families completed the survey, for a response rate of 95.0%.¹⁷ Table 3.5 shows the response rate while accounting for the missing surveys at the 24-month post program period and withdrawals since the beginning of the project (85.8%).

Table 3.5 Response rates for parent surveys at baseline (at enrolment in the program) and at the 24-month post-program follow-up

	Baseline survey (Enrolment)	24-month post-program survey (48 months)
Surveys administered	356	302
Absent	0	16
Withdrawals	0	38
Response rate	100%	85.8%

3.5.3 Child Measures

Identity Dimension

The children's direct evaluation began with four questions relating to the Francophone cultural identity and the vitality of the Francophone community. These items captured the child's perception of these identity dimensions. The first two questions assessed the language most often used by the child in school and the language most often spoken by people in the community on a 4-point scale, where 0 indicates "English only and/or another language", 1 indicates "English and/or another language more often than French", 2 indicates "French more often than English and/or another language", and 3 indicates "French only". Children were asked two more questions to assess how important it is for him/her to speak in one language more than another, and whether he/she is proud to speak French.

Language Skills

Domain C (Language and Communication) Early Years Evaluation — Direct Assessment (ÉPE-AD; Willms, 2007): This test consists of 14 four-point items measuring the child's communication and comprehension abilities. The evaluator asks the child to point to pictures that represent a word she says, repeat seven syllable sentences, answer questions with complete sentences, use pictures to tell a story, and demonstrate the meaning of four action words. This is the only domain of this measure administered to all children in French since it was part of the decisional tree used to determine the

¹⁷ Note that analyses covered 336 parents since it was possible to impute data for the eighteen families who withdrew in the second phase of the project and sixteen families who were absent during the 24-month post-program evaluation period using data collected at the end of program delivery (at 24 months) and at the 12-month follow-up evaluation period (36 months). Section 4.2 contains details on imputation of missing data.

language in which the direct assessment would be administered.¹⁸ Only results from the baseline assessment were retained to statistically control for initial intra individual differences. The scale's internal consistency is excellent, with a Cronbach alpha of 0.92.

Échelle de vocabulaire en images Peabody – Révisé (ÉVIP-R; Dunn, Thériault-Whalen, & Dunn, 1993): The Échelle de vocabulaire en images Peabody – Révisé (ÉVIP-R) is the validated French translation of the Peabody Picture Vocabulary Test – Revised (PPVT-R), which measures a child's receptive vocabulary. The test resembles a game: the child hears a word spoken out loud and must identify the correct picture from among four alternatives. The test stops once a child makes six errors in eight tries. According to test rules, the child's starting point for the test is based on his or her age and performance. The PPVT-R was administered twice in the context of the Readiness to Learn project: when the program ended (0 months post-program) and at 24-months post-program. The starting point at the 24-month post-program evaluation was established based on children's scores on the first administration of the test as per the recommendation in the test manual.¹⁹ The child's score represents the sum of the correct responses up to the last administered item, as per the test stop rule (score range = 7 to 131).

Verbal fluency (Cormier, Desrochers & Sénéchal, 2006): This test is part of the *Batterie de tests pour l'évaluation multidimensionnelle de la lecture en français* (BÉMÉL) which has the benefit of having been validated in French-Canadian minority communities. Verbal fluency refers to the ease with which a person accesses linguistic information (for example, naming the item quickly and automatically; Plaza, 2003). The test consists of presenting the child with a category (for example, fruit) and asking the child to name as many examples as possible in the given category within a specified time (for example, apple, orange, etc.). The child obtains an overall score based on the total number of acceptable examples given for each category within 30 seconds. The score partially reflects the child's efficiency at retrieving his or her semantic network (Rosen & Engle, 1997). Validation studies show an acceptable temporal fidelity index when the score used is the total number of examples given for only two categories ($r = 0.76$; Korkman, Kirk & Kemp, 1998). The BÉMÉL semantic fluency includes several categories. For the purposes of this project, only four categories were considered to be necessary to obtain a good measure of verbal fluency (i.e., animals, fruit, vegetables, and drinks). The overall score represents the total number of examples given for all of the categories combined (score range = 0 to 41).

Reading Skills

Reading Complex Words (*Lecture orale de mots complexes*; Cormier, Desrochers & Sénéchal, 2006): This test is part of the *Batterie de tests pour l'évaluation multidimensionnelle de la lecture en français*

¹⁸ The administration procedure of the ÉPE-AD as well as the decisional tree used to determine testing language are detailed in the Appendix D of the *Report of Findings from the Preschool Phase* submitted to HRSDC in June 2011.

¹⁹ According to the rules of the test, a child can start at a different point in the test than the one suggested for his/her age group on the basis of his language skills. By referring to the child's previous scores, the ÉVIP-R starting point at 24 months post-program was determined by calculating the baseline level (the last series of eight correct consecutive responses). The starting point is the first item of that baseline level.

(BÉMÉL). It assists in assessing precursors to reading as well as children's reading skills from kindergarten to grade six. It consists of 40 one to six-syllable words (with complex spelling) presented in increasing order of difficulty for young Francophone Canadians (from Ontario and Quebec). The test is stopped if the child fails to read four out of six consecutive words. The overall score represents the number of words that were read correctly. The range of scores for this study sample was 0 to 39.

Reading Sentences (*Lecture orale de phrases; Cormier et al., 2006*): This test is also part of the *Batterie de tests pour l'évaluation multidimensionnelle de la lecture en français* (BÉMÉL) validated in French-Canadian minority communities. This second reading test serves to distinguish between reading words and reading full sentences. In both cases, children's performance is evaluated on the basis of words' correct pronunciation. Reading sentences requires additional skills from the child and its ecological validity is greater in the sense that reading sentences more closely resembles typical reading done by children. The Reading Sentences test includes six sentences, in which ten words are evaluated per sentence, for a total of 60 words. The test administration is stopped after two minutes of reading. The overall score represents the number of words correctly read. The range of scores for this study sample was 0 to 60.

Comprehension of Written Sentences (*Compréhension de phrases écrites; Cormier et al., 2006*): This test, which assesses reading comprehension, is also part of the *Batterie de tests pour l'évaluation multidimensionnelle de la lecture en français* (BÉMÉL) validated in French-Canadian minority communities. It consists of a series of sentences presented to the child in which a word is missing to make the sentence complete. The child must read silently each of the 40 sentences and write his/her response in an answer notebook. For each of the sentences, the child must choose the word that allows to complete the sentence among four options (multiple choices). The test is stopped after seven minutes. The overall score represents the number of correct responses. The range of scores for this study sample was 0 to 27.

Mathematics skills

Knowledge of Numbers (Case & Okamoto, 1994): This test is a French translation of the *Number Knowledge Test* (NKT) by Case & Okamoto (1994). It is designed to assess children's age-appropriate levels of comprehension of the system of whole numbers (Okamoto & Case, 1996). The test is subdivided into five levels that correspond to the normal levels of mathematics knowledge in children aged 4, 6, 8, 10 and 12. The test includes five levels that measure children's abilities to count, add, and compare. Depending on the items, children are asked to manipulate objects (e.g., tokens, coins or felt shapes) or use stimuli plates. Children are asked questions verbally and must successfully answer a minimum number of questions before moving on to the next level (for example, three of the five items at the first level; seven of the 14 items at the second level; eight of the 17 items at the third level; and eight of the 16 items at the fourth level). Children have about 30 seconds to answer each question after which, the item is scored as failed. Simple arithmetic problems measured in this test proved to be predictive of a child's ability to succeed in mathematics. The test was administered at 12 months post-program and again at 24 months post-program, albeit with a slight modification in the administration instructions. Given that it was the second administration of this test, an individual starting point was determined for each child based on his/her performance on the previous evaluation. Therefore, children started at the first question of the level they had previously failed. For example, if a child had

successfully achieved level three (based on the stop rules), but had failed level 4, his starting point would be the first item of level 4. This strategy allowed us to reduce the administration time by a few minutes, all the while allowing children to focus on concepts adapted to his/her level of difficulty. The total score represents the number of problems solved until a child can no longer answer the questions at a given level. The range of scores at 24 months post-program was 0 to 49.

Executive Functions

Digit span test (Wechsler, 2004; Wechsler, 2005): This test is a subscale of the Wechsler Intelligence Scale for Children adapted for Francophone Canadians (Franco-Ontarians, Quebecois; WISC-IV^{CDN-F}, Wechsler, 2005). It assesses the ability to retain oral information in memory and then to manipulate that information. The test consists of a memory span task where children are asked to repeat a series of numbers. In the first task, the child simply repeats a series of numbers as heard (**Forward Digit Span**). Completing this task is an exercise of the working memory. In the second task, the child repeats a sequence of numbers in reverse order (**Backward Digit Span**). In addition to the working memory, this second task also requires mental flexibility. In other words, to successfully complete this task, the child must be able to retain the numbers heard and manipulate them before answering. In both tasks, the sequence of numbers to be memorized gets longer and longer as the child progresses in the test. Each sequence of numbers is read out loud to the child once. The child successfully completes the task if he or she can correctly repeat the sequence of numbers in the order requested. The test is stopped after two failed attempts for the same item (each item is comprised of two trials). The working memory exercise has been validated and has French-Canadian norms. The first composite score represents the number of sequences repeated correctly as heard (Forward Digit Span). A second composite score represents the number of sequences repeated correctly in reverse order (Backward Digit Span). The range of scores for the current sample is 0 to 14 for the Forward Digit Span and 0 to 10 for the Backward Digit Span.

The NEPSY²⁰ Knock-Tap Test (Korkman et al., 1998): This test is a sub-scale of the battery of NEPSY tests appropriate for children aged 3 to 12. Molfese, Molfese, Molfese, Rudasill, Armstrong and Starkey (2010) successfully used the Knock-Tap test in their studies that included children in grade 2. These authors found that the Knock-Tap test was strongly correlated with scores from other more expensive and time consuming tests (e.g., Directional Stroop Task” on the computer; Davidson, Cruess, Diamond, O’Craven & Savoy, 1999).

The Knock-Tap Test includes two series of 15 trials. In the first series, the evaluator performs an action (knocks at the table or taps the table with an open hand) and the child must perform the opposite action. The evaluator chooses the action for each trial according to a predetermined order. For the second series, the rules of the game change with the introduction of a new action: when the evaluator knocks on the table with his fist, the child must do the same with the side of his fist; when the evaluator knocks the table with the side of his fist, the child must knock the table with the knuckles of his fist. Finally, when the evaluator taps the table with an open hand, the child must not do anything. This task is complex to administer and for this reason, was subjected to an intensive training session for the evaluators. Two points are given for each correct response, one point is given to each autocorrection (if

²⁰ NEPSY is a named formed from the spelling of the words “neurology” and “psychology”.

the child gives the correct answer immediately after having done or started the incorrect action), and 0 point is given for an incorrect action. The child must obtain six correct responses in the first series in order to proceed to the second series. The overall score represents the number of correct responses in the second series of trials (score range = 6 to 15).

3.5.4 Parent Measures

The scales used in the parent surveys were obtained from studies on Canada's Francophone populations, such as the National Longitudinal Survey of Children and Youth (NLSCY; Statistics Canada and Human Resources and Social Development Canada, 2005, 2006), the Quebec Longitudinal Study of Child Development (QLSCD; *Institut de la statistique du Québec*, 2003) and the Survey on the Vitality of Official Language Minorities (SVOLM, Statistics Canada, 2006). A few questions created by SRDC for the purpose of the study were added at the end of the survey for parents in the Program Daycare group. The questions selected for the surveys of the Readiness to Learn project were those relevant to the children's age group at the time of the baseline survey and the 24-month post-program follow-up survey. Note that only the scales included in the impact analyses are detailed in this section. Consequently, the list of scales differs somewhat from those found in previous Readiness to Learn project reports. Several other constructs were measured though they were not retained in impact analyses. The decision to include them or not was based on preliminary analyses, results of which are reported in Chapter 4.

Sociodemographic Characteristics

The sociodemographic characteristics of children and parents stem from questions asked on the parental consent form (for example, the child's gender and date of birth) and in the baseline survey. The follow-up surveys were an opportunity to make any necessary changes to this initial profile. This section identifies the sociodemographic variables used in the impact analyses.

Information on the mother's age at the child's birth, parents' mother tongues and knowledge of official languages were gathered in the baseline survey. Parents' immigrant status was established by means of a question in the follow-up survey administered upon program completion (i.e., at 0 months post-program according to the Figure 3.1). The 24-month post-program follow-up survey was used to update information on parents' education level, family income, household size, family composition (i.e. single-parent families) and the number of paid hours worked weekly (see Appendix A for a complete list of variables considered for the impact analyses). Other variables included in the analyses remained constant throughout the study (child's gender, child's age at baseline assessment, mother's age at the child's birth, immigrant status, and social capital).

Linguistic Variables

Some questions in the 24-month post-program follow-up survey were used to update the linguistic profile in the home of participating families, especially the ***Languages Spoken by Mother to Child*** and the ***Language Spoken by Father to Child***. SRDC created two variables to measure the ***Household type***, which describes the child's linguistic home environment.

The first variable, entitled ***Household type based on the language spoken to the child*** is calculated by crossing the languages spoken to the child by the mother and the father.²¹ It is considered to be a more accurate reflection of the child's linguistic home environment. Respondents had several options from which to choose the category that was most representative of their experience (i.e., whether they spoke English only to their child, English and French, French more than English, etc.). The variable Household type based on language spoken to the child was then dichotomized, with the score of 1 signifying "French only" (48% of the sample) and 0 reflecting all other categories (52% of the sample).

SRDC created a second variable entitled ***Household type based on FOLS*** to assess the language spoken in the home. This variable was created by crossing the mother's First official language spoken (FOLS) with that of the child's father. This variable takes into consideration knowledge of both official languages, mother tongue and the language most often spoken at home (Forgues and Landry, 2006). The Household type based on FOLS score was then dichotomized with 1 indicating "Francophone endogamous" and 0 grouping together all other categories. This dichotomized variable was used in analyses identifying confounding variables (see Section 4.3 and Appendix A).

The ***Continuum of French Spoken by Child*** is based on the languages the child normally uses to communicate with his or her mother, father, friends and siblings at home and outside of the home. Languages spoken by children are a good indication of the languages in which they feel the most comfortable expressing themselves. They also act as a predictor of the child's cultural identity. Respondents chose among several categories the one that best represents their child's experience (e.g., if the child speaks English only, English and French, French more than English, etc.). A global score was obtained by averaging scores for each item. Items were answered on a three-point scale where a score of 1 indicates that the child communicated very little in French and a score of 3 indicates that he or she communicated in French only. The scale's internal consistency is very good with a Cronbach alpha of 0.88.

Family Processes

Most family process measures were gathered from the baseline survey. Some of these processes were measured again in the follow-up surveys. A total of seven family processes were computed as scales, including Family functioning, Depression, Positive parenting practices, Authoritarian parenting practices, Empowerment (or supporting autonomy), Frequency of literacy activities and Language of literacy activities.

The ***Family functioning*** scale, consisting of eight items, assesses the quality of connectedness within the family. The items pertain to emotional openness, expression of feelings, and positive interactions within the family. The choice of answers for the items on the scale ranged from 1, "Strongly disagree," to 4, "Strongly agree." An overall score is obtained by averaging the scores for each item. The Family functioning scale shows excellent internal consistency, with a Cronbach alpha of 0.81.

²¹ For single-parent families, only the language spoken by the parent living with the child was considered in the creation of both variables that measure the home language environment. The languages spoken to the child by the mother and father are also used as dependent variables in impact analyses in Chapter 7.

The **Depression** scale has eight items that reflect a despondent mood (e.g., feeling depressed or sad, crying, feeling lonely). The answers for these items are scored on a 4-point scale, where 1 indicates that the respondent felt this way “Rarely or none of the time” and 4 signifies that the respondent felt this way “Most or all of the time.” A global score is obtained by averaging the scores for each item. The Depression scale has a high internal consistency with a Cronbach alpha of 0.80.

The **Positive parenting practices** scale assesses the warmth dimension of the parenting style. It consists of five items measuring the frequency of positive interactions between parent and child (for example, the number of times the parent praises the child, laughs with him or her or expresses affection). Items are scored on a five-point scale, where 1 indicates “Never” and 5 indicates “Many times a day.” An overall score is obtained by averaging the scores for each item. The scale’s internal consistency is acceptable, with a Cronbach alpha of 0.62.

The **Authoritarian parenting practices** scale assesses the control dimension of the parenting style. It consists of four items measuring the degree of supervision and discipline. It tells us, among other aspects, whether the child complies with the punishments imposed or whether punishments vary depending on the parent’s mood. Items are scored on a five-point scale where 1 indicates “Never” and 5 indicates “Almost always.” An overall score is obtained by averaging the scores for each item. The scale shows an acceptable internal consistency with a Cronbach alpha of 0.61.

The **Empowerment** (or autonomy support) scale considers the opportunities afforded to the child to develop his or her autonomy (for example, does the child have specific daily chores to do, does the child have the possibility to explore his or her own interests, does the child care for a pet or another person). The five items are scored on a 4-point scale where 1 indicates “Strongly disagree,” and 4 indicates “Strongly agree.” An overall score is obtained by averaging the scores for each item. The Empowerment scale internal has poor internal consistency with a Cronbach alpha of 0.33.

The **Frequency of literacy activities** scale consists of five items from the baseline survey measuring the frequency of reading, writing and numeracy activities. Measured activities are those parents do with their child, including reading with the child, teaching the child how to read letters or words, and teaching the child to write letters or words. These items are scored on a 5-point scale, where 1 indicates that an activity is done “Rarely or never” and 5 indicates that an activity is performed “Every day”. An overall score is obtained by averaging the scores for each item. The scale’s internal consistency is relatively poor, with a Cronbach alpha of 0.52 at baseline. The Frequency of literacy activities was measured with a single item at the 24-month post-program follow-up survey.

The **Languages of literacy activities** consists of five items from the baseline survey measuring languages used when the parent leads the child in reading books, letters or words, and in writing letters or words. Respondents have several categories from which to choose the one most representative of the language used when engaging in a group of similar literacy activities. These categories were combined to create a 5-point scale representing a language continuum *for each group of similar activities* where a score of 1 indicates that the activity is done in “English only”, a score of 3 indicates that the activity is done in “French and English and/or another language”, and a score of 5 indicates that the activity is done in “French only”. An overall score is obtained by averaging the scores for each item. Internal consistency is very high with a Cronbach alpha of 0.94 for the baseline survey. The

Languages of literacy activities was measure using a single item at the 24-month post-program follow-up survey.

School Environment

The 24-month post-program follow-up survey include questions on the type of school (French language, English language or immersion) the child attends, his or her participation in a francization program the previous year, and the need for additional assistance or tutoring. Two other questions dealt with homework: how often during a typical month did the child have homework/schoolwork, and the number of hours spent on homework each day. Finally, the survey included four scales which served to establish parents' perception of: (1) their child's school, (2) their child's teacher, (3) their child's readiness for school, and (4) their child's school achievement in grade one.

The ***Perception of the school*** scale measures the parent's perception of the child's school based on five items (e.g., most children seem to be happy at school; parents feel welcome at school; students have a strong sense of belonging). The items are scored on a 4-point scale where 1 corresponds to "Strongly disagree" and 4 corresponds to "Strongly agree". An overall score is obtained by averaging the scores for each item. The scale's internal consistency is very high, with a Cronbach alpha of 0.85.

The ***Perception of the teacher*** scale consists of four items measuring communications between the teacher and the parents (e.g., the amount of information provided by the teacher concerning the child's behaviour and the child's activities during the school day). The items are scored on a 4-point scale where 1 signifies "Strongly disagree" and 4 corresponds to "Strongly agree". An overall score is obtained by averaging the scores for each item. The scale's internal consistency is very good, with a Cronbach alpha of 0.79.

The ***Perception of the child's school readiness*** by the parent consists of five items which measures the parent's perception of his/her child's school readiness when he/she attended grade one of elementary school. The items are scored on a 3-point scale where 1 corresponds to "Not at all" and 3 corresponds to "A great deal". An overall score is obtained by averaging the scores for each item. The scale's internal consistency is acceptable, with a Cronbach alpha of 0.63.

The ***Perception of the child's school achievement*** by the parent consists of four items which measures the parent's perception of his/her child's school achievement when he/she attended grade one of elementary school. The items are scored on a 4-point scale where 1 corresponds to "Very poor" and 4 corresponds to "Very good". An overall score is obtained by averaging the scores for each item. The scale's internal consistency is very good with a Cronbach alpha of 0.86.

Sociolinguistic Environment

Questions pertaining to the sociolinguistic environment in which the child is being raised were obtained from the baseline survey and the 24-month post-program follow-up survey.

The ***Vitality of the Francophone community*** was assessed by way of four items pertaining to the frequency with which French is used in public areas (i.e., businesses, work places, and government services) and access to French-language services (media). The overall score gives us an indication of how often French is used in the community. The answers are scored on a 6-point scale where 1

indicates “Never” and 6 indicates “Always”. An overall score is obtained by averaging the scores for each item. The scale’s internal consistency is very high, with a Cronbach alpha of 0.82 at baseline and of 0.72 at 24 months post-program.

Engagement in Francophone culture includes four items designed to measure to what degree the parents are willing to take part in Francophone cultural activities in their community and get involved in organizing them. The items are rated on a 5-point scale where a score of 1 indicates “Not at all” and a score of 5 indicates “Very strongly”. An overall score is obtained by averaging the scores for each item. The scale’s internal consistency is acceptable, with a Cronbach alpha of 0.72 at baseline.

Sense of belonging to Francophone culture is measured using a question designed to determine the cultural group with which the parents identify. Choices included primary or sole identification with the Francophone group, primary or sole identification with the Anglophone group, and identification with both groups equally or another linguistic group.

Perceived Effects of the Program

A series of questions pertaining to the perceived effect of the program were included in the survey for the parents in the program group. These questions were created by SRDC in line with the program objectives. Eight questions examined the perceived effect of the program on children’s school readiness, school achievement in grade one and development of the francophone cultural identity. Five additional questions examined the perceived effect of the program on the parents, for example, if the program encouraged parents to communicate more often in French with their child, initiate more literacy activities with their child, and develop a feeling of belonging toward their child’s school and toward the French community. The scales internal consistency is very good, with a Cronbach alpha of 0.88 for the perceived effects on children and of 0.78 for the perceived effects on parents.

Daycare Environment

Dosage: The number of hours per week spent in child care allows to measure the program “dosage” that children receive at daycare. To gather this information, SRDC used the attendance record already filled out by the educators as part of their duties, which includes the time of arrival and departure for each child. The total number of hours the child spent at daycare was compiled on a weekly basis and sent once a month to SRDC’s Ottawa office.

Furthermore, elements of the structural quality of daycares, such as the educators’ salary, training, education level and number of years of experience, were obtained through in-depth interviews or through data collected in the educator’s signed consent form.

3.6 Hypotheses Being Tested

Through its two components – the daycare component and the family literacy component – the Readiness to Learn project seeks to enhance the school readiness of young Francophones living in a minority community and positively influence their abilities in dimensions associated with academic achievement so that their school performance is ultimately enhanced. The main objective of the daycare component is to directly influence child outcomes, while the objective of the Family Literacy

component is to indirectly influence the child outcomes by modifying the parents' attitudes and behaviour. The main research question of the present report is to examine if the *combined effect* of the preschool program has a positive impact on predictors of children's school achievement. Based on our previous results (see the *Report of Findings from the Preschool Phase* and the *Report of Program Effects in Grade 1* submitted to HRSDC in May 2011 and May 2012 respectively) and research findings on the development of children growing up in a minority context (e.g., Chartier et al., 2011; Maltais, 2007), we propose the following hypotheses:

1. Compared to children in the comparison groups, children in the Program Daycare group will have better language skills. This effect will be more pronounced for children in the Program Daycare group with *low exposure* to French in the home at baseline.
 - This hypothesis is consistent with findings of Maltais' work (2007), where the effect of a full time preschool program on linguistic development in a minority context at the end of kindergarten and grade 2 depends on weak exposure to French in the home.
2. Compared to children in the comparison groups, children from the Program Daycare group will have greater reading skills. This effect will be more pronounced for children in the Program Daycare group with *high exposure* to French in the home at baseline.
 - This hypothesis is based on the fact that basic linguistics skills promotes the ability to learn in French and the development of reading skills.
3. Compared to children in the comparison groups, children from the Program Daycare group will have greater mathematics skills. This effect will be more pronounced for children in the Program Daycare group with *high exposure* to French in the home at baseline.
 - This hypothesis is based on the fact that basic language skills facilitate the ability to learn in French, and consequently, promotes the development of more complex skills such as mathematic skills.
4. Compared to children in the comparison groups, children from the Program Daycare group will have greater scores on scales measuring executive functions. This effect will be more pronounced for children in the Program Daycare group with *high exposure* to French in the home at baseline.
 - This hypothesis is based on the fact that a strong exposure to French is necessary to compensate for the largely Anglophone environment in the public sphere, which allows children to develop an additive bilingualism instead of subtractive bilingualism, and in turn, additive bilingualism is associated with the development of executive functions (Adesope et al., 2010).
5. Compared to parents in the comparison groups, parents in the Program Daycare group will engage more often in literacy activities, and these activities will be performed more often in French. Furthermore, compared to the parents in the comparison groups, the Program Daycare group parents will use French more often to communicate with their child.

6. Looking back, parents of the Program Daycare group will perceive a positive effect of the program on their child's school readiness, school achievement, and development of the francophone cultural identity, as well as on their own behavior and feelings of belonging to the school and the francophone community.

4.0 Preliminary Analyses

This chapter describes the steps used to validate quantitative data from both cohorts of the Readiness to Learn project. These preliminary analyses have two primary goals: to optimize the database and to determine the data's limitations with respect to the internal²² and external²³ validity of the results.

The preliminary analyses presented in this chapter primarily address the 24-month follow-up post-program evaluation period (see Figure 3.1 for the timeline of data collection for the two phases of the study). The next sections discuss respectively: the quality control process (Section 4.1), treatment of missing values and attrition (Section 4.2), identification of confounding variables (Section 4.3) and assessment of the project sample's representativeness (Section 4.4). The chapter ends with a summary of the preliminary analysis and its implications in evaluating the impact of the tested program (Section 4.5).

4.1 Quality Control Process

SRDC applied a rigorous quality control process for data used in the preliminary analyses and the impact analyses. These precautions rule out errors from the outset and optimize the database in accordance with the basic assumptions of each analysis (e.g., no outliers).

Ensuring the quality of the data collected comprises multiple steps ranging from instrument selection or conception, to data collection and data entry. The selection or design of measuring tools (e.g., survey, interview grid, field observation grid, etc.) is a first step in producing a "clean" dataset. Whenever possible, the Readiness to Learn project team selected pre-existing scales that have been tested and validated with Francophone minority populations. When such measures were unavailable, the research team developed new tools (e.g., scales, observation grids or interview grids) by applying solid psychometric principles. For instance, care was taken to ensure that various possible sources of measurement error were minimized. Questions were written in a clear, precise and simple language. Among other considerations, the format of measurement tools and questions were conceived so as to avoid placing an excessive burden on the recall memory of participants. All measurement tools were pilot-tested prior to their use in the field. In the battery of control procedures of the pilot tests, we asked members of the team to validate: a) the clarity of the wording for the questions (in French and English); b) the congruence of the questions in both languages, in terms of form and content; c) the logical order of the items; and d) the relevance of the response choices.

In addition, high standards in the quality of data collection by research personnel were ensured by developing tool-specific technical material and instruction manuals. These materials were distributed to all relevant members, who were also trained in the practical administration of the measurement tools. These members included interviewers, the educators and the community coordinators. The training of all members was updated before each testing period. For example, the evaluators received

²² Concerning the following question: "To what extent can we state that the reported effects are solely the results of the tested program?"

²³ Concerning the following question: "Is it reasonable to assume that the effect would be obtained with a sample representative of the target population?"

training before each evaluation. These training sessions allowed the evaluators to perfect their knowledge of the tests used in the past and to familiarize themselves with the new tests added to the battery of tools. For their part, the interviewers were reminded of or informed regarding the nature and objective of the parent survey questions before each wave of data collection. The ongoing training of research personnel ensured measurement use coherence across time and within each of the data collections. All data collection questions and preoccupations raised by personnel were dealt with during the training sessions. The Readiness to Learn project research team closely monitored progress with respect to data collection, providing personnel with the necessary techniques, strategies, and help. In certain cases, adjustments were made to the data collection plan as a result of information obtained in the field.

A control of the data quality was put in place at the outset of the Readiness to Learn project. The raw data were collected in two steps. Community coordinators served as the initial hub, receiving the data collected in their respective communities. Once the data was collected, it was sent to the SRDC Ottawa office. The community coordinators ensured that missing data was minimal in the parent surveys and child assessments by verifying whether they were completed properly. If errors or omissions were found, interviewers or evaluators were asked to collect the missing information by contacting the parent or by completing the child's assessment. Community coordinators were instrumental in guaranteeing the high response rates and retention rates observed in the Readiness to Learn project.

The quality of the data entered and the psychometric properties of the measurement scales were then verified in the Ottawa office. Data were entered into an electronic database and then submitted to a rigorous verification system to ensure accuracy. In a first step, a random check of 10% of the data was conducted to verify accuracy of data entry. Next, descriptive analyses were conducted to verify if item frequencies fell within the expected range. Crosschecks were conducted based on the electronic databases to ensure that responses were consistent within respondents. Inconsistent or implausible values were verified with the paper copy²⁴ or the data collector.

Statistical methods were then used to confirm the quality of the scales. The internal consistency of scales and the validity of the measured dimensions were verified respectively using Cronbach alpha and factor analysis. The construct validity of the measured variables was verified by examining whether the direction of the observed inter-correlations between variables was consistent with expectations.

Lastly, the data were routinely screened for univariate and multivariate outliers prior to analysis. All collected survey data were subjected to imputation of missing values, according to accepted procedures (Cohen, Cohen, West & Aiken, 2003, pp., 431–451; Tabachnick & Fidell, 2006, pp. 62–71).

4.2 Missing Data and Attrition Analyses

Missing values in a database can threaten the external and internal validity of an analysis. Cases with missing values for a variable are usually excluded from an analysis, which may be problematic when

²⁴ Note that the paper copy of the parent survey at 24 months post-program was available only for participants of the first cohort, because for the second cohort, the survey data was collected electronically (see Section 3.5 for more details on the administration of the survey).

they have characteristics that differ from cases that remain in the analysis. If the sample composition changes after a subsample of children are excluded, this has implications for the *external validity* of the results. For example, if the missing values occur disproportionately for girls, the results may not generalize to this population. Similarly, the *internal validity* of the estimates of the program effects depends on the stability of group composition over time. If missing values disrupt group composition, then this may bias estimates of the program effects. Next we present an analysis of the missing values that assesses the potential for both types of bias. The strategies applied to cancel out these effects are also identified.

4.2.1 Source of Missing Data

There were missing values in the data collected from the assessments and surveys for the 24-month post-program follow-up evaluation period. These unexpected missing values can be placed into two main categories: a) complete missing data; and b) incomplete data. The next few paragraphs will discuss the sources of the missing values and their effects on the selection of an imputation strategy.

First, during the 24-month post-program evaluation period, there was a relatively low percentage of complete missing data. These were due to either the non-administration of the survey or participant attrition. Participant attrition can prove to be particularly problematic if it results in a change in the sample composition. If that is the case, it is preferable to use a data imputation strategy for these participants to avoid doubt as to the external and internal validity of the program.

Second, data from assessments or surveys are sometimes incomplete, which means that valid data are obtained for certain questions but not for others, either because the interviewer made a mistake or because the participant refused to answer. In such a situation, it must be determined whether an aspect of the question systematically increases the possibility that a participant will not answer the question. For example, it is well known that respondents at the two ends of an income bracket are more likely to not respond to income-related questions. In this example, the process that produces the missing values is clearly systematic. If the mechanism producing the missing values is systematic (not random), excluding cases with missing values may significantly change the characteristics of the gross sample.

In such a situation, it is best to use a data imputation technique. In a longitudinal design, the same question can be asked several times in order to increase the chance that the desired information will be obtained from all participants. To illustrate this in the context of the project at hand, we asked about family income five times during the four years of the study.²⁵ For participants who remained in the project until the ninth data collection period, it is possible to make full use of the redundancy by imputing the missing values for these questions when they occur.²⁶

²⁵ This question was asked in the baseline survey and during the fifth, seventh, eighth and ninth evaluation period.

²⁶ It must also be assumed that the measured variable is unlikely to change systematically over time or to be affected by the program. We consider family income an excellent example of a variable that can evolve over time, but does not really show a systematic relationship with time (over the period of one to four years in question) or with the participants' assignment to groups in the study.

The analysis in Section 4.2.2 explains the nature of the mechanism that generated the missing data, while Section 4.2.3 describes the imputation strategies used to minimize the effect of the missing values in the impact analyses.

4.2.2 Pattern of Missing Data

Missing values are like any other outcome in that it is possible to model the process that generated them. The conclusions drawn from this modeling exercise determine what steps are taken to preserve the internal validity and external validity of the study. If the process that led to the missing data is random, validity is not threatened. However, if the process is not random, steps must then be taken to avoid introducing bias by excluding cases that have been self-selected. Below we describe the modeling strategy used to elucidate the pattern of missing data in the project database.

According to Little and Rubin (1987), there are three types of unpredictable missing values: a) missing completely at random (MCAR); b) missing at random (MAR); and c) missing not at random (non-ignorable MNAR). The most desirable scenario is a situation where a small number of missing values is distributed randomly throughout the data (i.e., MCAR). Conversely, the worst scenario is having a large number of missing data distributed non-randomly. In the first case, the problem of missing values can be solved by applying a listwise deletion without risk of biasing the results of an analysis (i.e., removal of cases with missing values). This solution is not advisable for the second scenario. Using this method to deal with missing values that are distributed non-randomly may bias estimates of the program's effects. This bias can be avoided by: a) excluding any irregular variables from the analysis; b) applying a data imputation strategy; or c) accepting bias in the analysis and considering its nature when interpreting results (e.g., missing values were more common in population X, therefore the results based on cases with complete data may not apply to population X).

The first step in this decision process is to determine the prevalence of missing values in the database (i.e., the percentage of missing values across all variables in the database) and the pattern of these missing values. The prevalence of the missing values is simply assessed by means of basic descriptive analyses. However, a more in-depth analysis is required to determine the pattern of the missing data.

The most vital question to answer is whether the missing values are predictable or not. As we have already seen, unpredictable missing values or those missing "at random" are classified as MCAR. One necessary condition for demonstrating MCAR is to show that the relationship between the occurrence of the missing values and the observed values of variables in the database is statistically null. This property can be verified by conducting tests of association for each variable in the database. For continuous variables, one may also use Little's MCAR test. If the MCAR test or another association test reveals that values are systematically missing, then the working hypothesis of an MCAR distribution must be rejected in favour of a less restrictive assumption: the distribution of missing values is actually MAR (i.e., missing at random).

For a pattern of missing data to be considered MAR, two conditions must be respected: a) the missing values are non-randomly distributed and b) it must be possible to predict the value of the missing value. The first condition is met when one or more variables in the database allow us to predict the incidence of missing values; the second condition is met when strong predictors of the measured variable allow us to accurately predict the value of the missing observation. When the first condition is

met but not the second, there is an MNAR-type distribution of missing data. In this case, we have no other option but to describe the pattern of missing data in enough detail to properly understand the limitations with respect to the study's validity.

In the following section, we report the results of the missing-values analysis conducted in preparation for the impact analyses of the Readiness to Learn project. First we report the results of a quantitative analysis of participant attrition. We then present an analysis of complete missing values due to a failure to assess a child or administer a survey. For each analysis, we describe the missing values from two angles: as a function of their breakdown by experimental group and as a function of their relationship to other variables in the database.

Missing Values Due to Attrition

The attrition rate is relatively low for both cohorts of participants. Since the beginning of the project, only 38 of the 356 families in the sample recruited from the four communities retained for the impact analyses (10.7%) withdrew from the study. Specifically, in the first two years of the project, 20 families from both cohorts left the study, for an attrition rate of 5.6% for the first two years of the project. In the third year of the project, the attrition rate rose to 9.8% of the sample for the four communities, in that 15 families were no longer participating in the project (see Chapter 3.4.1 for further details on the retention rate). Finally, in the fourth year of the project, three more families withdrew from the project. In total, both cohorts combined constituted an enrolment sample of 356 children with an 89.3% retention rate for the four years of the study.

It should be mentioned that during the first phase of the study (the first two years of the project), attrition frequency was too low (20 families withdrew) to formally test whether participation retention was tied to experimental group assignment in the study. The descriptive analysis of frequency did not show a systematic relationship during the first phase. Descriptive analyses were also used to examine the attrition pattern for the 15 families who withdrew during third year of the project. As indicated in the *Report of Program Effects in Grade 1*, results of these analyses revealed that withdrawal was associated with group membership, and was significantly associated with certain sociodemographic and dependent study variables. Results of a formal analysis performed on the total sample of participants who withdrew during the first three years of the project followed the same trend as those performed on participants who withdrew in the third year. Therefore, to correct for the potential bias linked to attrition, data was imputed for participants who withdrew from the project in the third year. Overall, the sample used for the impact analyses in the *Report of Program Effects in Grade 1* included 336 participants.

For the current report, attrition analyses were performed on data from the fourth year. Firstly since attrition in the fourth year was too low to perform a formal analysis, we performed a descriptive frequency analysis of the fourth year data. Then, we performed a formal analysis using the total sample of participants who withdrew across the four years of the project. Results of the descriptive analyses indicate that three families withdrew from the project in the fourth year. Of the three families, two belong to the Program Daycare group, while the third belongs to the Informal Care group. In addition, two of the three families come from Orleans (2nd cohort), whereas the other comes from Cornwall (1st cohort). As indicated in the methodology section, one of the two Program Daycare group families

withdrew from the project as the result of a move, whereas the two other families (one from the Program Daycare group and the other from the Informal Care group) withdrew because the parents non longer wanted to respond to surveys.

Furthermore, the formal attrition analysis revealed that withdrawal from the project in the first four years did not occur randomly. In fact, results are similar to those obtained from the formal attrition analyses performed on the total sample of withdrawals after the first three years of the project, or more namely, there was a link between the frequency of withdrawals and the experimental group $\chi^2 (2, N = 356) = 9.53, p < 0.01$. Overall, 17 families from the Program Daycare group (17%), 6 families from the Comparison Daycare group (4%) and 15 families from the Informal Care group (13%) withdrew from the project. Furthermore, withdrawal from the project was significantly linked to three dichotomous covariates, namely family income,²⁷ $\chi^2 (1, N = 354) = 3.03, p < 0.1$, mother's education level at the baseline survey, $\chi^2 (1, N = 356) = 3.20, p < 0.1$, and a change in experimental group during the first year, $\chi^2 (1, N = 356) = 22.68, p < 0.001$. Specifically, the percentage of withdrawals from the study was higher in families with an income below \$60,000 and in families where the mother's education level at the baseline survey was less than a college diploma. The change in experimental group during the first year was also a predictor of withdrawal, such that 44% of the families whose child changed experimental group during the first year withdrew from the study, compared to only 9% of the families whose child did not change groups.

Finally, withdrawal from the project was also significantly linked to several outcomes measured at baseline, such that children who withdrew from the study tended to have lower scores on the baseline assessment for the Communication, $t(44.52) = 5.09, p < 0.001$, Self-awareness, $t(35.49) = 3.06, p < 0.01$, cognition, $t(36.81) = 3.02, p < 0.01$, Expressive vocabulary, $t(41.91) = 4.82, p < 0.001$ and Receptive vocabulary, $t(31.47) = 3.72, p < 0.01$ domains. It should be noted that these analyses do not include participants who completed the assessment in English or the four participants who left the study before the first assessment. The same pattern was observed for outcomes measured in the parent survey. Specifically, participants who withdrew had lower scores for certain linguistic variables on the baseline survey, including Language of literacy activities, $t(43.21) = 2.14, p < 0.05$, and to a lesser extent, Language spoken by the mother to her child, $t(43.71) = 1.81, p < 0.1$, and Language spoken by the child to others, $t(46.53) = 1.78, p < 0.1$.²⁸ These results suggest that the children who withdrew were less exposed to French and communicated less in French at the beginning of the project than the participants still enrolled in the study.

Although the attrition rate for the Readiness to Learn project compares favourably to those of other studies (e.g., Rogers, Fernandez, Thurber & Smitley, 2004), analyses show that, since the beginning of the project, the attrition rate has been linked to experimental group assignment, certain covariates and several outcomes collected at baseline. These analyses suggest that some of the participants' characteristics at baseline can predict withdrawal from the study, including a family income below

²⁷ It should be noted that among the families who withdrew, two data items relating to family income are missing from the baseline survey.

²⁸ Since the variance is assumed to be unequal between the group of participants who withdrew and the group of participants who did not withdraw, the Welch robust heterogeneity estimator was used to evaluate the difference between these groups. The adjusted degrees of freedom are presented in parentheses.

\$60,000, the mother's education level, and a change in experimental group during the first year of the study. Analyses also reveal that children from families who withdrew from the study had lower scores on the baseline assessment. In conclusion, there is a risk of attrition biasing the estimate of the tested program's effect and limiting the generalization of results. The fact that there is a negative link between withdrawal and performance on the baseline assessment means that simply excluding these cases would artificially increase the sample's language skills level, which would in turn limit the generalization of results. This aspect is particularly important since program impact is assumed to vary based on French language skills. The problem posed by the missing values must be managed using a more sophisticated strategy: replacing the missing values by imputation.

Complete Missing Data from Families Enrolled in the Project

For the families who did not withdraw, we observe a relatively low rate of missing data at the 24 month post-program evaluation period. Among the 318 families still enrolled in the study, 16 parent surveys were not completed (5%) and four assessments were not administered to children (less than 1.3%). The incidence of missing data from the children's direct assessment is too low to test its association with experimental group assignment. The descriptive analyses indicate that one family comes from the Program Daycare group and the three others come from the Comparison Daycare group. The missing data from the children's direct assessment include children from the two cohorts (one child from the first cohort and three from the second cohort) spread across two of the four communities, namely, Cornwall and Edmundston. While formal significance analyses can't be performed, the descriptive analyses reveal that children who are absent have lower scores than the mean on all dependent variables measured in the direct child assessment at the 12 month follow-up evaluation.

Furthermore, the incidence of missing data from the parent survey at the 24 month post-program follow-up is insufficient to test its association with experimental group assignment. The descriptive analyses indicate that among the absent families for the survey, six families are assigned to the Program Daycare group, eight to the Comparison Daycare group, and two from the Informal Care group. In addition, analyses indicate that cases with a missing parent survey are comparable to other participants in terms of covariates and baseline outcomes measured at baseline, except for three covariates. Completion of the parent survey at 24 months post-program is positively associated with family income ($r = 0.22$) and the father's level of education ($r = 0.17$), and negatively associated with families headed by single parents ($r = -0.14$). We observe correlations between completion of the 12-month follow-up survey and the same three covariates: family income ($r = 0.19$), father's education level ($r = 0.15$) and families headed by single parents ($r = -0.13$).

In short, missing values for the evaluations and surveys are infrequent and their real values can be estimated accurately given the many predictors and the repeated administration of several measuring tools. Despite the negligible quantity of missing values, the fact that they are not randomly missing (MCAR) could bias the results. Imputation of the missing values is therefore deemed important to offset any bias in the generalization of results that could be produced by excluding these cases.

Partially Missing Data from Families Enrolled in the Project

An analysis of the missing values due to partially missing data was conducted for the 314 evaluations administered to the children at the 24-month post-program period. This analysis examined the child outcomes included in the impact analyses. The analysis indicated that these variables have less than 1% of missing data, except for the variable measuring the child's perception of the Vitality of the Francophone community (2.2% of missing data). Little's MCAR test was not significant $\chi^2 (213) = 102.59, p = 1.00$, suggesting that the missing values are distributed randomly. In such a situation, where there is a low incidence of missing data and they are distributed randomly, it is acceptable to eliminate the participants with the missing data from the analyses (Tabachnick & Fidell, 2006, p. 63).²⁹

The missing data analyses due to partially missing data was also conducted on the 302 surveys administered to parents at the 24-month post-program period. This analysis examined the confounding variables to be included in analyses (for a complete list, see Section 4.3) and the outcomes measured through the survey. For some of these variables, there is enough redundancy in the database (e.g., the question on family income is asked five times in the four years of the project) to perform a simple imputation of the missing values (see Section 4.2.3 for more information on the data imputation).³⁰

All the variables in the impact analyses have less than 1% of data missing, with the exception of the four following variables: family income (13.6%), Francophone vitality (6.0%), Achievement in child's writing as perceived by the parent (5%), and the parent's perception of his child's school (1.7%). The significant Little's MCAR test, $\chi^2 (245) = 377.92, p < 0.001$ suggests that the missing values are not distributed randomly. Imputation of missing data is recommended when the rate of missing values is greater than 5% (Tabachnick & Fidell, 2006, p. 63) to include cases with missing values in the impact analyses.

4.2.3 Data Imputation Strategy

An analysis of missing data has pointed to the importance of imputing missing data, particularly for the data that is completely missing due to attrition and to the absence during child assessments or parent surveys. This analysis suggests that the process leading to the missing data was not random, and therefore represents a threat to the internal validity and external validity of the study. To offset the potential bias associated with attrition, imputation of missing data was used only for participants who withdrew during the second phase of the study, that is, during the third and fourth years of the project.

²⁹ When possible, we chose to replace the missing scores by estimating a participant's missing score based on his or her answers to other items measuring the given outcome. Estimation of this type of data can be performed easily when tests are presented in order of difficulty (e.g., Knowledge of numbers). This approach enabled us to maintain all of the participants who were assessed for the purposes of the impact analyses, except for the variables measuring the child's perception of the vitality of the Francophone community.

³⁰ When a given question or scale is administered several times, the various instances can be combined in order to create a single variable for the impact analyses that contains the greatest amount of information and the fewest missing values. In some cases (e.g., income), a difference in measurement scale required a regression imputation to bridge the two measurement instances for this variable, thereby creating a single variable that contains all the information available in the database on the measured concept.

This decision was based on two main reasons: (1) descriptive analyses for attrition seem to indicate that withdrawal in the second phase (the third and fourth years of the project) is more likely to bias the validity of the study than withdrawal during the first phase (first and second year); and (2) actual data obtained at the end of the second year are only available for the children who withdrew during the second phase (76%), making it possible to estimate the missing data with greater accuracy (MAR type missing data). Finally, the completely missing data for participants still enrolled in the project were also imputed (MAR type data).

The strategy used to address missing values changes depends on the variable. In every instance, we aim for the use of repeated measures in the project. We will describe, in separate sections below, the imputation strategy used for assessment measures (i.e., child outcomes) and for survey measures (i.e., covariates and a few outcomes).

Imputation of Child Outcomes (child assessment only)

Of the 336 participants considered for the impact analyses, we imputed outcomes for a total of 22 children (6.5% of the sample), corresponding to 18 children who withdrew in the second phase and four children who were still enrolled but absent during the 24-month post-program evaluation period. These participants are spread across the experimental groups as follows: 10 participants from the Program Daycare group, five participants from the Comparison Daycare group and seven participants from the Informal Care group. Scores for variables measured during the previous evaluation (at the program exit and at 12 months post-program) were used for imputation purposes. Table 4.1 shows the correlations between these variables and those measured at the 24-month post-program evaluation period. In order to accurately estimate the missing values, it is necessary to rely on variables which are linked to those with missing values. As demonstrated in the Table 4.1, with the exception of the correlations involving the “Knock-Tap” variable, all correlations are strong and significant at $p < 0.001$.

The SPSS Missing Value Analysis (MVA) module, designed to address missing data, was used to estimate the missing values for nine outcomes of the direct assessment of the children. Specifically, we performed a multiple regression using the full sample, which made it possible to estimate scores based on variables presented in Table 4.1, that is, the seven variables from the assessment at the program exit and eight variables from the 12-month post-program follow-up. The residuals for a randomly sampled case are added to the value estimated by the regression model to imitate the “random” variability typical of a real observation (Roth & Switzer, 1995).

Table 4.1 Correlations between dependent variables at 48 months (24 months post-program) and those measured at the 24-month and 36-month evaluations

		48 Months (24 Months Post-Program)								
Mesures		1	2	3	4	5	6	7	8	9
36-Month Evaluation	Knowledge of Letter Names	0.22*** (313)	0.33*** (313)	0.41*** (313)	0.35*** (313)	0.51*** (313)	0.74*** (313)	0.54*** (313)	0.50*** (313)	0.28*** (312)
	Knowledge of Letter Sounds	0.27*** (313)	0.37*** (313)	0.41*** (313)	0.34*** (313)	0.54*** (313)	0.78*** (313)	0.55*** (313)	0.53*** (313)	0.20*** (312)
	Reading Simple Words	0.35*** (313)	0.37*** (313)	0.44*** (313)	0.42*** (313)	0.63*** (313)	0.75*** (313)	0.67*** (313)	0.55*** (313)	0.15*** (312)
	Word Reasoning	0.34*** (313)	0.22*** (313)	0.46*** (313)	0.56*** (313)	0.36*** (313)	0.34*** (313)	0.35*** (313)	0.37*** (313)	0.16*** (312)
	Verbal Fluency	0.31*** (313)	0.27*** (313)	0.63*** (313)	0.49*** (313)	0.36*** (313)	0.41*** (313)	0.40*** (313)	0.38*** (313)	0.19*** (312)
	Knowledge of Numbers	0.35*** (309)	0.41*** (309)	0.43*** (309)	0.41*** (309)	0.43*** (309)	0.52*** (309)	0.53*** (309)	0.74*** (309)	0.18*** (308)
	Forward Digit Span	0.59*** (313)	0.27*** (313)	0.26*** (313)	0.23*** (313)	0.27*** (313)	0.22*** (313)	0.26*** (313)	0.38*** (313)	-0.03 (312)
	Backward Digit span	0.21*** (313)	0.32*** (313)	0.36*** (313)	0.29*** (313)	0.34*** (313)	0.39*** (313)	0.41*** (313)	0.48*** (313)	0.20*** (312)

		48 Months (24 Months Post-Program) (r (n))								
Measures		1	2	3	4	5	6	7	8	9
24-Month Evaluation	Knowledge of Letter Names	0.29*** (314)	0.35*** (314)	0.39*** (314)	0.30*** (314)	0.47*** (314)	0.60*** (314)	0.55*** (314)	0.50*** (314)	0.12** (313)
	Knowledge of Letter Sounds	0.31*** (314)	0.34*** (314)	0.34*** (314)	0.28*** (314)	0.42*** (314)	0.47*** (314)	0.51*** (314)	0.50*** (314)	0.08 (313)
	Self-Awareness	0.37*** (313)	0.26*** (313)	0.58*** (313)	0.76*** (313)	0.49*** (313)	0.49*** (313)	0.51*** (313)	0.46*** (313)	0.27*** (312)
	Communication	0.38*** (314)	0.28*** (314)	0.45*** (314)	0.49*** (314)	0.48*** (314)	0.49*** (314)	0.52*** (314)	0.47*** (314)	0.23*** (313)
	Cognition	0.31*** (314)	0.38*** (314)	0.46*** (314)	0.45*** (314)	0.42*** (314)	0.57*** (314)	0.55*** (314)	0.60*** (314)	0.13** (313)
	Expressive Vocabulary	0.35*** (314)	0.20*** (314)	0.54*** (314)	0.71*** (314)	0.48*** (314)	0.45*** (314)	0.45*** (314)	0.35*** (314)	0.29*** (313)
	Receptive Vocabulary (PPVT-R)	0.30*** (314)	0.20*** (314)	0.47*** (314)	0.74*** (314)	0.46*** (314)	0.40*** (314)	0.47*** (314)	0.36*** (314)	0.17*** (313)

Note : *** $p < 1\%$; ** $p < 5\%$; * $p < 10\%$.

Legend of dependent variables measured at 48 months (24 months post-program)		
1	Forward Digit Span	4 Receptive Vocabulary (PPVT-R)
2	Backward Digit Span	5 Reading Complex Words
3	Verbal Fluency	6 Reading Sentences
		7 Comprehension of Written Sentences
		8 Knowledge of Numbers
		9 "Knock-Tap" Test

Imputation of Parent Survey Data

Survey data was imputed for the 18 covariates retained for the impact analyses and for the five outcomes measured through the survey.³¹ Most of the covariates (15 of the 18) came from the baseline survey or from information gathered during the first year of the project. The missing data associated with these covariates were imputed during the first phase of the study (for further details, see the *Report of Findings from the Preschool Phase*, Legault et al., 2014) or during the third year of the project (see the *Report of Program Effects in Grade 1*, Patry et al., 2014). The three other retained covariates were measured in the 24-month post-program survey, namely, Younger Siblings, Household Size, and the Vitality of the Francophone Community. Data from previous surveys were used to impute the missing data for these three variables.

Finally, the five dependent variables taken from the survey at 24 months post-program with missing data were the following: Frequency of Literacy Activities, Language of Literacy Activities, Language Spoken by Mother to Child, Language Spoken by Father to Child, and the Continuum of French Spoken by Child. Missing values for these variables were from participants who withdrew during the second phase and from 16 families who were still enrolled in the project, but unable to respond to the survey during the 24-month post program follow-up. These values were imputed directly based on data collected in previous follow-up surveys. We recognize that these variables could change over time. It should be noted, however, that the dependent variables at 24-months post-program are strongly correlated to the respective variables of the previous waves (e.g., $r = 0.94$, $p < 0.001$ between the Continuum of French measured at 12 months post-program and 24 months post-program).

The final sample therefore included 336 participants. The descriptive analyses (and correlations) for child and parent outcomes are presented in Table 4.2 and Table 4.3, respectively.

³¹ The four outcomes measuring child achievement in the parent survey could not be imputed because it was the first time the items were asked.

Table 4.2 Descriptive analyses and correlations between dependent variables for children

Dependent Variables	Descriptive Statistics					Correlations									
	N	Min	Max	Mean	SD	1	2	3	4	5	6	7	8	9	10
1 – Forward Digit Span	336	0	14	7.49	1.97	—									
2 – Backward Digit Span	336	0	10	4.64	1.44	0.31***	—								
3 - « Knock-Tap » Test	336	6	15	14.27	2.09	0.03	0.09*	—							
4 – Verbal Fluency	336	0	41	22.38	6.28	0.23***	0.24***	0.17***	—						
5 – Receptive Vocabulary PPVT-R	336	7	131	80.78	21.23	0.30***	0.23***	0.17***	0.53***	—					
6 – Reading Complex Words	336	0	39	11.73	9.07	0.31***	0.31***	0.08	0.38***	0.45***	—				
7 – Reading Sentences	336	0	60	42.11	17.20	0.31***	0.38***	0.10*	0.44***	0.43***	0.71***	—			
8 – Comprehension of Written Sentences	336	0	27	7.47	5.23	0.31***	0.34***	0.11**	0.43***	0.42***	0.73***	0.73***	—		
9 – Knowledge of Numbers	336	10	49	28.13	6.63	0.37***	0.50***	0.09	0.39***	0.42***	0.44***	0.57***	0.54***	—	
10 - Continuum of French	336	1	3	2.16	0.61	0.13**	-0.05	0.19***	0.32***	0.52***	0.35***	0.25***	0.26***	0.07	—

Note: Min = Minimum value observed; Max = Maximum value observed; Mean = Unadjusted mean; SD = Standard deviation; Continuum of French = Continuum of French spoken by the child.*
 $p < 0.05$, ** $p < 0.01$.

Table 4.3 Descriptive analyses and correlations between dependent variables for parents

Dependent Variables	Descriptive Statistics					Correlations			
	N	Min	Max	Mean	SD	1	2	3	4
1 – Language Spoken by Mother to Child	328	1	5	3.90	1.32	---			
2 – Language Spoken by Father to Child	301	1	5	3.54	1.64	0.11**	---		
3 – Language of Literacy Activities	336	1	5	4.46	0.86	0.57***	0.11*	---	
4 – Frequency of Literacy Activities	336	2	5	4.59	0.72	0.48***	0.07	0.57***	---

Note: Min = Minimum value observed; Max = Maximum value observed; Mean= Unadjusted mean; SD = Standard deviation. * $p < 0.05$, ** $p < 0.01$.

4.3 Identifying Confounding Variables

This section summarizes the results following an exercise aimed at generating a list of variables to be retained as covariates in the impact analyses. The selection criteria can be summarized as follows: a variable is deemed useful as a covariate if it is significantly associated with the outcomes and if it varies significantly by experimental group. The importance of these two criteria is easy to understand. To affect the results (e.g., increase statistical power, offset a bias in group composition), a variable must be significantly associated with the outcomes. For a variable to bias the estimate of program effect, the variable must be significantly associated with the experimental groups. If one of these conditions is missing, controlling for the variable or not in the impact analyses does not dramatically change the estimate of program impact. In particular, controlling for the bias related to group composition is essential to maximizing the internal validity of the comparisons of interest in a quasi-experimental study.³²

Accordingly, preference has been given to variables that are associated with both the study outcomes and membership to experimental groups. Note that redundant variables were excluded from these preliminary analyses. Variables deemed potentially affected by the program (e.g., literacy activities) were taken from the baseline survey administered prior to the intervention, while demographic and socio-economic factors were taken from data collected at the baseline survey and from data collected more recently (at 24 months post-program) to capture changes in these variables over time. When one of these variables meets covariate selection criteria for both measuring periods, we favoured the

³² Note that a measured variable can only correct for differences observed between experimental groups. Because the measured variable is imperfect (it contains the measurement error), there may well be an undetected real difference between the groups. A difference that is real but undetected cannot be corrected by including the measured variable in a regression analysis. This is an example of an unobserved difference. Unobserved differences can be cancelled only through random assignment to the experimental groups.

measurement that is most recent, that is, at 24 months post-program.³³ Finally, education variables from the 24-month post-program follow-up survey were also analyzed.

We began by checking a variable's association with experimental groups and with child outcomes for the 24-month post-program evaluation period in a series of preliminary analyses. The following strategy was used to identify the variables to be included as covariates in the impact analyses.

- We verified whether the relationship between the variables under consideration and experimental group membership was significant. The choice of test depended on the type of variable examined: the F-test was used for continuous variables, the Chi-square test for categorical variables.
- We verified whether there was a significant relationship between the variable and at least one outcome observed during the 24-month post-program evaluation period.
- Variables that met both of the above criteria are included in the specification for the regression models to offset the potential bias they represent. The results of these preliminary analyses are reported in Appendix A. The variables presented in bold are those retained as covariates. For more details, see the appendix A.

In total, 18 covariates were retained for the 24-month post-program impact analyses. These included three variables pertaining to the methodology: Cohort, Community and Change in Experimental Group during the first year. The following 12 baseline covariates were added to the list: Single-Parent Families, Mother's Age at Birth of First Child, Frequency of Literacy Activities, Language of Literacy Activities, Language Spoken by Mother to Child, Language Spoken by Father to Child, Continuum of French Spoken by Child, Child's Age, Domain C of the ÉPE-AD (Language and Communication), Family Functioning, Depression, and Authoritarian Parenting Style. Finally, the three last covariates retained for the impact analyses were measured at the 24-month post-program evaluation period and include: Younger Siblings, Household Size, and Vitality of the Francophone Community.

In short, a control process was rigorously applied to associate observed variables with experimental groups and child outcomes. The observed variables that were not retained for the impact analyses are distributed similarly across the experimental groups and therefore do not significantly bias the estimate of the tested program's impact (i.e., the groups are matched for these characteristics). The variables that were retained are used to perform a "statistical" matching as part of the impact analyses. We hypothesize that, after statistical matching of the experimental groups, the children's developmental trajectories would progress at the same rate in the absence of the tested program.

³³ Two variables met the selection criteria for both measuring periods (baseline and 24 months post-program): Household Size and the Vitality of the Francophone Community. The residual between the two measurement periods was not significantly associated with the outcomes or the experimental group. Hence, including these variables at both measurement periods would be redundant.

4.4 Representativity of the Sample (Readiness to Learn Project Versus Survey on the Vitality of Official-Language Minorities)

The sample of the 2006 Survey on the Vitality of Official-Language Minorities (SVOLM; Corbeil, Grenier & Lafrenière, 2007) serves as a benchmark for the Readiness to Learn project sample. The purpose of the current analyses is simply to answer the following question: If the two-pronged preschool program were offered to the entire Francophone minority in the project's participating communities, would the observed effects be similar to those of the Readiness to Learn project?

In order to answer this question, it is essential that both samples be drawn from the same Francophone minority population. However, this is not the case since the SVOLM and the Readiness to Learn project used different sampling strategies. Consequently, their populations are different, thereby limiting the samples' comparability in several regards. These differences stem in part from how the two projects define the minority Francophone population. As explained in the *Reference Report*, the SVOLM's sampling process is less restrictive. There may be substantial demographic differences between the two samples due solely to a difference in the studies' definitions of the minority Francophone population.

Next, the sampling of the Readiness to Learn project and the SVOLM differ in terms of demographic data. To ensure that a large enough sample was extracted from the SVOLM database, the data for children ages 3 to 5 were used in the comparative analyses. This contrasts with the average age of 3 observed for the project sample at baseline and the average age of 7 observed for the sample at 24-month post-program. Finally, project participants were selected in a non-probabilistic manner based on daycare attendance, which means that the sample's geographic distribution is located within the communities participating in the project. In contrast, the distribution of the SVOLM sample is more geographically diverse because the survey in question uses random sampling.

Note that wherever possible, we used the available data to re-evaluate SVOLM statistics based on the reduced sample of the four communities so as to maximize the validity of the comparison with the Readiness to Learn project sample used in the impact analyses.³⁴ When this strategy was impossible for practical reasons, we made comparisons with the SVOLM sample gleaned from the six geographic regions (*Reference Report*). These are acknowledged in the body of the text. Further, the project sample data used in the comparative analyses were collected at the baseline survey although they only included participants included in the 24-month post-program impact analyses (N = 336). This decision was made to ensure that the data was collected relatively in the same period across both samples.

³⁴ Calculating appropriate estimates for the gross sample including the four communities was not possible for certain variables where the analysis by community resulted in sample sizes too small to be extracted from Statistics Canada data. The six communities in the SVOLM sample nevertheless represent a worthwhile comparative group for the purposes of establishing the external validity of the Readiness to Learn Project sample for the four communities included in the impact analyses.

4.4.1 Immigrant and Linguistic Profile

Sampling procedures for the Readiness to Learn project and the SVOLM were carefully detailed and compared in the *Reference Report*. The following quotation summarizes the conclusions of that analysis:

According to Forgues and Landry (2006), a Francophone population (such as the one in the Readiness to Learn project) defined using the ‘ayant droit’ criterion would result in a much more restrictive pool compared to a Francophone population (such as the one in the SVOLM) defined using several criteria (e.g., mother tongue, knowledge of official languages and languages spoken at home) that would result in a greater number of eligible individuals.

Two predictions were made in light of this consideration: a) the SVOLM sample likely includes a higher proportion of immigrants than the Readiness to Learn project and b) relatively fewer children are likely to report French as their mother tongue in the SVOLM. The following sections present the results of the comparative analysis on the immigrant status, the children’s mother tongue and those of the parents.

Respondents Born in Canada

The immigrant status of respondents in the Readiness to Learn project and SVOLM samples (four communities) is reported in Table 4.4. The first row reports the frequency of respondents who say they were born in Canada and the second, that of people born outside Canada. As anticipated, an examination of the distribution of responses for both surveys clearly indicates that the Readiness to Learn project has a higher proportion of respondents who were born in Canada. About 92% of the study sample members were born in Canada, while only 75.7% of respondents in the SVOLM sample were born here. This difference was confirmed by applying a statistical Chi-square test that proved to be significant [$\chi^2(1, N = 1\,118) = 36.45, p < 0.01$].

Table 4.4 Comparison of the Readiness to Learn Project and the SVOLM

Immigrant Status	Readiness to Learn Project	SVOLM	Significant differences between the two samples?
	N (%)	N (%)	Chi-square
Born in Canada	300 (91.5)	598 (75.7)	Yes***
Born outside Canada	28 (8.5)	192 (24.3)	

Note: The SVOLM sample is from four regions. The Readiness to Learn project sample includes participants retained for the impact analyses (N = 336). Significance levels set at: *** $p < 0.1\%$; ** $p < 1\%$; * $p < 5\%$.

First Language Learned and Still Understood — Children

Data on the mother tongue of children in the Readiness to Learn project were captured on the consent form filled out by parents. For the SVOLM, a child’s mother tongue is deduced from the following question (Statistics Canada, 2006, p. 35): “What is the language that [child’s name] first learned at home in childhood and still understands?”

Table 4.5 shows that the Readiness to Learn project sample has a greater percentage of children in the project who report French only as their mother tongue (first row of the table). The percentage of children whose mother tongue is English only or English and another language is greater in the SVOLM sample (third row of the table). The representation of children identified as bilingual in the two samples is practically identical (second row of the table).

Application of the statistical Chi-square test confirms that the distribution of the project children (four communities) across the mother-tongue categories is not representative of the Francophone minority population in the six geographic regions based on SVOLM data [$X^2(2, N = 1,097) = 103.81, p < 0.001$].

Table 4.5 Comparison of the Readiness to Learn Project and the SVOLM — Children Categorized by Mother Tongue

Mother Tongue	Readiness to Learn Project	SVOLM	Significant differences between the two samples?
	N (%)	N (%)	Chi-square
French only	244 (72.6)	306 (40.2)	Yes***
English and French equally OR French and another language	31 (9.2)	89 (11.7)	
English only OR English and another language OR other language(s)	61 (18.2)	366 (48.1)	

Note: The SVOLM sample is from six regions. Significance levels set at: *** $p < 0.1\%$; ** $p < 1\%$; * $p < 5\%$.

First Language Learned and Still Understood — Mothers

Table 4.6 indicates that more than half of the mothers in the project (67.3%) and SVOLM (58.3%) samples reported French as their only mother tongue (first row of the table), although the proportion in this regard is slightly higher in the sample of the Readiness to Learn project. Moreover, a smaller proportion of mothers in the project chose the “English only OR English and another language OR other language(s)” category (22.9% in the third row). A Chi-square test indicates that the distribution of the project mothers (four communities) across the mother-tongue categories is not representative of the Francophone minority population in the six geographic regions based on SVOLM data [$X^2(2, N = 1,125) = 10.02, p < 0.01$].

Table 4.6 Comparison of Mothers in the Readiness to Learn Project and the SVOLM — Mothers Categorized by Mother Tongue

Mother Tongue	Readiness to Learn Project	SVOLM	Significant differences between the two samples?
	N (%)	N (%)	Chi-square
French only	226 (67.3)	460 (58.3)	Yes**
English and French equally OR French and another language	33 (9.8)	75 (9.5)	
English only OR English and another language OR other language(s)	77 (22.9)	254 (32.2)	

Note: The SVOLM sample is from six regions. Significance levels set at: *** $p < 0.1\%$; ** $p < 1\%$; * $p < 5\%$.

First Language Learned and Still Understood — Fathers

Table 4.7 compares the linguistic profile of fathers in the Readiness to Learn project and the SVOLM based on their mother tongue. We observe a substantial number of fathers in the SVOLM who reported “English only OR English and another language OR other language(s)” as their mother tongue. The proportion of fathers in the SVOLM at either end of the distribution in Table 4.7 is similar (46.7% versus 47.7%). However, fathers in the project sample are more represented in the “French only” category (55.9% in the first row) than in the “English only OR English and another language OR other language(s)” category (35.8% in the third row).

A Chi-square test confirms that the distribution of the project fathers (four communities) across the mother-tongue categories is not representative of the Francophone minority population in the six geographic regions based on SVOLM data [$X^2(2, N = 1,110) = 13.95, p < 0.001$].

Table 4.7 Comparison of Fathers in the Readiness to Learn Project and the SVOLM — Fathers Categorized by Mother Tongue

Mother Tongue	Readiness to Learn Project	SVOLM	Significant differences between the two samples?
	N (%)	N (%)	Chi-square
French only	181 (55.9)	367 (46.7)	Yes***
English and French equally OR French and another language	27 (8.3)	44 (5.6)	
English only OR English and another language OR other language(s)	116 (35.8)	375 (47.7)	

Note: The SVOLM sample is from six regions. Significance levels set at: *** $p < 0.1\%$; ** $p < 1\%$; * $p < 5\%$.

4.4.2 Sociodemographic Characteristics

Total Family Income

Table 4.8 shows that the families in the Readiness to Learn project and those in the SVOLM are distributed similarly among the income brackets considered here. In both cases, the modal and median category is \$60,000 or more per year. A Chi-square test confirms that the distribution of the project parents (four communities) across the income brackets is statistically equivalent to that observed for the Francophone minority population in the six geographic regions based on SVOLM data [$X^2(5, N = 1,125) = 5.67, p > 0.05$].

Table 4.8 Comparison of the Readiness to Learn Project and the SVOLM — Families by Income Bracket

Income Bracket	Readiness to Learn Project	SVOLM	Significant differences between the two samples?
	N (%)	N (%)	Chi-square
\$10,000 or less	20 (5.9)	54 (6.9)	No
From \$20,000 to \$29,999	14 (4.2)	23 (2.9)	
From \$30,000 to \$39,999	19 (5.6)	64 (8.1)	
From \$40,000 to \$49,999	17 (5.1)	57 (7.2)	
From \$50,000 to \$59,999	45 (13.4)	95 (12.0)	
\$60,000 and over	221 (65.8)	496 (62.9)	

Note: The SVOLM sample is from six regions. Significance levels set at: *** $p < 0.1\%$; ** $p < 1\%$; * $p < 5\%$.

Mothers' Level of Education

Table 4.9 shows that the mothers in the Readiness to Learn project are more educated than mothers in the SVOLM sample. Almost 80% of the project mothers have a college diploma (DEC, or diploma of collegial studies, DCS) or a university degree versus about 70% of mothers in the SVOLM. This difference is mainly attributable to the low number of mothers with at least one diploma or one certificate of collegial studies in the SVOLM versus those of the project (second row). Second, there are as many mothers with a college diploma (38.7%) as there are mothers with a university degree (41.1%) in the project. Third, the proportion of SVOLM mothers who attended university (42.7%) is similar to that of the project mothers (41.1 %).

The Chi-square test confirms that the mothers' level of education in the Readiness to Learn project is not representative of the Francophone minority population in the four geographic regions based on SVOLM data [$X^2(2, N = 877) = 22.03, p < 0.01$].

Table 4.9 Comparison of Mothers' Level of Education in the Readiness to Learn Project and in the SVOLM

Level of Education	Readiness to Learn Project	SVOLM	Significant differences between the two samples?
	N (%)	N (%)	Chi-square
High school diploma or less OR a few post-secondary courses	68 (20.2)	172 (31.8)	Yes***
College diploma/certificate (e.g., trade school)	130 (38.7)	138 (25.5)	
University degree (bachelor's, master's or PhD)	138 (41.1)	231 (42.7)	

Note: The SVOLM sample is from four regions. Significance levels set at: *** $p < 0.1\%$; ** $p < 1\%$; * $p < 5\%$.

Fathers' Level of Education

Table 4.10 indicates that the number of fathers in the SVOLM who attended university (35.9%) is similar to that of those in the Readiness to Learn project (34.7 %). The results show that two-thirds the project fathers have a college diploma (DEC, or diploma of collegial studies, DCS) or a university degree, while 60% of fathers in the SVOLM have an equivalent level of education. Finally, application of the Chi-square test suggests that fathers' level of education in the Readiness to Learn project is not representative of the Francophone minority population in the four geographic regions based on SVOLM data [$\chi^2 (2, N = 867) = 6.80, p < 0.05$].

Table 4.10 Comparison of Fathers' Level of Education in the Readiness to Learn Project and in the SVOLM

Level of Education	Readiness to Learn Project	SVOLM	Significant differences between the two samples?
	N (%)	N (%)	Chi-square
High school diploma or less OR a few post-secondary courses	109 (33.4)	216 (39.9)	Yes**
College diploma/certificate (e.g., trade school)	104 (31.9)	131 (24.2)	
University degree (bachelor's, master's or PhD)	113 (34.7)	194 (35.9)	

Note: The SVOLM sample is from four regions. Significance levels set at: *** $p < 0.1\%$; ** $p < 1\%$; * $p < 5\%$.

Family Size

According to Table 4.11, the modal and median family size is four for both samples (four communities). In both surveys, families of four represent about half of the sample. The remaining families are distributed fairly equally between families of three or less and families of five or more. A Chi-square

test suggests that the distribution of family size for families participating in the Readiness to Learn project is representative of the Francophone minority population in the four geographic regions based on SVOLM data [$X^2(2, N = 874) = 1.83, p > 0.05$].

Table 4.11 Comparison of Family Size in the Readiness to Learn Project and the SVOLM

Number of Family Members	Readiness to Learn Project	SVOLM	Significant differences between the two samples?
	N (%)	N (%)	Chi-square
Three or less	78 (23.2)	143 (26.6)	No
Four	190 (56.5)	280 (52.0)	
Five or more	68 (20.2)	115 (21.4)	

Note: The SVOLM sample is from four regions. Significance levels set at: *** $p < 0.1\%$; ** $p < 1\%$; * $p < 5\%$. The number of people in a family refers to the number of parents and children only.

Siblings

Table 4.12 indicates that the modal and median number of children per family is two for the Readiness to Learn project and for the SVOLM. There are slightly more two-child families in the project (60.1%) than in the SVOLM (50.4%). In addition, there is a greater percentage of families with three or more children in the SVOLM (30.0%) than in the project (20.8%). Conversely, the number of families with a single child, about 20%, is roughly the same for both samples. A Chi-square test confirms that the distribution of the number of children per family in the Readiness to Learn project is not representative of the Francophone minority population in the four geographic regions based on SVOLM data [$X^2(2, N = 1,122) = 11.52, p < 0.01$].

Table 4.12 Comparison of the Readiness to Learn Project and the SVOLM — Number of Children per Respondent

Number of Children	Readiness to Learn Project	SVOLM	Significant differences between the two samples?
	N (%)	N (%)	Chi-square
One child	64 (19.0)	154 (19.6)	Yes**
Two children	202 (60.1)	396 (50.4)	
Three or more children	70 (20.8)	236 (30.0)	

Note: The SVOLM sample is from four regions. Significance levels set at: *** $p < 0.1\%$; ** $p < 1\%$; * $p < 5\%$.

Family Structure

Families in the Readiness to Learn project were categorized as either single-parent families or two-parent families in order to compare family structure in the project sample with that in the SVOLM (see

Table 4.13). The two-parent category includes intact families and blended families where both parents (or one parent and his or her spouse) live with the child. The single-parent category consists of families where only one parent lives in the home with the child.

Note that a child's father or mother may be either his or her biological or adoptive parent. Finally, same-sex couples were excluded from the analysis as were children raised by a person other than the child's biological or adoptive mother or father. A Chi-square test confirms that children's distribution in single-parent or two-parent homes in the project is representative of the Francophone minority population in the four geographic regions based on SVOLM data [$\chi^2(1, N = 1,125) = 1.46, p > 0.05$].

Table 4.13 Comparison of the Readiness to Learn Project and the SVOLM — Number of Single-Parent and Two-Parent Families

Family Structure	Readiness to Learn Project	SVOLM	Significant differences between the two samples?
	N (%)	N (%)	Chi-square
Single-parent	29 (8.6)	87 (11.0)	No
Two-parent	307 (91.4)	702 (89.0)	

Note: The SVOLM sample is from four regions. Significance levels set at: *** $p < 0.1\%$; ** $p < 1\%$; * $p < 5\%$.

4.5 Summary of the Implications for Impact Analyses

In this chapter, we covered the methodological issues that affect the internal and external validity of the impact analyses to follow. Technical matters related to quality control processes were examined. Subsequently, analyses were conducted on missing values to inform the decision to impute missing data. In a third step, analyses were performed to identify confounding variables. The chapter ended with analyses aimed at determining the external validity of the study.

Overall, the attrition rate was relatively low over the four years of the project. However, analyses indicate that the missing values due to attrition during the second phase of the study (12 and 24 months post-program) are not distributed equally across the experimental groups, which could bias the internal and external validity of the study. Furthermore, children who withdrew from the study were likely to obtain lower scores at baseline than those who continued to participate in the study. This analysis suggests that excluding children who withdrew would artificially increase the skill level of children still enrolled in the project. It was therefore deemed important to impute missing data, thereby preserving the characteristics of the overall sample. Finally, the analysis of missing values due to partially missing data indicates that, with the exception of a few variables³⁵, there was not more than 1% missing data for any variables from the survey or from the direct assessment of the children. The analyses indicate that the missing values do not appear to have been produced randomly. We therefore

³⁵ These variables include Family Income, the Vitality of the Francophone Community, the Child's Achievement in Writing, and the Parent's Perception of his Child's School.

imputed the missing data to minimize the potential bias in estimates of program effects and maximize the number of participants for impact analyses. For all missing data, we focused on the longitudinal nature of the study to impute data. Specifically, previously collected data was used to estimate the missing values.

The results of the confounding variables analysis aimed to identify variables that allow for statistical adjustments to correct initial differences between the experimental groups and changes to group composition over time. As a results of this analysis, a number of covariates were identified for inclusion in the impact analyses (see Appendix A for an exhaustive list of the variables examined and the detailed results). Introducing these covariates in the impact analyses maximizes the internal validity of this quasi-experimental study with non-equivalent control groups.

Finally, we examined the study's external validity by comparing the Readiness to Learn sample with that of the SVOLM. Results of the analyses showed that the project sample at the 24-month post-program follow-up (N = 336) included more Francophones than the SVOLM sample. This result replicates those of previous studies. In the *Reference Report*, we hypothesized that this apparent bias would stem from the population of children typically found in French-language daycares. To the extent that this argument is justified, all the results of this study would apply only to a population of Francophone children enrolled in daycare. First, this limit appears to be self-evident in the sense that this population of children would be affected by a daycare intervention. However, if the differences in mother tongue observed between the Readiness to Learn project and the SVOLM reflect a true lack of representativity - which is tantamount to saying that the project sample is not representative of the target population - then the results of the impact analyses in Chapter 6 of this report may in fact underestimate the magnitude of the program's true effect for a population characterized by greater linguistic diversity. The possibility that linguistic variables may emphasize or mitigate the tested program's effect can be examined by reassessing program effects separately for children who mainly speak French and those who speak it less (see Section 6.5, Analyses by Linguistic Profile). The information resulting from these analyses may help determine whether the intervention would be more effective if it targeted given subpopulations, including that of children who are mainly exposed to languages other than French in their family environment.

Furthermore, the samples of the Readiness to Learn project and the SVOLM are similar with regard to non-linguistic characteristics, such as Family Income, Household Size, and Family Structure. The only difference worth mentioning is the fact that parents in the Readiness to Learn project are slightly more likely to report a level of education beyond high school than parents in the SVOLM sample.

In short, a number of precautions were taken to ensure the internal validity of the program's estimated effects and to estimate its degree of external validity. Other verifications will be discussed as they become relevant to the interpretation of results in the following sections of this report.

5.0 Strategies of the Analyses

This chapter deals with the logic underlying the analyses described in Chapters 6 and 7. The adopted approach factors in the data's longitudinal and multi-level structure and involves verification of the robustness of results (see Section 5.1). The method used to identify the program's effect is suitable for a quasi-experimental study with non-equivalent groups (see Section 5.2). This general approach (see Section 5.3) was applied for the specification of several empirical data models, which are presented in Chapters 6 and 7. These empirical models are presented with an indicator of the effect size (see Section 5.4).

5.1 Hierarchical Linear Modeling (HLM)

The data were analyzed using linear regression models based on the core assumption that each observation point or data point in the analysis was observed independently. This assumption is not respected when the sample units (e.g., daycares or children) contribute to multiple observations for a set of data. In this case, the observations made by a given sample unit are said to be nested or clustered. In a longitudinal design, observations are grouped by participant (i.e., each participant contributes to several observations) and sometimes based on another type of analysis unit. The Readiness to Learn project in particular presents data that are nested by daycare and by participant. This multi-level structure, often analyzed using Hierarchical Linear Modeling (HLM), must be reflected in the analyses to avoid overestimating the statistical significance of results (Hox, 2002; Moulton, 1990). Treatment of the study's longitudinal aspect is detailed in Section 5.2, whereas treatment of the "daycare" effect will be addressed now.

To maximize the robustness of results, we use the Huber-White heterogeneity-consistent estimator (White, 1980). Two models are specified: 1) a disaggregate model with errors at the individual level; and 2) an aggregate model with errors grouped by daycare. The aggregate model is a modification of the disaggregate model that makes it robust to clustering (Williams, 2000). According to Woodbridge (2002), the properties of this method are satisfactory for analyzing a database like that of the Readiness to Learn project (i.e., the ratio of the number of groups/observations per group) when the number of groups determines the degrees of freedom for the significance tests. The accuracy of the reported effects is then robust to heterogeneity and to clustering by childcare environment.

5.2 Analysis of Covariance (ANCOVA) Estimator

A popular method for estimating the effects of a program or intervention in humanities literature is the use of an Analysis of Covariance (ANCOVA). This approach is particularly useful in a quasi-experimental study, where group composition is not random (Tabachnick & Fidell, 2006). In such a situation, it is more likely that systematic differences will be found between the members of the Program Daycare group and those of the comparison groups. The benefit of the ANCOVA procedure is its ability to offset potential biases linked to group composition by statistically controlling the effect of covariates, that is, variables that have an assumed impact on the expected outcomes. Including covariates in the equations provides enhancement of the internal validity of results (see Appendix A for an exhaustive list of the covariates that were retained).

In a quasi-experimental design, internal validity also depends on statistical control of intra-individual factors to correct initial individual differences that might influence outcome values. This statistical control is generally a pre-intervention measure directly linked to outcomes of interest. For the purposes of impact analyses, pre-intervention measures directly linked to skills measured during the 24-month post-program evaluation period would ideally provide statistical control.³⁶ However, a single valid baseline measurement can provide intra-individual control. This measurement is the French ÉPE-AD (*Évaluation de la petite enfance – Appréciation directe*, Willms, 2007) Language and communication domain completed at baseline by all of the children enrolled in the study. Adding this variable made it possible to more accurately estimate the program's effect by statistically eliminating initial differences in language skills between the experimental groups. Although some of the outcomes measured during the 24-month post-program evaluation period are not directly related to language skills, their development indirectly depend on knowledge of the French language. In other words, intra-individual statistical control is based on a development model which recognizes that knowledge of the language of instruction facilitates acquisition of academic skills, such as reading and math skills, as well as the development of executive functions (see Figure 2.1 for the theoretical model of school achievement). This argument was supported by the fact that the tools used to measure these constructs required a solid understanding of French.

5.3 Model Specification

The simplest model to capture a program effect involves two groups of participants: the “treated” group and the “untreated” group. This type of model is most valid when the distinction between a treated group and an untreated group is absolute, that is, the untreated group receives absolutely no intervention, while all members in the treated group receive the same intervention (e.g., the same dosage or “exposure”). For studies carried out in the field, such clean-cut distinctions are rather rare, and the Readiness to Learn project is no exception to this rule. The intensity of intervention received by participants varied in at least two regards: degree of program exposure (dosage) and the fidelity/quality of the program. During the first three years of the project, a period during which children attended daycare until the beginning of grade one in elementary school, the impact of the intensity of the program was examined on children's outcomes. The results of the 12-month post-program analyses clearly showed that variations in the intensity of the program lost its importance after program delivery ended. Other than the parents' influence, the primary source of influence on children's development at that time was school attendance. Therefore, the model specification focuses on group comparison analyses with and without covariates. We also describe below the underlying logic of the program evaluation as it pertains to the child's linguistic profile.

³⁶ The differences-in-differences (DiD) estimator applied in the first phase of the Readiness to Learn project cannot be used to estimate program effects at 24 months post-program since it requires the same pre- and post-intervention measure. Different tools were used in the 24-month post-program follow-up period to track both the children's learning and to measure academic performance indicators rather than school readiness indicators.

5.3.1 Evaluating the Program's Effect by Linguistic Profile

Children living in a minority Francophone community are faced with a major challenge in terms of developing the French language. High exposure to French is required to offset their primarily English environment in the public sphere, enabling children to develop additive rather than subtractive bilingualism. With additive bilingualism, children can benefit from what is taught in kindergarten and grade one (see Cummins, 1979; Doherty, 1997; Hindman et al., 2010). The children most vulnerable to develop subtractive bilingualism are those who received limited exposure to French in the private and public spheres. The Readiness to Learn preschool project is designed to bridge this gap by exposing the children to French more often at home and at daycare.

In light of the emphasis on the linguistic environment of the child, we examined how the long-term effect of the program was moderated by the linguistic profile at home. The results of the analyses provide some answers to the long-term effects assumptions and are presented in the following chapters.

5.4 Size of the Effect

An indicator of the size of the effect accompanies the impact analyses for each experimental group. According to Cohen (1988), the d statistic is a way of describing the size of the effect, that is, the “standardized” mean difference between the groups. Cohen provides conventional references for interpreting the size of the effects expressed on a standardized scale. A standardized difference of $d = 0.20$ between the groups is considered to be small, while a difference of $d = 0.50$ is considered to be average and a difference of $d = 0.80$ is considered to be large. These points of reference support the results of a meta-analysis examining the distribution of standardized sizes of effect in various intervention studies (Lipsey & Wilson, 1993). However, they must only serve as a general guideline in determining the significance of an effect. An effect may be considered more or less significant depending on the research context (Kane, 2004; Hill, Bloom, Black & Lipsey, 2008).

Kane (2004) and Hill et al. (2008) have provided tools useful to assess the effect size of an intervention. They recommend comparing the effect size of an intervention with normal developmental gains observed during one year of development. According to Hill et al. (2008; Table 1), the average increase in the development of literacy and numeracy expected for the period from kindergarten to grade one is approximately $d = 1.33$. In other words, a program effect of $d = 1.33$ would represent a year of development and an effect of 0.67 would represent an increase equivalent to approximately six months of development.

6.0 Impacts of the Tested Program

This chapter documents the analysis results for the predictors of a child's performance. Four groups of predictors are of interest: language and reading skills, math skills, and executive functions.

The chapter is presented as follows:

- Section 6.1 presents the analysis of variance (ANOVA) results for the unadjusted groups, comparing children in the Program Daycare group with children in the two comparison groups for child outcomes;
- Section 6.2 gives the results of the children's construction of their linguistic identity and their perception of the vitality of the Francophone community;
- Section 6.3 describes the results for the analysis of the program's impact on children's cultural development and school readiness, from the parents' perspective;
- Section 6.4 presents the analysis of variance results for the groups adjusted with covariates, comparing children in the Program Daycare group with children in the two comparison groups for the main child outcomes;
- Section 6.5 reports the results of analyses by linguistic profile, re-examining the differences between the experimental groups, for children who had a high initial exposure to French, and children who had a low initial exposure;
- Section 6.6 presents a summary of the long term impact of the program on the children.

6.1 Impact on Children's Skills – Analyses by Unadjusted Group

The purpose of the first series of analyses was to determine whether the program succeeded in reducing the gap that was observed *at baseline* between the children in the Program Daycare group and those in the Comparison Daycare group. Recall that children in the Program Daycare group scored lower on the Communication, Self-awareness, Expressive Vocabulary and Receptive Vocabulary variables in the baseline assessment than the children in the Daycare Comparison group.³⁷ The underlying logic of the analyses by unadjusted group is as follows: a boost can be expected if there are no significant differences observed between the children in the Program Daycare group and the comparison groups at 24 months post-program.

For the purposes of studying the boost, estimates of the program effect are based on the specification used for the data modelling. The strategy adopted is to present two specifications for each analysis: a "disaggregate" model with standard errors at the individual level, and an "aggregate" model with standard errors grouped by daycare. The two specifications produce results which, when compared, enable us to finely tune our interpretation of the data. It should be pointed out that the aggregate model is considered to be more conservative than the disaggregate model. The aggregate model is robust in terms of heterogeneity and also considers clustering by daycare. It is regarded as the final result.

³⁷ Analyses of multiple comparisons were conducted for the 336 participants included in this report.

In both models, the “group” factor is represented by two dummy variables designed to compare the comparison groups with the Program Daycare group. In other words, the Program Daycare group is set up as the “reference” group. *It is important to note that the decision to identify the Program Daycare group as the reference means that **negative values in the ANOVA and effect size (Cohen's d statistic) estimates for all comparisons between groups represent a positive effect of the program (i.e., an advantage for the Program Daycare group).***

6.1.1 Language Skills

This subsection contains the impact analysis results for language skills by experimental group. Two of the three language skill indicators were drawn from the direct assessment of children, i.e. the PPVT-R (Receptive Vocabulary) and Verbal Fluency (Expressive Vocabulary). The third indicator comes from the parents' survey (Continuum of French Spoken by the Child). The impact analysis results for these variables are presented in Table 6.1.

PPVT-R

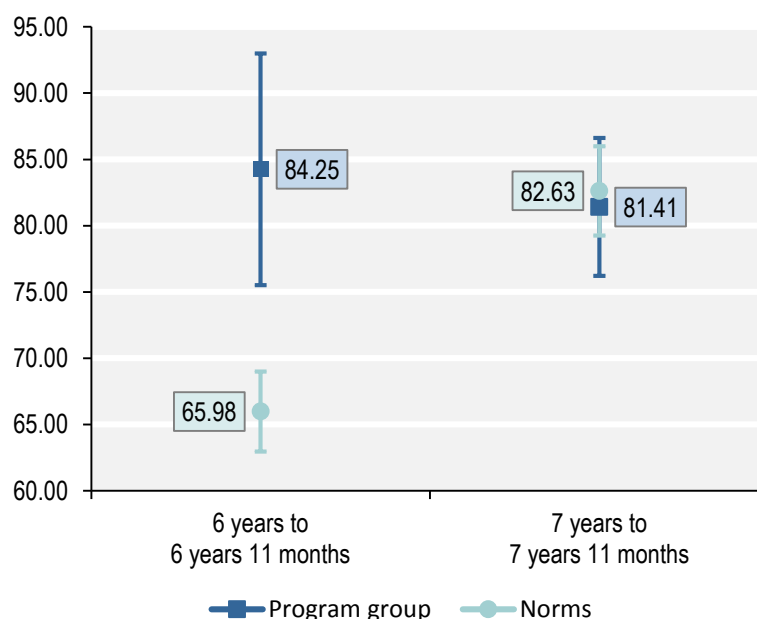
The results for the PPVT-R variable are similar regardless of the data modelling specification used. A slight advantage was noted for the Program Daycare group compared to the Comparison Daycare group, but this difference was not significant and the size of this effect was small ($d = -0.13$).³⁸ Results indicate that the scores for the Informal Care group were no different from those of the Program Daycare group, as demonstrated by the lack of significant difference and effect size close to nil ($d = -0.04$).

Analyses were also performed to compare the PPVT-R raw scores for the Program Daycare group with French Canadian standards. The results only revealed a significant difference in favour of the children in the Program Daycare group compared to French Canadian standards for children between the ages of 6 and 6 years 11 months. The children in the Program Daycare group between the ages of 7 and 7 years 11 months performed at the same level as their [French] Canadian counterparts. These results suggest a program impact on children's Receptive Vocabulary, one that is more pronounced at a younger age. Finally, the mean raw scores for the three experimental groups were also converted to a percentile rank³⁹. The results indicate that on average, the children in the Program Daycare group fall within the 70 percentile rank, while those in the Comparison Daycare group and the Informal Care group fall in at 63 and 65 respectively. These results enable us to identify that all of the children participating in the Readiness to Learn project have a Receptive Vocabulary larger than the French Canadian standard.

All of these results suggest that the real impact of the program has been underestimated in terms of vocabulary size.

³⁸ Effect size (i.e. Cohen's d) is explained in Section 5.4.

³⁹ The percentile rank ranges from 1 to 99 and corresponds to the ranking of a subject in a benchmarking group of 100 people (Dunn et al., 1993).

Figure 6.1 Comparison Between PPVT-R Scores and French Canadian Standard Scores

Verbal Fluency

ANOVA estimates for the Verbal Fluency variable did not reveal any significant differences between the Program Daycare group and the two comparison groups. This result is further supported by the close to nil effect size regardless of the comparison group.

Continuum of French

The results for the Continuum of French variable did not reveal any significant differences between the Program Daycare group and the Comparison Daycare group, regardless of the data modelling specification used. ANOVA estimates revealed an advantage for the Informal Care group, but this difference was only significant for the disaggregate model with standard errors at the individual level and the size of this effect was considered to be small ($d = 0.24$).

6.1.2 Reading and Writing Skills

Table 6.1 shows the impact analysis results for reading and writing skills. Indicators for these skills, taken from the children's assessments, include Reading Complex Words, Reading Sentences Aloud, and Comprehension of Written Sentences. Two additional variables for reading and writing skills were drawn from the parents' survey, namely Reading Performance and Writing Performance.

Reading Complex Words

The results were similar for the Reading Complex Words variable, regardless of the data modelling specification used. No significant differences were observed between the Program Daycare group and

the comparison groups. The size of the effect was close to nil for the comparison with the Comparison Daycare group ($d = 0.05$) and small for the comparison with the Informal Care group ($d = 0.18$).

Reading Sentences Aloud

The comparison with the Comparison Daycare group did not reveal any significant differences for the Reading Sentences Aloud variable. However, the results do indicate an effect in favour of the Informal Care group, although the difference is only significant in the disaggregate model with standard errors at the individual level and the size of the effect is small ($d = 0.29$).

Comprehension of Written Sentences

The comparison with the Comparison Daycare group did not reveal any significant differences for the Comprehension of Written Sentences variable. ANOVA estimates indicate an effect in favour of the Informal Care group in the disaggregate model and the size of the effect is small ($d = 0.24$).

Reading Performance

The negative value of ANOVA estimates for the Reading Performance variable revealed a slight advantage for the Program Daycare group compared to the two comparison groups. However, these differences were not significant and Cohen's d revealed a small effect regardless of the comparison group.

Writing Performance

The results for the Writing Performance variable suggest a slight advantage for the Program Daycare group compared to the two comparison groups. For this variable, the difference is only significant for the comparison with the Comparison Daycare group, in both specified models. A small effect was observed for the comparison with both the Comparison Daycare group ($d = -0.25$) and the Informal Care group ($d = -0.15$).

Table 6.1 Comparison of Language and Reading Skills between Groups – Unadjusted Results

		Program Daycare Group	Comparison Groups	Progam Effect	Effect Size	Standard Error	
Measure	Comparison	unadjusted Mean	unadjusted Mean	Difference	Cohen's <i>d</i>	S.E. ₁	S.E. ₂
Language Skills							
PPVT	G1 vs. G2	82.14	79.28	-2.86	-0.13	2.94	6.33
	G1 vs. G3	82.14	81.36	-0.78	-0.04	2.96	7.50
Verbal Fluency	G1 vs. G2	22.40	22.29	-0.12	-0.02	0.79	1.15
	G1 vs. G3	22.40	22.48	0.08	0.01	0.85	1.16
Continuum of French	G1 vs. G2	2.11	2.12	0.01	0.02	0.08	0.21
	G1 vs. G3	2.11	2.25	0.15	0.24	0.08*	0.24
Reading Skills							
Reading Complex Words	G1 vs. G2	11.01	11.41	0.40	0.05	1.20	2.71
	G1 vs. G3	11.01	12.72	1.71	0.18	1.34	3.13
Reading Sentences Aloud	G1 vs. G2	39.51	42.08	2.57	0.15	2.33	3.49
	G1 vs. G3	39.51	44.37	4.86	0.29	2.38**	4.10
Comprehension of Written Sentences	G1 vs. G2	6.87	7.29	0.42	0.09	0.67	0.91
	G1 vs. G3	6.87	8.19	1.33	0.24	0.75*	1.26
Reading Performance	G1 vs. G2	2.11	1.91	-0.21	-0.20	0.15	0.16
	G1 vs. G3	2.11	1.96	-0.15	-0.14	0.16	0.18
Writing Performance	G1 vs. G2	2.29	2.05	-0.23	-0.25	0.14*	0.13*
	G1 vs. G3	2.29	2.14	-0.15	-0.15	0.15	0.16

Note: G1 = Program Daycare group; G2 = Comparison Daycare group; G3 = Informal Care group; S.E.₁ corresponds to disaggregate standard error at individual level; S.E.₂ corresponds to aggregate standard error with clustering by daycare. Standard errors are estimated using the robust Huber-White heterogeneity estimator. *Negative values in ANOVA estimates for all comparisons between groups represent a positive effect of the program (i.e., an advantage for the Program Daycare group); *p<0.10, **p<0.05, ***p<0.01.*

6.1.3 Math Skills

Table 6.2 contains the impact analysis results for math skills by experimental group. The Knowledge of Numbers variable comes from the direct assessment of children, while the Math Performance variable is drawn from the parents' survey.

Knowledge of Numbers

ANOVA estimates for the Knowledge of Numbers variable indicate that there was no significant difference between the Program Daycare group and the comparison groups. The effect size varied from very little for the comparison with the Comparison Daycare group ($d = 0.13$) to small for the comparison with the Informal Care group ($d = 0.22$).

Math Performance

The results for Math Performance show the same trend as those for the Knowledge of Numbers variable, i.e. no significant difference was observed between the groups. The effect size was close to nil for comparisons with both the Comparison Daycare group ($d < 0.08$) and the Informal Care group ($d < 0.05$).

6.1.4 Executive Functions

Table 6.2 also presents the impact analysis results by experimental group for the development of executive functions. The three variables presented — Forward Digit Span, Backward Digit Span and the Knock-Tap test— are drawn from the direct assessment of children.

Forward Digit Span

No significant difference was observed between the Program Daycare group and the comparison groups for the Forward Digit Span variable. Furthermore, the effect was very little to nil, i.e. $d = 0.16$ and $d = -0.01$ for the comparisons with the Comparison Daycare group and the Informal Care group respectively.

Backward Digit Span

The results did not reveal any significant differences between the Program Daycare group and the comparison groups for the Backward Digit Span variable. The effect was very little for the comparison with the Comparison Daycare group ($d = -0.10$) and close to nil for the comparison with the Informal Care group ($d = 0.03$).

Analyses were also conducted to compare the Program Daycare group scores with Canadian standards.⁴⁰ French Canadian standards are only available for the combined Forward Digit Span/ Backward Digit Span scores, in other words, the total for the two tests. The results of these analyses show that the children in the Program Daycare group are comparable to French Canadian standards,

⁴⁰ Analyses are based on a sample representative of Ontario's Francophone population, consisting of 74 children per age range.

regardless of the age range (from 6 to 6 years 11 months; from 7 to 7 years 11 months). Although the analyses did not reveal any significant differences between the two samples, results indicate that the children in the Program Daycare group from the 6 to 6 years 11 months age range performed above the standardized sample mean, with a mean score of 11.75 compared to 11.00, with a standard error of approximately 0.25 (Wechsler, 2005; see Table 6.1, Technical and Interpretative Manual). Furthermore, for the 7 to 7 years 11 months age range, the children in the Program Daycare group obtained scores equivalent to the standardized sample mean.

Knock-Tap Test

ANOVA estimates for the Knock-Tap variable suggest that the children in the Program Daycare group perform at the same level as children in the comparison groups, as demonstrated by the lack of significant difference and nil effect size for the comparisons.

6.1.5 Other Predictors of Academic Achievement

Finally, Table 6.2 provides the impact analysis results, by experimental group, for two other predictors of academic achievement: School Readiness and Overall Performance, as perceived by the parents.

School Readiness

No significant difference was observed between the Program Daycare group and the comparison groups for the School Readiness variable, and size effects were nil.

Overall Performance

Results for the aggregate model suggest an advantage for the Program Daycare group in comparison with the Informal Care group for the Overall Performance variable. The effect size was considered to be very little ($d=-0.14$) to small ($d = -0.21$).

Table 6.2 Comparison between Groups for Math Skills, Executive Functions and Other Predictors of Academic Achievement – Unadjusted Results

		Program Daycare Group	Comparison Groups	Program Effect	Effect Size	Standard Error	
Measure	Comparison	unadjusted Mean	unadjusted Mean	Difference	Cohen's <i>d</i>	S.E. ₁	S.E. ₂
Math Skills							
Knowledge of Numbers	G1 vs. G2	27.31	28.16	0.85	0.13	0.86	0.92
	G1 vs. G3	27.31	28.80	1.49	0.22	0.94	0.98
Math Performance	G1 vs. G2	1.63	1.68	0.06	0.08	0.11	0.13
	G1 vs. G3	1.63	1.67	0.04	0.05	0.12	0.10
Executive Functions							
Forward Digit Span	G1 vs. G2	7.37	7.69	0.32	0.16	0.27	0.23
	G1 vs. G3	7.37	7.35	-0.02	-0.01	0.24	0.19
Backward Digit Span	G1 vs. G2	4.69	4.54	-0.15	-0.10	0.19	0.19
	G1 vs. G3	4.69	4.73	0.04	0.03	0.17	0.16
Knock-Tap Test	G1 vs. G2	14.22	14.11	-0.11	-0.08	0.17	0.22
	G1 vs. G3	14.22	14.21	-0.01	-0.01	0.15	0.21
Other Predictors of Academic Achievement							
School Readiness	G1 vs. G2	14.41	14.44	0.03	0.03	0.14	0.10
	G1 vs. G3	14.41	14.47	0.06	0.07	0.13	0.11
Overall Academic Performance	G1 vs. G2	1.87	1.76	-0.11	-0.14	0.12	0.11
	G1 vs. G3	1.87	1.70	-0.18	-0.21	0.12	0.08**

Note: G1 = Program Daycare group; G2 = Comparison Daycare group; G3 = Informal Care group; S.E.₁ corresponds to disaggregate standard error at individual level; S.E.₂ corresponds to aggregate standard error with clustering by daycare. Standard errors are estimated using the robust Huber-White heterogeneity estimator. *Negative values in ANOVA estimates for all comparisons between groups represent a positive effect of the program (i.e., an advantage for the Program Daycare group); *p<0.10, **p<0.05, ***p<0.01*

6.2 Impact on Children's Development of Linguistic Identity and Perception of the Vitality of the Francophone Community – Unadjusted Analyses by Group

In this section, we will present the results from the four questions on the direct assessment of children that deal with the child's perception of linguistic identity and perception of the vitality of the Francophone community. Since it was impossible to impute missing data for these variables, the analyses were carried out on a sample of children who completed the direct assessment at 24 months post-program (N = 307 to 313, depending on the question).

Language Used Most Often at School

According to the results presented in Table 6.3, more than 90% of children speak French only at school, regardless of the experimental group. The non-significant result of the Chi-square test confirmed that the distribution of the children in the Program Daycare group compares to the two comparison groups in terms of language spoken at school ($\chi^2 (6, N = 308) = 3.50, p > 0.10$).

Table 6.3 Language Used Most Often at School

	Program Daycare Group	Comparison Daycare group	Informal Care Group	Significant differences between the two samples
Number of Children	N (%)	N (%)	N (%)	Chi-square
English only and/or another language	1 (1.19)	1 (0.82)	1 (0.98)	No
English and/or another language more than French	2 (2.38)	3 (2.46)	0 (0.00)	
French more than English and/or another language	3 (3.57)	5 (4.10)	2 (1.96)	
French only	78 (92.86)	113 (92.62)	99 (97.06)	

Note: Significance levels: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Perception of the Vitality of the Francophone community

The child's perception of the vitality of the Francophone community was measured through the following question: "Which language do people in your community (at the store, at the park) speak the most?" Three main points are noted in Table 6.4. First of all, a greater proportion of the children in the Program Daycare group (41.67%) perceived that people in their community speak English only compared to 30.0% of the children in the Comparison Daycare group and 27.18% of the children in the Informal Care group. Secondly, a smaller proportion of children in the Program Daycare group (9.52%) perceived that people speak French more than English or any other language in their community compared to the children in the Comparison Daycare group (21.67%). Finally, children in the Informal

Care group (31.07%) were more likely to believe that people speak French only in their community compared to children in the Program Daycare group (15.48%) and children in the Comparison Daycare group (18.33%).

In other words, children in the Informal Care group reported a greater vitality of French speakers in their community compared to children in the other two groups. The total of the two answer options “French more than English and/or another language” and “French only” showed that a significantly lower proportion of the children in the Program Daycare group (25%) perceived their community as a Francophone environment, compared to the children in the Comparison Daycare group (40%) and the Informal Care group (44.7 %). The significant result of the Chi-square test was supported by the fact that the experimental groups differed in their perception of the vitality of the Francophone community ($\chi^2 (6, N = 307) = 15.06, p < 0.05$).

Table 6.4 Perception of the Vitality of the Francophone Community

	Program Daycare Group	Comparison Daycare group	Informal Care Group	Significant differences between the two samples?
Number of Children	N (%)	N (%)	N (%)	Chi-square
English only and/or another language	35 (41.67)	36 (30.00)	28 (27.18)	Yes**
English and/or another language more than French	28 (33.33)	36 (30.00)	29 (28.16)	
French more than English and/or another language	8 (9.52)	26 (21.67)	14 (13.59)	
French only	13 (15.48)	22 (18.33)	32 (31.07)	

Note: Significance levels: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Importance of Speaking One Language More Than Another

The analysis results reported in Table 6.5 reveal that nearly half of the children (40.8% - 49.04% depending on the experimental group) did not feel that it was important to speak one language more than another. Among the children who answered that it was important, there were no significant differences between the groups. However, although the chi-square was not significant ($\chi^2 (6, N = 313) = 12.43, p > 0.10$), there did appear to be a tendency among the children in the Program Daycare group (32.14%) and the Comparison Daycare group (32.8%) to believe that it was more important to speak French than English (or any another language) compared to the children in the Informal Care group (24.0%). It should also be noted that the percentage of children who did not answer the question was somewhat higher among the children in the Comparison Daycare group (16.0%) than those in the Program Daycare group (7.14%) and the Informal Care group (8.65%).

Table 6.5 Importance of Speaking One Language More Than Another

Number of Children	Program Daycare Group	Comparison Daycare group	Informal Care Group	Significant differences between the two samples?
	N (%)	N (%)	N (%)	Chi-square
No	37 (44.05)	51 (40.8)	51 (49.04)	No
French	27 (32.14)	41 (32.8)	25 (24.04)	
English	11 (13.10)	13 (10.4)	15 (14.42)	
Other	3 (3.57)	0 (0.00)	4 (3.85)	
No answer/No cultural identity	6 (7.14)	20 (16.00)	9 (8.65)	

Note: Significance levels: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Pride in Speaking French

Table 6.6 shows that approximately 97% of the children in all three experimental groups are proud to speak French. No statistical difference was observed between the experimental groups in terms of the level of pride they experienced in speaking French ($\chi^2 (6, N = 309) = 3.01, p > 0.10$).

Table 6.6 Pride in Speaking French

Number of Children	Program Daycare Group	Comparison Daycare group	Informal Care Group	Significant differences between the two samples?
	N (%)	N (%)	N (%)	Chi-square
Yes	82 (97.62)	119 (96.75)	99 (97.06)	No
A bit	0 (0.00)	3 (2.44)	2 (1.96)	
No	2 (2.38)	1 (0.81)	1 (0.98)	

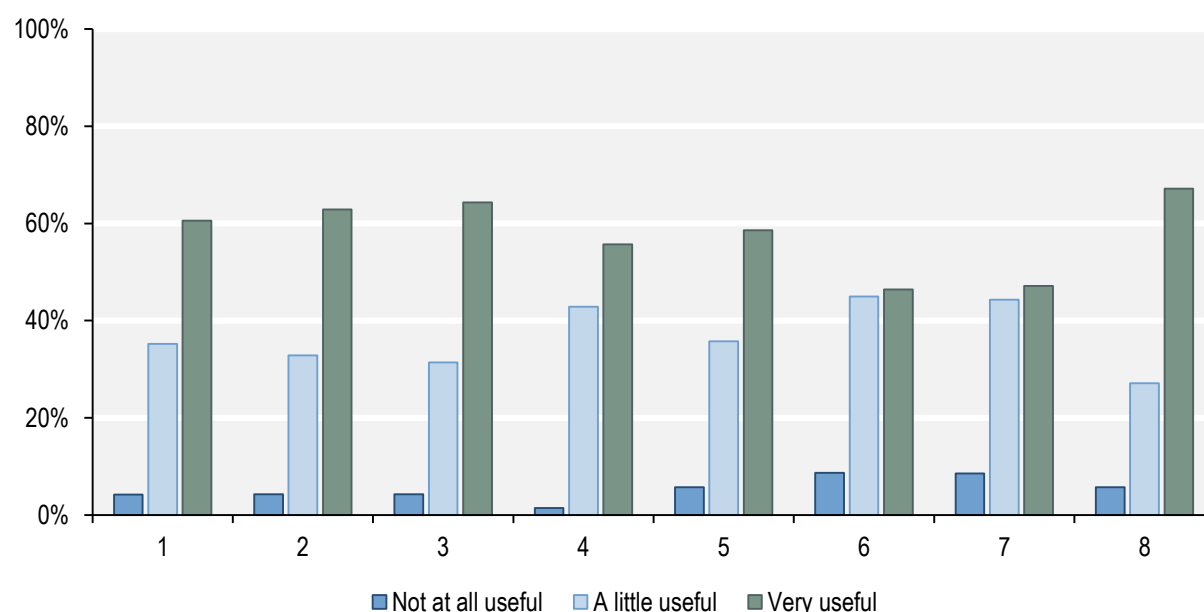
Note: Significance levels: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

6.3 Impact on Children's Development of Francophone Cultural Identity and School Readiness – Parents' Perception

Figure 6.2 illustrates the program's impact on children's development of their Francophone cultural identity and their school readiness, as perceived by the parents. It should be noted that these results are based on data collected from the 72 families in the Program Daycare group who participated in at least one of the two program components during the first two years (N varied from 69 to 72, depending on the question). Results show that more than half of the parents stated that the program was very

helpful in developing their child's Francophone cultural identity (67.1%), easing the child's integration into school (64.3%), adapting to the school routine (62.9%), feeling excited about beginning school (60.6%), learning to interact with others (58.6%) and preparing for academic requirements (55.7%). Furthermore, close to half of the parents mentioned that the program was also very helpful in developing their child's sense of autonomy (47.1%) and better preparing for grade one (46.4%). For each of the statements, less than 9% of the parents indicated that the program had not had any effect on the children (from 1.4% to 8.7%, depending on the statement).

Figure 6.2 Parents' Perception of the Program's Impact on their Child's Cultural Development and School Readiness



1	Feeling excited about beginning school	5	Learning to interact with others
2	Adapting to the school routine	6	Being better prepared for grade one
3	Easing integration into school	7	Developing a sense of autonomy
4	Preparing for academic requirements	8	Developing a Francophone cultural identity

6.4 Impact on Children's Skills – Analyses by Group Adjusted with Covariates

The series of reported analyses presents two specifications for each analysis: a “disaggregate” model with standard errors at the individual level, and an “aggregate” model with standard errors grouped by daycare. The two specifications produce results which, when compared, enable us to finely tune our interpretation of the data. It should be pointed out that the aggregate model is considered to be more conservative than the disaggregate model. The aggregate model is robust in terms of heterogeneity and

also considers clustering by daycare. It is regarded as the final result. To control for the differences at baseline, analyses for the two models included group membership and the 18 covariates (see Appendix A for an exhaustive list of covariates).⁴¹

Similar to the analyses carried out in Section 6.1 (ANOVA), the Program Daycare group is set up as the “reference” group, meaning that ***negative values in the ANCOVA and effect size (Cohen’s *d* statistic) estimates for all comparisons between groups represent a positive effect of the program (i.e., an advantage for the Program Daycare group).***

6.4.1 Language Skills

PPVT-R

Results for the PPVT-R (Receptive Vocabulary) variable are similar regardless of the model specification (see Table 6.7). A significant advantage for the Program Daycare group was observed compared to the two comparison groups. The effect size was medium for the comparison with the Comparison Daycare group ($d = -0.58$) and small to medium for the comparison with the Informal Care group ($d = -0.35$).

Verbal Fluency

According to ANCOVA estimates for the Verbal Fluency (Expressive Vocabulary) variable, there was no significant difference between the Program Daycare group and the comparison groups (see Table 6.7).

Continuum of French Spoken by the Child

Results for the variable Continuum of French Spoken by the Child reveal a significant difference in favour of the Program Daycare group, compared to the Comparison Daycare group, in both the aggregate and disaggregate models (see Table 6.7). The effect size was relatively small ($d = -0.26$). Furthermore, no significant difference was observed for the comparison with the Informal Care group and the effect size was close to nil ($d = -0.04$).

6.4.2 Reading and Writing Skills

Reading Complex Words

A slight advantage for the Program Daycare group was observed compared to the Comparison Daycare group for the Reading Words variable (see Table 6.7). However, this difference was not significant and the effect was considered to be small ($d = -0.25$). Furthermore, the positive value for the estimate suggests a trend in favour of the Informal Care group, but the difference was not significant and the effect was small ($d = 0.18$).

⁴¹ Note that the 18 covariates include the Language and Communication variable measured at baseline (Domain C, Early Years Evaluation – Direct Assessment; Willms, 2007) to statistically control for the children’s initial differences in language skills.

Reading Sentences Aloud

For the Reading Sentences Aloud variable, the children in the Program Daycare group appeared to perform at the same level as the children in the Comparison Daycare group ($d = -0.04$) (see Table 6.7). They did not perform as well as the children in the Informal Care group. This latter comparison was significant in the aggregate model with a small to medium effect size ($d = 0.40$).

Comprehension of Written Sentences

Results for the Comprehension of Written Sentences variable suggest that children in the Program Daycare group performed as well on this reading test as the children in the Comparison Daycare group (see Table 6.7). Furthermore, it was observed that their performance was significantly inferior to that of the children in the Informal Care group with a small to medium effect size ($d = 0.45$).

Reading Performance

ANCOVA estimates for the Reading Performance variable did not reveal any significant differences between the Program Daycare group and the two comparison groups (see Table 6.7).

Writing Performance

The negative values of the ANCOVA estimates suggest a trend in favour of the Program Daycare group for the Writing Performance variable, but the differences were not significant (see Table 6.7). It should be noted, however, that the effect size was close to medium for the comparison with the Comparison Daycare group ($d = -0.42$).

Table 6.7 Comparison between Groups for Language and Reading Skills – Adjusted Results

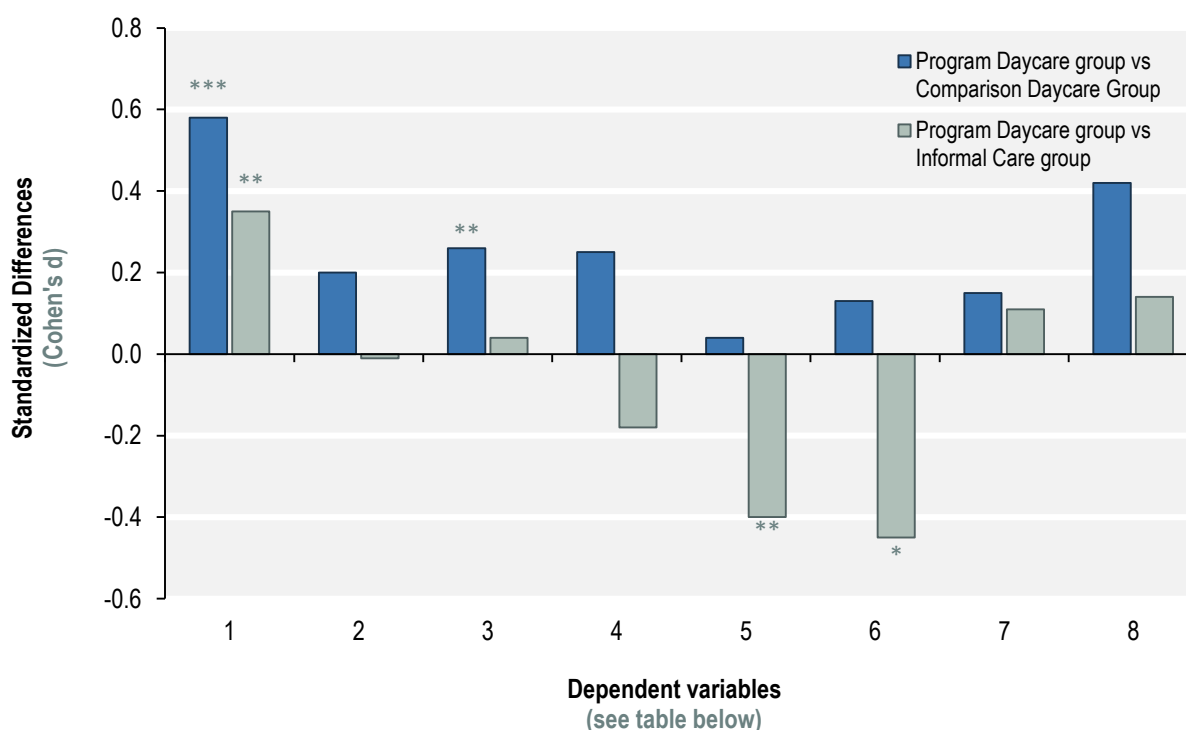
		Program Daycare Group	Comparison Groups	Program Effect	Effect Size	Standard Error	
Measure	Comparison	adjusted Mean	adjusted Mean	Difference	Cohen's <i>d</i>	S.E. ₁	S.E. ₂
Language Skills							
PPVT-R	G1 vs. G2	85.56	77.40	-8.16	-0.58	2.32***	1.78***
	G1 vs. G3	85.56	80.64	-4.92	-0.35	2.39**	1.86**
Verbal Fluency	G1 vs. G2	22.63	21.97	-0.66	-0.20	0.72	0.45
	G1 vs. G3	22.63	22.65	0.02	0.01	0.84	0.58
Continuum of French	G1 vs. G2	2.21	2.10	-0.11	-0.26	0.06*	0.05**
	G1 vs. G3	2.21	2.19	-0.02	-0.04	0.07	0.04
Reading Skills							
Reading Complex Words	G1 vs. G2	11.93	10.62	-1.30	-0.25	1.04	0.77
	G1 vs. G3	11.93	12.86	0.93	0.18	1.24	0.95
Reading Sentences Aloud	G1 vs. G2	41.12	40.81	-0.31	-0.04	2.26	2.02
	G1 vs. G3	41.12	44.49	3.36	0.40	2.34	1.26**
Comprehension of Written Sentences	G1 vs. G2	7.20	6.86	-0.35	-0.13	0.62	0.51
	G1 vs. G3	7.20	8.41	1.21	0.45	0.72*	0.62*
Reading Performance	G1 vs. G2	2.02	1.96	-0.05	-0.15	0.16	0.13
	G1 vs. G3	2.02	1.97	-0.04	-0.11	0.17	0.14
Writing Performance	G1 vs. G2	2.21	2.08	-0.14	-0.42	0.15	0.12
	G1 vs. G3	2.21	2.17	-0.05	-0.14	0.16	0.14

Note: G1 = Program Daycare group; G2 = Comparison Daycare group; G3 = Informal Care group; S.E.₁ corresponds to disaggregate standard error at individual level; S.E.₂ corresponds to aggregate standard error with clustering by daycare. Standard errors are estimated using the robust Huber-White heterogeneity estimator. *Negative values in ANCOVA estimates for all comparisons between groups represent a positive effect of the program (i.e., an advantage for the Program Daycare group); *p<0.10, **p<0.05, ***p<0.01*

Summary

A summary of the ANCOVA results for language, reading and writing skills is presented in Figure 6.3. The blue and grey bars represent the effect size for the comparisons with the Comparison Daycare group (G2) and the Informal Care group (G3) respectively. It should be noted that a bar value greater than zero signifies an effect in favour of the Program Daycare group and effect significance levels are indicated by the asterisks above the bars.

Figure 6.3 Program Effect on Children's Language, Reading and Writing Skills Represented by Standardized Differences (Cohen's *d*)



1	PPVT-R	5	Reading Sentences Aloud
2	Verbal Fluency	6	Comprehension of Written Sentences
3	Continuum of French	7	Reading Performance
4	Reading Complex Words	8	Writing Performance

Note: Significance levels: * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

6.4.3 Math Skills

Knowledge of Numbers

There was no significant difference between the children in the Program Daycare group and those in the Informal Care group for the Knowledge of Numbers variable ($d = -0.04$) (see Table 6.8). However, results indicate that the children in the Program Daycare group did not perform as well in math as the children in the Informal Care group. This comparison was significant in both models with a medium size effect ($d = 0.48$).

Math Performance

Results for the Math Performance variable did not show any significant difference between the Program Daycare group and the comparison groups (see Table 6.8).

6.4.4 Executive Functions

Forward Digit Span

No significant difference was observed between the Program Daycare group and the comparison groups for the Forward Digit Span variable (see Table 6.8). The effect size was very little for the comparison with the Comparison Daycare group ($d = -0.08$) and small for the comparison with the Informal Care group ($d = -0.28$).

Backward Digit Span

Results also showed no significant difference between the Program Daycare group and the comparison groups for the Backward Digit Span variable (see Table 6.8). Although there was no significant difference, the medium size effect ($d = -0.54$) in relation to the Comparison Daycare group suggests a trend in favour of the Program Daycare group.

Knock-Tap Test

A significant difference was observed for the Knock-Tap Test, in favour of the Program Daycare group compared to the Comparison Daycare group and the effect size was medium ($d = -0.64$) (see Table 6.8). Furthermore, although the comparison with the Informal Care group was not significant, the effect size suggests a slight advantage for the Program Daycare group ($d = -0.34$).

6.4.5 Other Predictors of Academic Achievement

School Readiness

ANCOVA estimates did not reveal any significant differences between the Program Daycare group and the two comparison groups for the School Readiness variable (see Table 6.8). The effect size for the comparison with the Comparison Daycare group was considered to be small to medium ($d = -0.39$).

Overall Academic Performance

No significant difference was observed between the Program Daycare group and the comparison groups for the Overall Academic Performance variable (see Table 6.8). However, the mean size of the effect does suggest an advantage for the Program Daycare group, particularly in relation to the Informal Care group ($d = -0.49$).

Table 6.8 Comparison between Groups for Math Skills, Executive Functions and Other Predictors of Academic Achievement – Adjusted Results

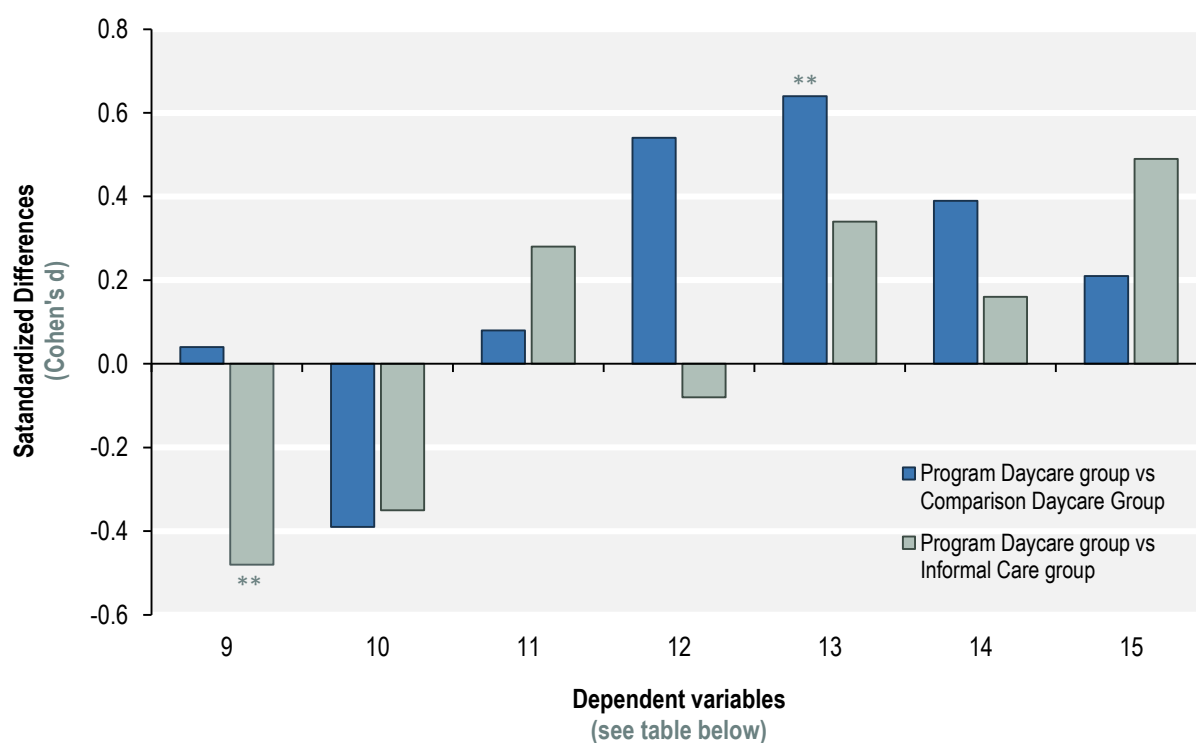
		Program Daycare	Comparison Groups	Program Effect	Effect Size	Standard Error	
Measure	Comparison	adjusted Mean	adjusted Mean	Difference	Cohen's <i>d</i>	S.E. ₁	S.E. ₂
Math Skills							
Knowledge of Numbers	G1 vs. G2	27.67	27.54	-0.13	-0.04	0.84	0.57
	G1 vs. G3	27.67	29.20	1.53	0.48	0.9*	0.65**
Math Performance	G1 vs. G2	1.59	1.69	0.10	0.39	0.12	0.09
	G1 vs. G3	1.59	1.68	0.09	0.35	0.13	0.07
Executive Functions							
Forward Digit Span	G1 vs. G2	7.59	7.52	-0.07	-0.08	0.27	0.21
	G1 vs. G3	7.59	7.36	-0.23	-0.28	0.26	0.19
Backward Digit Span	G1 vs. G2	4.74	4.47	-0.27	-0.54	0.19	0.18
	G1 vs. G3	4.74	4.78	0.04	0.08	0.19	0.20
Knock-Tap Test	G1 vs. G2	14.34	14.05	-0.29	-0.64	0.19	0.12**
	G1 vs. G3	14.34	14.18	-0.15	-0.34	0.16	0.09
Other Predictors of Academic Achievement							
School Readiness	G1 vs. G2	14.50	14.39	-0.11	-0.39	0.15	0.10
	G1 vs. G3	14.50	14.46	-0.04	-0.16	0.14	0.09
Overall Academic Performance	G1 vs. G2	1.83	1.78	-0.05	-0.21	0.12	0.09
	G1 vs. G3	1.83	1.71	-0.12	-0.49	0.13	0.09

Note: G1 = Program Daycare group; G2 = Comparison Daycare group; G3 = Informal Care group; S.E.₁ corresponds to disaggregate standard error at individual level; S.E.₂ corresponds to aggregate standard error with clustering by daycare. Standard errors are estimated using the robust Huber-White heterogeneity estimator. *Negative values in ANCOVA estimates for all comparisons between groups represent a positive effect of the program (i.e., an advantage for the Program Daycare group); * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

Summary

The combined ANCOVA results for math skills, executive functions, and the two other predictors of academic achievement are presented in Figure 6.4. The blue and grey bars represent the effect size for comparisons with the Comparison Daycare group (G2) and the Informal Care group (G3) respectively. It should be noted that a bar value greater than zero signifies an effect in favour of the Program Daycare group and significant effects are indicated by asterisks above the bar.

Figure 6.4 Program Effect on Math Skills, Development of Executive Functions and Two Other Predictors of the Children's Academic Achievement Represented by Standardized Differences (Cohen's d)



9	Knowledge of Numbers	13	Knock-Tap Test
10	Math Performance	14	School Readiness
11	Forward Digit Span	15	Overall Academic Performance
12	Backward Digit Span		

Note. Significance levels : * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

6.5 Impact on the Children – Analyses by Linguistic Profile

The purpose of the analysis by linguistic profile is to estimate the program's long term effect according to the household type (for children initially from families with high exposure to French versus those from families with low exposure to French at baseline). It should be noted that these analyses were

conducted on the entire sampling for the three experimental groups. The “Household Type” variable is an indicator that was calculated by crossing the languages spoken by the mother to the child with those spoken by the father to the child, measured at baseline. This variable was dichotomized into households with “high exposure” to French and households with “low exposure” to French.

Table 6.9 reports the results for ANCOVA estimates testing the moderator effect of Household Type on the impact at 24 months post-program. This series of analyses included 18 covariates (see Appendix for a complete list of covariates). ANCOVA estimates for the program effect are presented separately for the two household types.

6.5.1 Language Skills

When compared to the Comparison Daycare group, the program effect on Receptive Vocabulary (PPVT-R) and Expressive Vocabulary (Verbal Fluency) was more pronounced in children from households with high exposure to French (see Table 6.9). The program effect on Receptive Vocabulary (PPVT-R) was also significant for children from households with low exposure. According to the variable Continuum of French Spoken by the Child, children from families with low exposure to French benefited the most from the program. Overall, the results suggest that children from both types of households benefited from the program in terms of language skills development. Furthermore, the results of comparisons with the Informal Care group show that the program effect on receptive language (PPVT-R) varied depending on the household type, whereby children from families with high exposure to French benefited more from the program.

6.5.2 Reading and Writing Skills

Comparisons with the Comparison Daycare group indicate a greater program effect on the reading skills of children from families with high exposure (see Table 6.9). Specifically, estimates for two of the three variables (Reading Complex Words and Comprehension of Written Sentences) were significant in favour of the children in the Program Daycare group from families with high exposure to French. The program effect on the third variable (Reading Sentences Aloud) showed the same tendency. It should be noted that the estimates were only significant in the more conservative model (the aggregate model with standard errors calculated at the daycare level). The results are less clear in examining the differences with the Informal Care group. The program appears to have been a disadvantage for children from families with low exposure for the Reading Sentences Aloud variable, and for children from families with high exposure for the Comprehension of Written Sentences variable. These unexpected results are discussed at a later point in this report.

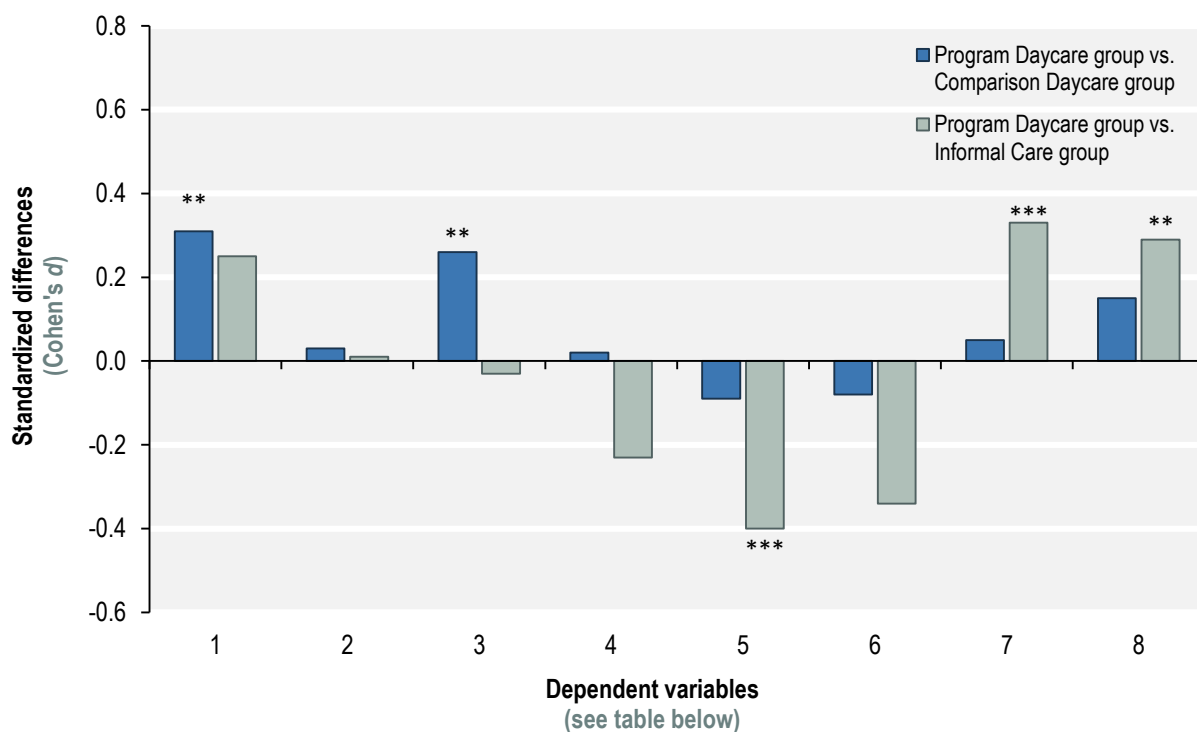
Finally, the program effect does not appear to vary according to household type for the variables Reading Performance and Writing Performance, which were measured through the parents in comparisons with the Comparison Daycare group. However, comparisons with the Informal Care group suggest that the program had a significant effect (aggregate model only) for Reading Performance and Writing Performance in children from families with low exposure to French. Figures 6.5 and 6.6 present a summary of the results by linguistic profile for language and reading skills.

Table 6.9 Program Impact on Children's Skills by Linguistic Profile

Measure	Comparison	Household with Low Exposure to French			Household with High Exposure to French		
		Estimate	Standard Error		Estimate	Standard Error	
		S.E. ₁	S.E. ₂		S.E. ₁	S.E. ₂	
Language Skills							
PPVT-R	G1 vs. G2	-6.66	3.41*	2.88**	-10.12	2.93***	1.87***
	G1 vs. G3	-5.23	3.87	3.57	-4.84	2.95	1.48***
Verbal Fluency	G1 vs. G2	-0.25	1.09	0.78	-1.20	0.89	0.55**
	G1 vs. G3	-0.08	1.41	0.67	0.24	0.98	0.64
Continuum of French	G1 vs. G2	-0.14	0.08*	0.06**	-0.09	0.09	0.08
	G1 vs. G3	0.02	0.09	0.09	-0.02	0.1	0.06
Reading Skills							
Reading Complex Words	G1 vs. G2	-0.19	1.31	0.99	-2.55	1.64	1.11**
	G1 vs. G3	2.15	1.6	1.67	-0.06	1.82	0.68
Reading Sentences Aloud	G1 vs. G2	1.94	3.02	3.02	-2.82	3.2	2.71
	G1 vs. G3	7.39	3.19**	1.94***	0.14	3.32	1.75
Comprehension of Written Sentences	G1 vs. G2	0.47	0.76	0.93	-1.13	0.94	0.57*
	G1 vs. G3	1.71	0.84**	1.04	1.05	1.1	0.53*
Reading Performance	G1 vs. G2	-0.08	0.23	0.23	-0.03	0.2	0.14
	G1 vs. G3	-0.48	0.25*	0.16***	0.24	0.23	0.19
Writing Performance	G1 vs. G2	-0.21	0.2	0.22	-0.06	0.2	0.13
	G1 vs. G3	-0.37	0.23	0.15**	0.21	0.21	0.16

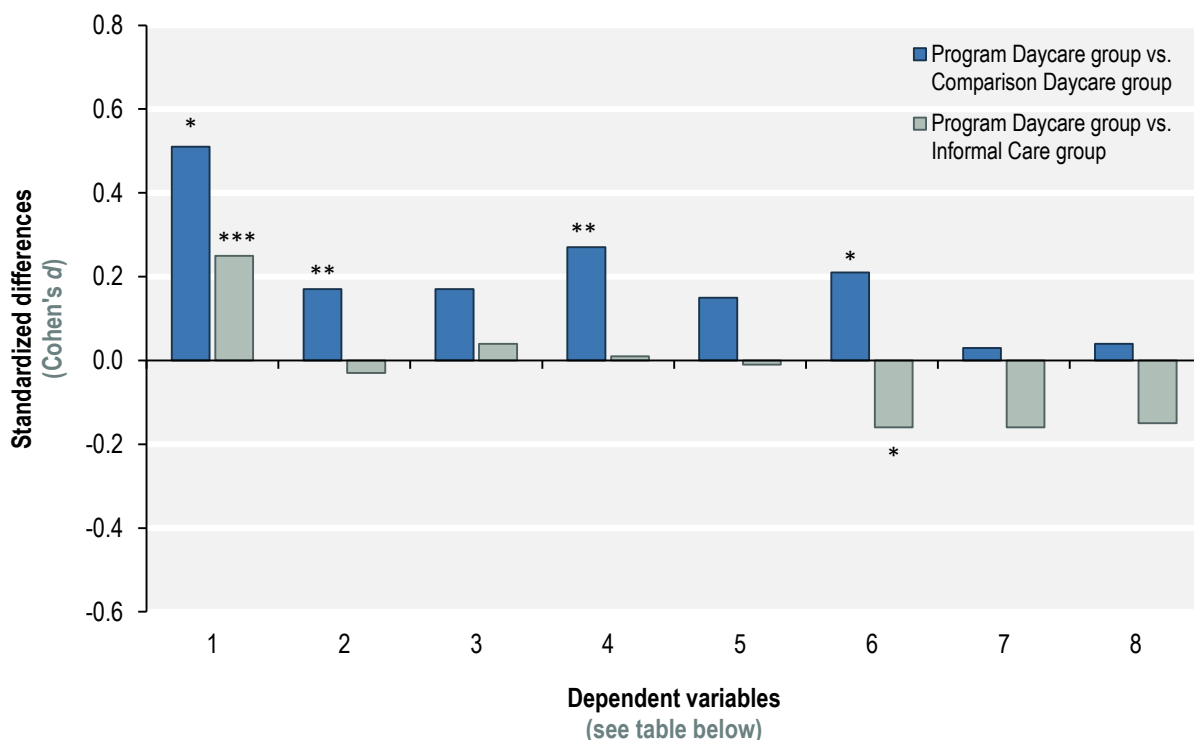
Note: G1 = Program Daycare group; G2 = Comparison Daycare group; G3 = Informal Care group; S.E.₁ corresponds to disaggregate standard error at individual level; S.E.₂ corresponds to aggregate standard error with clustering by daycare. Standard errors are estimated using the robust Huber-White heterogeneity estimator. *Negative values in ANCOVA estimates for all comparisons between groups represent a positive effect of the program (i.e., an advantage for the Program Daycare group); *p<0.10, **p<0.05, ***p<0.01.*

Figure 6.5 Program Impact on Language and Reading Skills for Children with Low Exposure



1	PPVT-R	5	Reading Sentences Aloud
2	Verbal Fluency	6	Comprehension of Written Sentences
3	Continuum of French	7	Reading Performance
4	Reading Complex Words	8	Writing Performance

Figure 6.6 Program Impact on Language and Reading Skills for Children with High Exposure



1	PPVT-R	5	Reading Sentences Aloud
2	Verbal Fluency	6	Comprehension of Written Sentences
3	Continuum of French	7	Reading Performance
4	Reading Complex words	8	Writing Performance

6.5.3 Math Skills

A review of the ANCOVA estimates presented in Table 6.10 indicates that there is no association between the Household Type and the program impact on math skills for comparisons with the Comparison Daycare group. However, children in the Informal Care group appear to have better math skills than children in the Program Daycare group, but only for children from families with high exposure to French.

6.5.4 Executive Functions

Estimates for the comparisons with the Comparison Daycare group indicate that the program effect on the development of executive functions varies significantly depending on the Household Type (see Table 6.10). In fact, for two of the variables in the direct assessment (Backward Digit Span and Knock-

Tap Test), children from families with high exposure appear to have benefited more from the program. On the other hand, estimates for the comparisons with the Informal Care group are similar regardless of the Household Type.

6.5.5 Other Predictors of Academic Achievement

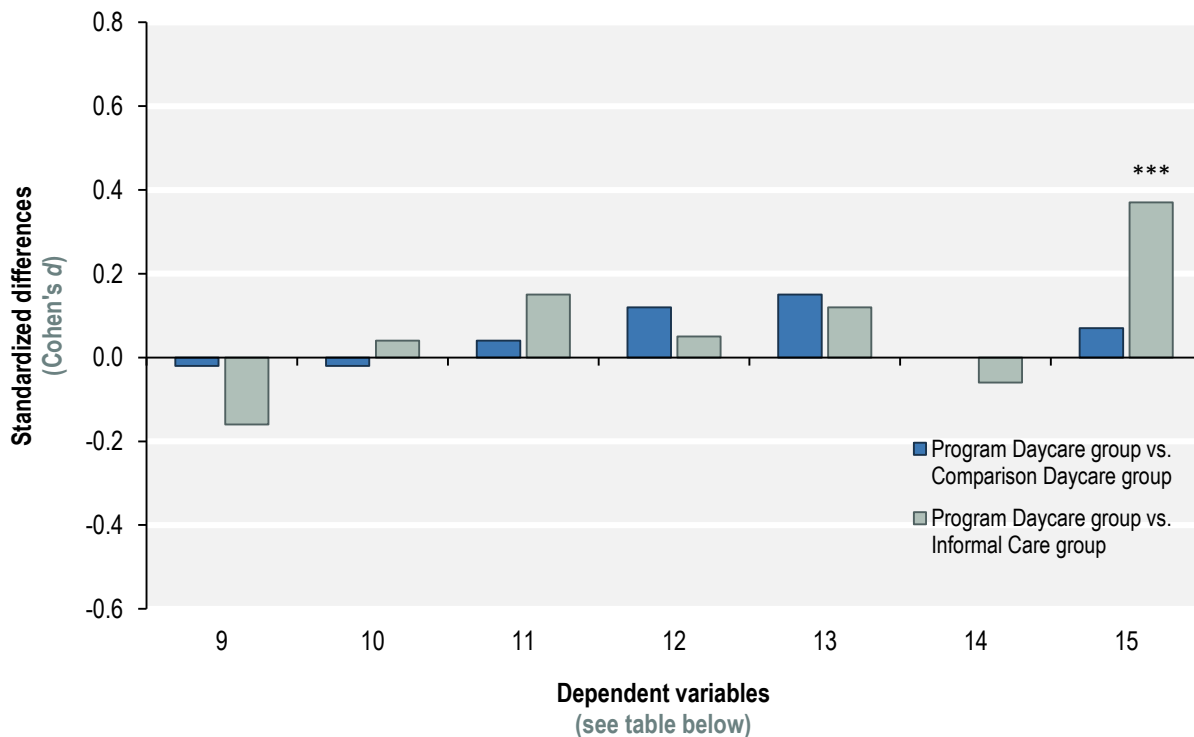
Comparisons with the two comparison groups show that there is no link between the Household Type and the program impact on the parents' perception of their child's school readiness (see Table 6.10). With respect to Overall Performance, comparisons with the Informal Care group indicate that children from families with low exposure benefited from the program. Figures 6.7 and 6.8 present a summary of the results for math skills, executive functions and other predictors of academic achievement by household type.

Table 6.10 Program Impact on Children's Skills by Linguistic Profile

Measure	Comparison	Household with Low Exposure to French			Household with High Exposure to French		
		Estimate	Standard Error		Estimate	Standard Error	
			S.E. ₁	S.E. ₂		S.E. ₁	S.E. ₂
Math Skills							
Knowledge of Numbers	G1 vs. G2	0.17	1.13	0.92	-0.46	1.22	0.77
	G1 vs. G3	1.22	1.29	1.28	1.64	1.27	0.38***
Math Performance	G1 vs. G2	0.02	0.16	0.18	0.18	0.17	0.13
	G1 vs. G3	-0.05	0.2	0.12	0.19	0.16	0.12
Executive Functions							
Forward Digit Span	G1 vs. G2	-0.10	0.38	0.34	-0.05	0.36	0.23
	G1 vs. G3	-0.36	0.39	0.28	-0.11	0.33	0.22
Backward Digit Span	G1 vs. G2	-0.21	0.26	0.27	-0.32	0.25	0.18*
	G1 vs. G3	-0.07	0.27	0.26	0.12	0.25	0.19
Knock-Tap Test	G1 vs. G2	-0.28	0.31	0.17	-0.31	0.19	0.12**
	G1 vs. G3	-0.22	0.28	0.15	-0.12	0.17	0.08
Other Predictors of Academic Achievement							
School Readiness	G1 vs. G2	0.00	0.22	0.22	-0.19	0.19	0.14
	G1 vs. G3	0.08	0.22	0.11	-0.11	0.18	0.15
Overall Performance	G1 vs. G2	-0.09	0.17	0.17	-0.05	0.16	0.13
	G1 vs. G3	-0.43	0.2**	0.12***	0.03	0.17	0.13

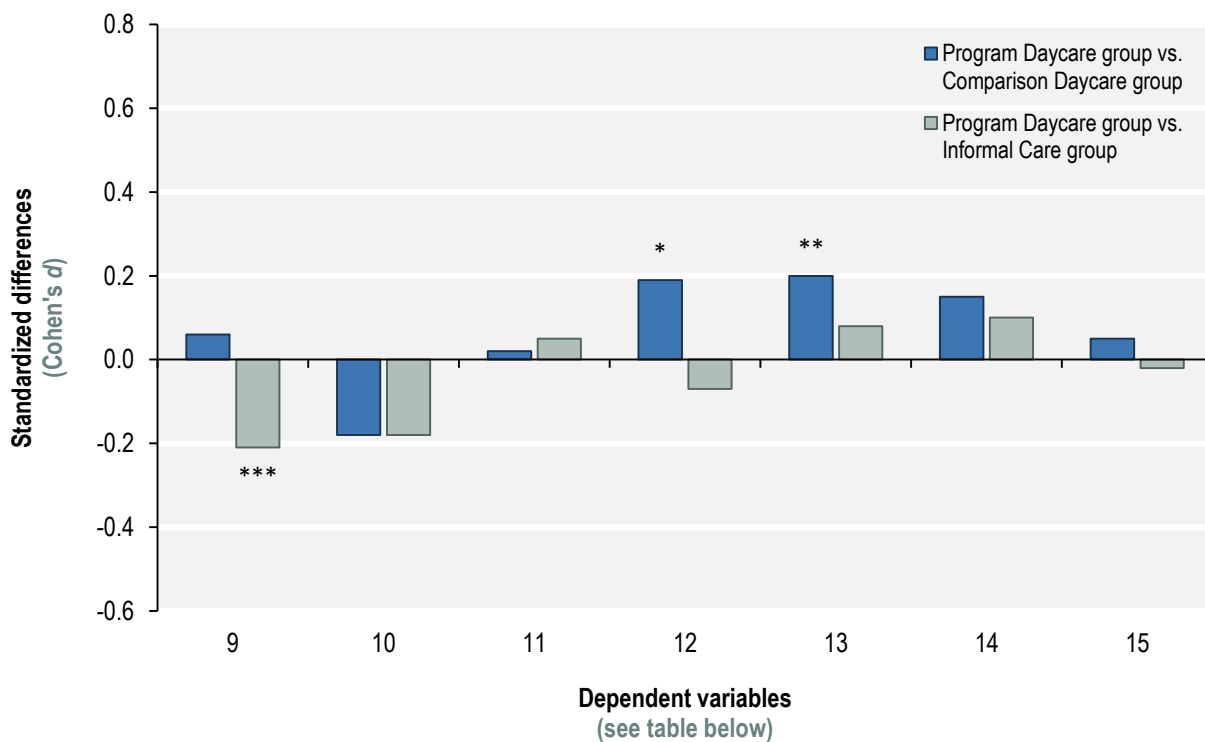
Note: G1 = Program Daycare group; G2 = Comparison Daycare group; G3 = Informal Care group; S.E.1 corresponds to disaggregate standard error at individual level; S.E.2 corresponds to aggregate standard error with clustering by daycare. Standard errors are estimated using the robust Huber-White heterogeneity estimator. Negative values in ANCOVA estimates for all comparisons between groups represent a positive effect of the program (i.e., an advantage for the Program Daycare group); *p<0.10, **p<0.05, ***p<0.01.

Figure 6.7 Program Impact on Math Skills, Executive Functions and Other Predictors of Academic Achievement for Children with Low Exposure



9	Knowledge of Numbers	13	Knock-Tap Test
10	Math Performance	14	School Readiness
11	Forward Digit Span	15	Overall Academic Performance
12	Backward Digit Span		

Figure 6.8 Program Impact on Math Skills, Executive Functions and Other Predictors of Academic Achievement for Children with High Exposure



9	Knowledge of Numbers	13	Knock-Tap Test
10	Math Performance	14	School Readiness
11	Forward Digit Span	15	Overall Academic Performance
12	Backward Digit Span		

6.6 Summary of the Impact on the Children

The purpose of this chapter is to examine the combined effect of both components of the tested program on the predictors of children's long term academic achievement. Overall, the results of **unadjusted analyses** by experimental group indicate that there is no significant difference between the Program Daycare group and the comparison groups for the predictors of French-language academic achievement. These predictors include language skills, reading skills, math skills, and executive functions. The pattern of responses from the direct assessment of the children indicates that the children in the Program Daycare group perform as well as their peers in the comparison groups in terms of language skills (PVVT-R, Verbal Fluency), reading skills (Reading Complex Words, Reading Sentences Aloud and Comprehension of Written Sentences), math skills (Knowledge of Numbers), and executive functions (Forward Digit Span, Backward Digit Span, Knock-Tap Test). These results are based on the aggregate model, considered to be the final test of significance.

Although no effects were significant, a review of effect size can be revealing in some situations, as it was for this study, where statistical power did not enable detection of small effects. The effect size for most indicators varied from null to small, providing further support of the claim that the children in the Program Daycare group perform as well as their peers in the comparison groups for the predictors of academic achievement that were assessed directly. Combined, these results suggest a boost in language skills at 24 months post-program for the children in the Program Daycare group. At baseline, the children in the Program Daycare group scored lower than those in the Comparison Daycare group for Communication, Self-awareness, Expressive Vocabulary and Receptive Vocabulary.

Measurements from the parents' survey depict a similar portrait. According to the parents' responses, children in the Program Daycare group are comparable to their counterparts in the comparison groups in terms of Reading Performance, Math Performance, the use of the French language to communicate, and school readiness. These results are supported by an effect size varying from null to small. Furthermore, it was noted that parents in the Program Daycare group reported a better overall performance for their children compared to the parents of the children in the Informal Care group, and a better performance in writing than the children in the Comparison Daycare group. The effect size for all indicators on the parents' survey varied from null to small. The final results from the parents' survey were the opposite of those obtained from the direct assessment of the children. Of the two sources of information (i.e., children's assessment and parents' survey), we place greater confidence in the impact analysis results based on the dimensions measured through direct assessment of the children. It is likely that the parents had a preconceived notion of the program's impact on their child's performance compared to parents in the comparison groups.

Overall, the pattern of results for the **adjusted analyses** indicates that the children in the Program Daycare group performed as well as their peers in the comparison groups for half of the predictors of French-language academic achievement, including: language skills (Verbal Fluency), reading skills (Reading Complex Words), and executive functions (Forward Digit Span, Backward Digit Span). The children in the Program Daycare group displayed a greater Receptive Vocabulary (PPVT-R) than the children in both comparison groups. With respect to reading skills and mathematics, the children in the Program Daycare group scored significantly lower than the children in the Informal Care group for three of the four direct measures. In terms of executive functions, the pattern of results indicates a

positive program effect in comparison with the Comparison Daycare group. Although only one out of three comparisons showed a significant effect in favour of the Program Daycare group, the results for two measures (Knock-Tap Test and Backward Digit Span) showed a medium program effect. According to the parents, the children in the Program Daycare group speak more French in different situations than the children in the Comparison Daycare group. Similarly, there is a non-significant trend in favour of the Program Daycare group for math performance, the degree of school readiness and academic performance, as reported by the parents.

Comparing the scores of the children in the Program Daycare group with Canadian standards enabled us to examine the program effect from another angle. According to comparative analysis results for the PPVT-R, younger children (age range 6 to 6 years 11 months) in the Program Daycare group performed significantly better than their Canadian counterparts in terms of Receptive Vocabulary (PPVT-R). Children in the Program Daycare group placed ahead of the children in the comparison groups when their performance was compared to the mean percentile rank obtained on the PPVT. Finally, the children in the Program Daycare group and the children in the comparison groups all performed as well as the children in the standardization sample in terms of executive functions (Forward Digit Span and Backward Digit Span). These results provide additional empirical evidence to support the theory that children in the Program Daycare group receive a boost in their language skills.

The results of a differential program impact according to household type (high/low exposure to French) confirms the study's internal validity. Compared to the Comparison Daycare group, the program had a positive and significant impact on children from households with a high exposure to French in terms of language skills (PPVT-R, Verbal Fluency), reading skills (Reading Complex Words, Comprehension of Written Sentences) and development of executive functions (Backward Digit Span, Knock-Tap Test). These children demonstrated math skills at the same level as the children in the Comparison Daycare group. For the sub-group of children with low exposure, the program appears to have had a positive and significant impact on the children's receptive language and use of French in different situations. Furthermore, this sub-group of children performed at the same level as their peers in the Comparison Daycare group for reading and math skills, and development of executive functions.

Compared to the Informal Care group, the program's impact on receptive language was positive and significant for children from households with high exposure to French. However, these same children did not perform as well on one of the three measures for reading skills (Comprehension of Written Sentences) and mathematics compared to children in the Informal Care group. It should be noted that no difference was observed between these two sub-groups of children in terms of development of executive functions. Children from households with low exposure did not perform as well as their peers in the Informal Care group for one of the three measures for reading skills (Reading Sentences Aloud). However, children from households with low exposure performed at the same level as their peers in the Informal Care group in terms of math skills and executive functions. It should be noted that the parents' perception was the complete opposite. According to the parents, the children in the Program Daycare group from households with a low exposure had a higher reading and writing performance, as well as overall performance, than their peers in the Informal Care group. Of the two sources, we have greater confidence in the results of the direct measures from the children's assessment.

In conclusion, the pattern of results by household type shows a long term program impact, primarily on children's language skills, regardless of their initial linguistic profile. Children from households with a high exposure to French benefited primarily in terms of development of reading skills and executive functions. These points will be further discussed in Chapter 8.

7.0 Impact of the Tested Program on the Parents

The contents of this chapter deal with the long term impact of the Family Literacy component on the parents' attitudes and behaviour, particularly with respect to the frequency of literacy activities and language habits. We will also present the results of analyses of parents' perception of the program's impact on their attitudes and behaviour. The data for these analyses has been drawn solely from the parents' survey completed by parents of family members in the Program Daycare group.

The chapter begins with the results of unadjusted analyses (Section 7.1) and adjusted analyses (Section 7.2) for comparisons between the experimental groups. Next, the perceived program impact on the parents will be presented in Section 7.3. Finally, a summary of the results will be presented in Section 7.4.

7.1 Impact on Parents – Unadjusted Analyses by Group

The series of analyses reported in this section includes the results of two estimates for the program impact — a “disaggregate” model with standard errors at the individual level, and an “aggregate” model with standard errors grouped by daycare. It should be pointed out that the aggregate model is considered to be more conservative than the disaggregate model, since it is not only more robust in terms of heterogeneity, it also considers clustering by daycare. These analyses do not include any covariates. *It is important to note that the Program Daycare Group has been set up as the reference, which means that **negative values in the ANOVA estimates and effect size (Cohen's d) for all comparisons between groups represent a positive effect of the program (i.e., an advantage for the Program Daycare group).***

The results of the unadjusted analyses indicate that there is no significant difference between the Program Daycare group and the Comparison Daycare group for all of the outcomes (see Table 7.1). Compared to the parents of the Informal Care group, the parents of the Program Daycare group use French far less often in their communications with the child and during literacy activities (disaggregate model only). It should be noted that the significance level of the effects observed for these outcomes is not confirmed when the calculation of standard errors takes the daycare effect into consideration (i.e., aggregate model) and the size of the effect is considered to be relatively small (d varies from 0.27 to 0.39). These results are identical to those produced at baseline, demonstrating that the children in the Informal Care group were exposed to a significantly more Francophone environment at home than the children in the Program Daycare group (see Appendix A, Table 3 of this report for the ANOVA results for the three language variables).⁴²

⁴² Several additional comparisons between the groups revealed that the parents of the Informal Care group reported a greater use of French for the three language variables at baseline compared to the parents of the Program Daycare group.

Table 7.1 Unadjusted Program Impact on Parents at 24 Months Post-program — Comparison Between Groups

Measure	Comparison	Program Daycare Group	Comparison Groups	Program Effect	Effect size	Standard Error	
		unadjusted Mean	unadjusted Mean	Difference	Cohen's <i>d</i>	S.E. ₁	S.E. ₂
Language Spoken by the Mother to the Child	G1 vs. G2	3.72	3.85	0.13	0.10	0.18	0.4
	G1 vs. G3	3.72	4.10	0.38	0.29	0.18**	0.5
Language Spoken by the Father to the Child	G1 vs. G2	3.34	3.50	0.16	0.10	0.24	0.53
	G1 vs. G3	3.34	3.77	0.44	0.27	0.24*	0.58
Languages of literacy activities	G1 vs. G2	4.38	4.36	-0.02	-0.02	0.12	0.19
	G1 vs. G3	4.38	4.67	0.29	0.39	0.11***	0.19
Frequency of literacy activities	G1 vs. G2	4.62	4.59	-0.03	-0.04	0.09	0.09
	G1 vs. G3	4.62	4.62	0.00	-0.01	0.08	0.09

Note: G1 = Program Daycare group; G2 = Comparison Daycare group; G3 = Informal Care group; S.E.₁ corresponds to disaggregate standard error at individual level; S.E.₂ corresponds to aggregate standard error with clustering by daycare. Standard errors are estimated using the robust Huber-White heterogeneity estimator. *Negative values in ANOVA estimates and Cohen's *d* for all comparisons between groups represent a positive effect of the program (i.e., an advantage for the Program Daycare group);* **p*<0.10, ***p*<0.05, ****p*<0.01.

7.2 Impact on Parents – Analyses by Group Adjusted with Covariates

The series of analyses reported in this section includes the results of two estimates for the program impact — a “disaggregate” model with standard errors at the individual level, and an “aggregate” model with standard errors grouped by daycare. It should be pointed out that the aggregate model is considered to be more conservative than the disaggregate model, since it is not only more robust in terms of heterogeneity, it also considers clustering by daycare. Both models include group membership and 18 covariates (see Appendix A for a complete list of covariates). *It is important to note that the Program Daycare Group has been set up as the reference, which means that **negative values in the ANCOVA estimates and effect size (Cohen's *d*) for all comparisons between groups represent a positive effect of the program (i.e., an advantage for the Program Daycare group).***

As illustrated in Table 7.2, there was only one significant difference, in relation to the Comparison Daycare group (aggregate model only). This difference was a greater use of French by the parents of the Program Daycare group during literacy activities compared to parents of the Comparison Daycare group. No significant difference was observed for comparisons with the Informal Care group. However, when compared to the two comparison groups, it was noted that the Program Daycare group tended to participate in literacy activities more frequently. The effect varied from small to medium (-0.30 to -0.33) depending on the comparison group (see Table 7.2).

Table 7.2 Adjusted Program Impact on Parents at 24 Months Post-program — Comparison Between Groups

Measure	Comparison	Program Daycare Group	Comparison Groups	Program Effect	Effect Size	Standard Error	
		adjusted Mean	adjusted Mean	Difference	Cohen's <i>d</i>	S.E. ₁	S.E. ₂
Language Spoken by the Mother to the Child	G1 vs. G2	3.98	3.86	-0.12	-0.10	0.09	0.12
	G1 vs. G3	3.98	3.88	-0.10	-0.08	0.1	0.13
Language Spoken by the Father to the Child	G1 vs. G2	3.55	3.58	0.03	0.02	0.12	0.12
	G1 vs. G3	3.55	3.50	-0.05	-0.04	0.15	0.12
Languages of literacy activities	G1 vs. G2	4.50	4.33	-0.17	-0.34	0.11	0.09*
	G1 vs. G3	4.50	4.60	0.10	0.20	0.09	0.08
Frequency of literacy activities	G1 vs. G2	4.67	4.59	-0.08	-0.30	0.09	0.09
	G1 vs. G3	4.67	4.59	-0.08	-0.33	0.08	0.07

Note: G1 = Program Daycare group; G2 = Comparison Daycare group; G3 = Informal Care group; S.E.₁ corresponds to disaggregate standard error at individual level; S.E.₂ corresponds to aggregate standard error with clustering by daycare. Standard errors are estimated using the robust Huber-White heterogeneity estimator. *Negative values in ANCOVA estimates and Cohen's d for all comparisons between groups represent a positive effect of the program (i.e., an advantage for the Program Daycare group);* **p*<0.10, ***p*<0.05, ****p*<0.01.

7.3 Program Impact on Parents' Attitudes and Behaviour – Parents' Perception

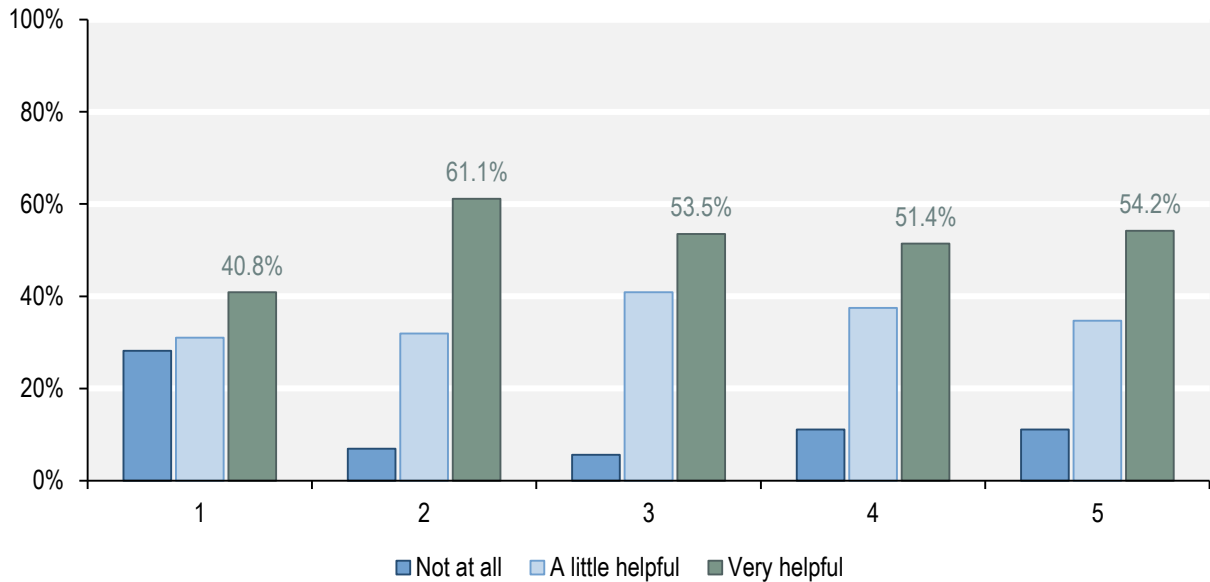
The following analyses were conducted with the 72 parents of the Program Daycare group. The purpose of these analyses was to assess the parents' perception of the program impact on their attitudes and behaviour associated with their child's school readiness, as well as the transmission of the French language and culture.

Parents' Perception of the Program Impact

In Figure 7.2, it can be observed that approximately half of the parents of the Program Daycare group stated that the dual-component program greatly encouraged them to engage in literacy activities more often with their child (61.1%), prepare their child for school (53.5%), develop a feeling of belonging to their child's school (51.4%) and strengthen their feeling of belonging to a Francophone community (54.2%). One of the outcomes stands apart from the others due to its response pattern. It was observed that 40.8% of the parents reported having been greatly encouraged by the program to communicate with their child more often in French, while 31.0% reported having been somewhat encouraged and 28.2% reported not having been encouraged at all. Further analyses revealed that more than half (60%) of the parents who answered "not at all" were from endogenous Francophone families. The

result is therefore not surprising, since the families were already communicating with their children in French practically all of the time at baseline.

Figure 7.1 Parents' Perception of Program Impact on Their Attitudes and Behaviour



- 1 Communicate with their child more often in French
- 2 Engage in literacy activities more often with their child
- 3 Prepare their child for school
- 4 Develop a feeling of belonging to their child's school
- 5 Strengthen their feeling of belonging to a Francophone community

7.4 Summary of the Impact on Parents

The pattern of the unadjusted impact analysis results gives the impression that the program has little long term impact on the parents' language variables. Two main findings arose from the analyses. The parents of the Program Daycare group use French for literacy activities significantly more often than the parents of the Comparison Daycare group, and the effect size varies from small to medium. We also noted a trend in favour of the parents of the Program Daycare group in the frequency of literacy activities compared to both comparison groups, and the size of this trend varied from small to medium. Although it was not significant, this trend was also seen in the perception of the Program Daycare group parents who felt that the program encouraged them to engage in literacy activities. Parents also reported that the program boosted their feeling of belonging to a school community and a Francophone community and encouraged them to speak in French more often with their child.

8.0 Discussion

This report presents the impact of a new dual-component preschool program on children and parents at 24 months post-program. The main objective at this point of the study was to verify whether the new program enabled Francophone children growing up in a language minority community to be better prepared to complete tasks that are essential to academic achievement, such as reading and mathematics. Closely linked to this objective, the study also sought to document the long term effects of the program on the parents' attitudes and behaviour. The program impact was examined using data from children's assessments and the parents' follow-up survey for both cohorts, 24 months after the program ended. The children were beginning grade two at the time. Baseline measurements were also included in the analyses as covariates so that the program impact could be isolated from other sources that might influence the parent and child outcomes.

Chapter 8 begins with a description of the dual-component program being tested and its contribution (Section 8.1). The chapter then continues with a discussion of the main findings drawn from the impact analyses of the children at 24 months post-program (Section 8.2) as well as the parents (Section 8.3). We will then track the developmental trajectory of child and parents outcomes over the four years of the Readiness to Learn project (Section 8.4). This trajectory will also be examined in relation to the linguistic profile of the participating families (Section 8.5). Next, we will discuss the implications of generalizing the results (Section 8.6) and the limitations of the study (Section 8.7). Finally, we will present the final conclusions for the project (Section 8.8).

8.1 Dual-Component Preschool Program and its Contribution

The project's main contribution is the recognition of the importance of a minority language setting on the development of linguistic and identity dimensions in young children. The importance of the language setting was shown in the study results indicating that the children's exposure to French in several areas of their life strengthened their sense of identity and feeling of belonging to a Francophone community (Landry & Allard, 2000). The reality is that in a minority language community, Francophone children are exposed to two different cultures at a time when their cultural identity and language skills are developing. Furthermore, sooner or later these children must learn the majority language (i.e. English), in addition to their mother tongue, to ensure their full integration into society. Mastering two languages, or additive bilingualism, yields many cognitive benefits, including better attention control, enhanced working memory and greater mental flexibility (i.e. enhanced executive functions; Adesope et al., 2010). However, children whose mother tongue is that of the minority are at greater risk of developing subtractive bilingualism, which is associated with lower academic achievement. This problem is particularly relevant when the mother tongue is the language of instruction, as is the case for many Francophones living in a minority community.

The condition required to develop additive bilingualism is not met for many Francophone children living in minority environments, a population that experiences certain delays in literacy in comparison with their peers (Bussière et al., 2001; Chartier et al., under press; Canadian Council on Learning, 2008; Knighton, Brochu and Gluszynski, 2010). The underlying causes for this performance gap are easily understood. Literature on bilingualism points to a clear cut mechanism: exposure to a language. For

bilingualism to be additive, a minimal threshold of exposure to, or use of, the mother tongue must be exceeded (for a review, see Pearson 2007). For various reasons (e.g., motivation, greater exposure to the majority language in many settings, Landry et al., 2009), the minimal threshold required is higher when the mother tongue is a minority language (Pearson et al., 1997; Vihman et al., 2006). Thus, Francophone children who grow up in a bilingual environment need ongoing support to improve their likelihood of achieving additive bilingualism.

The preschool program was meant to be a concrete response to this reality. The preschool program tested a Daycare component specifically designed to meet the needs of Francophone children living in a minority environment combined with a Family Literacy component targeted at the parents of these children. This program is pioneering through the influence it has on the two main environments likely to have an impact on learning by young children, its emphasis on exposure to French in these environments, and its ability to provide high quality content compliant with best practices in the areas of early childhood and family literacy. The many benefits of programs that modify both the child's daycare environment and home environment have been proven in studies on other so-called vulnerable populations (Reese et al., 2010; Engle et al., 2007). It is believed that the program effects can be maximized if the child's parents and educators use similar approaches. Given these findings, a decision was made early in the project to align the Daycare program and the Family Literacy program in terms of values, fundamental principles and approaches. The Daycare program stressed francization, as well as pre-reading and pre-writing skills in preschoolers. The Family Literacy program complemented the Daycare program through exchanges designed to make the parents aware of their role as their child's primary educators and the particularities of living in a minority language setting. The main themes addressed were ways in which they could support their child's development, stimulate learning and pass on the French language and culture. The program content was also meant to make parents aware of the early educator's role and to foster teamwork among the adults involved in the child's life (educator, teacher, parents and others).

The preschool program was studied from the time it was implemented. This type of study can prove to be an important tool in better understanding and interpreting the program effects. A growing number of studies are showing that the degree to which an intervention is implemented is directly related to the observed program effects on the participants (Charlebois et al., 2004; Conduct Problem Prevention Research Group, 1999; Dane & Schneider, 1998; Durlak & DuPre, 2008). Based on data from five meta-analyses, Durlak & DuPre (2008) concluded that the effect size of an intervention is two to three times greater when the program is implemented as planned. With respect to the Readiness to Learn project, a review of the preschool program implementation showed high program fidelity and quality. This pointed to a relatively stable implementation of the Daycare program over the two years of the project. The integrity of the program's implementation proved to be high, both in terms of structural elements and the quality of the educational content, for both cohorts. Finally, the Daycare program being tested stood apart from comparison daycares through its program fidelity and quality, showing that there was a noticeable difference compared to what previously existed in the community. When the integrity of the Family Literacy program was evaluated, it was found to be consistent with the planned program and the quality of leadership was considered to be good. Finally, the parents' mean participation rate was acceptable at 64% (extending from 38% to 81%), although it varied considerably depending on the

families. Basically, there is every reason to believe that the preschool program being tested had the desired effect on both the child and parent outcomes.⁴³

8.2 Impact of the Tested Program on the Children at 24 Months Post-Program

This dual-component program was evaluated using a quasi-experimental approach with non-equivalent control groups. The methodology involved three experimental groups: a program group consisting of children enrolled in a Francophone daycare centre offering the new preschool program; a comparison group consisting of children enrolled at a Francophone daycare centre that did not offer the new preschool program; and a comparison group of children who were cared for at home or in an informal family daycare setting. The objective of the formal daycare control group was to determine the influence of a formal daycare centre on a child's development, which is a treatment in itself. The objective of the comparison group not enrolled in a formal daycare centre was to determine the influence of an informal daycare on the child's development.

Analyses performed within the scope of the Readiness to Learn project cannot clearly distinguish the effect of one component from that of the other. A more complex experimental design would have been necessary to allow for that distinction. As such, the main analyses comparing the experimental groups test the *combined effect* of the program's two components on children's development. The child outcomes that were examined are from the direct assessment of the children and the parents' survey. They include indicators of language skills, reading and writing skills, math skills, development of executive functions, and other major predictors of academic achievement.

8.2.1 Were hypotheses tested?

Our findings provide empiric substantiation of our hypotheses when the Program Daycare group is compared to the Comparison Daycare group. ***The results of the adjusted main analyses suggest that the program impacted primarily on the size of the children's receptive vocabulary, and to a lesser degree, on the development of their executive functions.*** Further, the performance of the children in the Program Daycare group was comparable to that of their counterparts in the comparison groups for close to half of the measures, including: language skills (Verbal Fluency), reading skills (Reading Complex Words), and executive functions (Forward Digit Span, Backward Digit Span). Children in the Program Daycare group use French in their conversations with others as often as children in the Informal Care group and significantly more often than children in the Comparison Daycare group. Children in the Program Daycare group showed signs of having a greater Receptive Vocabulary (PPVT-R) than children in both comparison groups. With respect to more complex reading skills (i.e., Reading Sentences Aloud, Comprehension of Written Sentences) and mathematics, children in the Program Daycare group have been just as successful as their peers in the Comparison Daycare group, but significantly less successful than children in the Informal Care group. It should be noted that where executive functions are concerned, the pattern of results indicates a positive program effect in comparisons with the Comparison Daycare group. Although only one of the three comparisons showed a significant effect in favour of the Program Daycare group, results for two of the measures (Knock-Tap Test and Backward Digit Span) revealed a medium program effect. Similarly, there is a non-significant

⁴³ For more information, refer to the *Report of Findings from the Preschool Phase* (2014).

trend in favour of the Program Daycare group for math performance, the degree of school readiness and academic performance, as reported by the parents.

The significance level results are supported by the observed effect size, which equals a boost of a few months in the development of executive functions, as well as language and reading skills, with greater effects observed in comparisons with the Comparison Daycare group. It was difficult to interpret comparisons with the Informal Care group due to the wide diversity of childcare settings in this group and the impossibility of measuring the quality of this environment, particularly for linguistic indicators.

Comparing the scores of the children in the Program Daycare group with **Canadian standards** enabled us to examine the program effect from another angle. According to comparative analysis results for the PPVT-R, younger children (age range 6 to 6 years 11 months) in the Program Daycare group performed significantly better than their Canadian counterparts in terms of Receptive Vocabulary (PPVT-R). Children in the Program Daycare group placed ahead of the children in the comparison groups when their performance was compared to the mean percentile rank obtained on the PPVT. Finally, the children in the Program Daycare group and the children in the comparison groups all performed as well as the children in the standardization sample in terms of executive functions (Forward Digit Span and Backward Digit Span).

The finding that there is a differential program impact according to household type (high/low exposure to French) provides additional empirical evidence to support the study's internal validity. For children from *households with high exposure*, the program had a positive and significant effect on their language skills (both direct measures), reading skills (two of the three direct measures) and executive functions (two of the three direct measures) compared to the children in the Comparison Daycare group. These same children in the Program Daycare group performed as well as the children in the Comparison Daycare group for the math skills measure, but did not perform as well the children in the Informal Care group for the same measure.

For children from *households with low exposure*, the program had a positive and significant effect on their language skills (one of the two direct measures) compared to the children in the Comparison Daycare group. These same children in the Program Daycare group performed as well as the children in the Comparison Daycare group for more complex tasks essential to academic achievement including reading skills (all three direct measures) and mathematics (the single direct measure), and in terms of executive functions (all three direct measures). These children also performed as well as their peers in the Informal Care group for language skills (both direct measures), reading skills (two of the three direct measures), math skills (the single direct measure) and executive functions (all three direct measures).

To sum up, the pattern of results has proven to be interesting. The two sub-groups of children in the Program Daycare group (i.e., high and low exposure) both had a greater Receptive Vocabulary (PPVT-R) than their peers in the two comparison groups. This significant effect was more pronounced for the sub-group of children from households with a high exposure since it also showed up in terms of their Verbal Fluency (which can be considered as a measure of Expressive Vocabulary), particularly in comparison with their peers in the Comparison Daycare group. Further, the advantage observed for the children in the Program Daycare group with high exposure, and the comparable performance of the children in the Program Daycare group with low exposure for more complex skills, are generally

consistent with models that recognize how important language mastery is to academic achievement (Chartier et al., under press; Cummins, 1979; Doherty, 1997; Hindman et al., 2010).

8.3 Impact of the Tested Program on Parents at 24 Months Post-Program

The results of **adjusted analyses** show that the program effect is experienced primarily in terms of the language used during literacy activities with the child, and only in relation to the Comparison Daycare group. A benefit was observed by the parents of the Program Daycare group for this linguistic variable. A trend in favour of the Program Daycare group was also noted with respect to the frequency of literacy activities, regardless of the comparison group, although the difference was not significant.

To gain a clearer idea of the parents' perception of the program impact on their attitudes and behaviour, we asked them a few questions on the final survey.⁴⁴ The results of these analyses indicate that more than 60% of the parents stated that the program had greatly encouraged them to engage in more literacy activities with their child. Many of these parents also reported that the program had helped them to develop a feeling of belonging to their child's school and to the Francophone community, and had encouraged them to communicate with their child more often in French.

8.4 Children's Developmental Trajectory from 0 to 48 Months

The results of the main analyses conducted at 24 months post-program can be placed in context using the children's developmental trajectory over a period of four years. Recall that the Readiness to Learn project had two phases. The first phase covered the delivery of the program during the first two years of the project (from 0 to 24 months). At the time, we examined the program effect on the children's readiness for a French-language school. The outcomes of interest related to language skills, including the ability to communicate in French (ÉPE-AD – communication scale), Expressive Vocabulary (ÉPE-AD – Expressive Vocabulary scale and EOWPVT measured at 20 months only) and Receptive Vocabulary (ÉPE-AD – Receptive Vocabulary scale and PPVT-R measured at 24 months only), as well as cognitive skills (ÉPE-AD – cognitive skills scale, which measured precursors of literacy and numeracy).

The second phase of the study focused on the two years following completion of program delivery (36 to 48 months). We studied the program effect on key predictors of academic achievement at a French-language school. The outcomes of interest related to language skills, reading skills and numeracy, along with the development of executive functions. Measuring similar constructs adapted to the children's age over the four years of the study enabled us to follow the children's developmental trajectory. Since the program impact varied depending on the comparison group, we have presented the results separately for each of the two comparison groups. The measurement schedule is found in Figure 3.1. It should be noted that the program effects for the first phase of the study were calculated using the DD estimator while the effects for the second phase were calculated using ANCOVA estimates.

⁴⁴ These questions were asked at the end of the survey to avoid their potential influence on questions relating to the frequency and language of literacy activities.

8.4.1 Short, Medium and Long Term Program Effects on the Children

Comparison with the Comparison Daycare group

At baseline, the children in the Program Daycare group obtained significantly lower scores on language skills measures (Communication, Receptive Vocabulary and Expressive Vocabulary)⁴⁵ compared to the children in the Comparison Daycare group. These differences disappeared during the first phase of the study (from 0 to 24 months). The program effect on the ability to communicate in French (ÉPE-AD – communication scale) and on Expressive Vocabulary appeared early and remained stable during the first two years of the project. Furthermore, although the differences in the scores for the additional EOWPVT measure at 20 months were not significant between the experimental groups, the effect size in favour of the Program Daycare group still suggests a major boost in Expressive Vocabulary for these children. Finally, the positive and significant program effect on Receptive Vocabulary was clearly shown in the PPVT-R measure at 24 months. As illustrated in Table 8.1, the results reveal that the program impact on Receptive Vocabulary lasted until the end of the project, at 48 months. In addition, the ongoing program effect was seen in language skills and the children's use of French in the second phase of the study (at 36 months and 48 months). However, it was noted that the program impact on Expressive Vocabulary (measured through Verbal Fluency) appeared to weaken over time (at 48 months). Basically, the pattern of results shows that in relation to the Comparison Daycare group, the program's positive and significant effect appeared early for children's language skills and remained relatively stable over time.

⁴⁵ Analyses of multiple comparisons were conducted for the 336 participants included in this report.

Table 8.1 Comparisons between the Program Daycare Group and the Comparison Daycare group (G2) for Language Skills – Adjusted Results for the Four Years of the Project

Measurement Period	0 - 12 months	16 - 24 months	36 months	48 months
Measures				
Language Skills				
ÉPE-AD – Communication	▲	▲		
Expressive Vocabulary	▲	▲		
EOWPVT		<i>ns</i>		
PPVT-R		▲		▲
Word Reasoning			▲	
Verbal Fluency			▲	<i>ns</i>
Ability to Communicate in French (as perceived by the parent)			▲	
Continuum of French (as perceived by the parent)		▲	▲	▲

Note: m = months; no significant results were observed in favour of the Comparison Daycare group.

Legend:

Shaded boxes signify variables that were not measured

▲ = Significant result in favour of the Program Daycare group

ns = No significant difference

With respect to more complex skills, certain trends can be seen in Table 8.2 suggesting that the children in the Program Daycare group benefited from the program in different ways. The main analyses done on comparisons between groups suggest that the program had little effect on reading skills, but that it had an effect on some of the dimensions associated with math skills (i.e. the ÉPE-AD cognition scale at 12 months and Knowledge of Numbers at the 36-month assessment). However, the program's impact on these skills appears to have diminished over time (at 48 months). Finally, the results suggest that the program promoted the development of executive functions. This effect was observed for the Backward Digit Span at 36 months and the Knock-Tap Test in the 48-month assessment. In conclusion, the program's positive and significant effects on language skills and development of executive functions would lead us to believe that the children in the Program Daycare group are less likely to develop subtractive bilingualism than the children in the Comparison Daycare group. These findings are consistent with the results of prior studies demonstrating that mastery of a language fosters development of additive bilingualism and, by extension, facilitates the development of executive functions (Adesope et al., 2010).

Table 8.2 Comparisons Between the Program Daycare Group and the Comparison Daycare group (G2) for Complex Skills Linked to Academic Achievement – Adjusted Results for the Four Years of the Project

Measurement Period	0 to 12 months	16 to 24 months	36 months	48 months
Direct Measures				
Reading Skills				
Knowledge of Letters			<i>ns</i>	
Knowledge of Sounds			▲	
Reading Simple Words			<i>ns</i>	
Reading Complex Words				<i>ns</i>
Reading Sentences Aloud				<i>ns</i>
Comprehension of Written Sentences				<i>ns</i>
Math Skills				
ÉPE-AD - Cognition	▲ (12 m)	<i>ns</i>		
Knowledge of Numbers			▲	<i>ns</i>
Executive Functions				
Forward Digit Span			<i>ns</i>	<i>ns</i>
Backward Digit Span			▲	<i>ns</i>
Knock-Tap Test				▲

Note: m = months; no significant results were observed in favour of the Comparison Daycare group.

Legend:

Shaded boxes signify variables that were not measured

▲ = Significant result in favour of the Program Daycare group

ns = No significant difference

Comparison with the Informal Care Group

At baseline, a greater proportion of the children in the Informal Care group were from Francophone endogamous homes and scored higher on the Continuum of French variable (i.e. the language of preference for communications with the mother, father, siblings and friends).⁴⁶ Similar to the Comparison Daycare group, the program's effect on the ability to communicate in French (ÉPE-AD – communication scale) appears early on in the first phase (at 8 to 12 months), but then appears to diminish during the second year of the project (see Table 8.3). Furthermore, a positive and significant program effect on Expressive Vocabulary was gradually observed at the final two assessments of the first phase (at 20 months and 24 months). For the EOWPVT, measured at 20 months, no significant effect was observed, although the medium size suggests that a significant impact would have been observed with greater statistical power. The program's positive and significant impact on Receptive Vocabulary was observed at 24 and 48 months, both times that the PPVT-R was measured. Finally, greater use of French by the children in the Program Daycare group appeared at 24 and 36 months. At 48 months, the children in the Program Daycare group were using French in their conversations with others just as often as the children in the Informal Care group. In conclusion, the results show that in relation to the Informal Care group, the program had a significant effect on the Receptive Vocabulary of the children over time, and the effect was less pronounced for other dimensions of language skills.

⁴⁶ Recall that analyses of multiple comparisons for the 336 participants included in this report showed significant differences at baseline, in favour of the Informal Care group, for the following variables: Language Spoken by the Mother to the Child, Language Spoken by the Father to the Child, Language Used for Literacy Activities and Continuum of French Spoken by the Child.

Table 8.3 Comparisons Between the Program Daycare Group and the Informal Care group (G3) for Language Skills – Adjusted Results for the Four Years of the Project

Measurement Period	0 to 12 months	16 to 24 months	36 months	48 months
Measures				
Language Skills				
ÉPE-AD - Communication	▲ (8m/12m)	ns		
Expressive Vocabulary	ns	▲ (20m/24m)		
EOWPVT		ns		
PPVT-R		▲		▲
Word Reasoning			ns	
Verbal Fluency			▲	ns
Ability to Communicate in French (as perceived by the parent)			▲	
Continuum of French (as perceived by the parent)		▲	▲	ns

Note: m = months

Legend:

Shaded boxes signify variables that were not measured.

▲ = Significant result in favour of the Program Daycare group

ns = No significant difference

Furthermore, the program effect on more complex skills varied the most in analyses results comparing the Program Daycare group to the Informal Care group (see Table 8.4). In general, the children in the Informal Care group did not perform as well as the children in the Program Daycare group for the reading measure at 36 and 48 months. This disparity between the groups appeared to grow over time, possibly due to the greater complexity of reading tasks in grade two. In terms of math skills, significant effects in favour of the Program Daycare group were not seen until the end of the first year of program delivery (12 months), using the ÉPE-AD – Cognition measure. At 24 and 36 months, no program effect was observed for math skills. At 48 months, the results indicate that the children in the Informal Care group were performing significantly better than those in the Program Daycare group. As was evidenced for reading skills, it appears that the disparity in math skills between the children in the two groups is continuing to grow. Finally, the children in the Program Daycare group are comparable to the children in the Informal Care group in terms of executive functions.

Table 8.4 Comparisons Between the Program Daycare Group and the Informal Care Group (G3) for Complex Skills Linked to Academic Achievement – Adjusted Results for the Four Years of the Project

Measurement Period	0 to 12 months	16 to 24 months	36 months	48 months
Direct Measures				
Reading Skills				
Knowledge of Letters			<i>ns</i>	
Knowledge of Sounds			<i>ns</i>	
Reading Simple Words			●G3	
Reading Complex Words				<i>ns</i>
Reading Sentences Aloud				●G3
Comprehension of Written Sentences				●G3
Math Skills				
ÉPE-AD - Cognition	▲ (12 m)	<i>ns</i>		
Knowledge of Numbers			<i>ns</i>	●G3
Executive Functions				
Forward Digit Span			<i>ns</i>	<i>ns</i>
Backward Digit Span			<i>ns</i>	<i>ns</i>
Knock-Tap Test				<i>ns</i>

Note: m = months

Legend:

Shaded boxes signify variables that were not measured.

▲ = Significant result in favour of the Program Daycare group

●G3 = Significant result in favour of the Informal Care group

ns = No significant difference

In essence, in relation to the Informal Care group, the results over the four years of the study have shown that the dual-component program had more of an impact on some learning skills more than others. In general, a more pronounced and stable effect was observed for the children's language skills over the years. Effects were also noted for math skills at 12 months, regardless of the comparison group, and at 36 months in relation to the Comparison Daycare group. Finally, the program appears to have boosted the development of executive functions in the children at 36 and 48 months, but this effect was only observed when the Program Daycare group was compared to the Comparison Daycare group.

8.4.2 Short, Medium and Long Term Effects of the Family Literacy Program on the Parents

The study of the program's effect on parents over time focused primarily on changes in their behaviour with respect to the frequency of literacy activities, the language used for these activities and the language used when they spoke to their child. The summary results presented in Table 8.5 are based on **adjusted analyses with covariates** in order to statistically control for the initial differences between the experimental groups.

The results of the program's impact on the parents partially supports the hypothesis that the Family Literacy program would have a positive influence on their behaviour. The effect on the frequency of literacy activities emerged early on in the first year, at 8 and 12 months, with the frequency becoming comparable to that of the Comparison Daycare group during the second year. This trend continued into the second phase of the study (i.e., at 36 and 48 months). In comparison to the Informal Care group, the program's effect on the frequency of literacy activities appeared early on and continued until 36 months, when the children began grade one, then it diminished by 48 months.

Furthermore, during the first phase of the study, a program effect was observed for the language of literacy activities, in relation to the Comparison Daycare group, emerging at 4 months, then reappearing at 20 months. The effect re-emerged at 36 months and continued through to 48 months. A program impact on the language of literacy activities was observed, compared to the Informal Care group, for all measures during the first two years, except for the assessments at 12 and 24 months. Results for the second phase of the study indicate that the effect continued to 36 months then dropped off at 48 months. The program therefore appears to have had a positive influence on the language used by the parent during literacy activities with the child, over the entire duration of the project. These results are promising because according to a recent study in a linguistic minority setting (Chartier et al., under press), when French is used during literacy activities with the child, there is a marked impact on the child's French reading performance in grade three, and a somewhat less pronounced effect on math problem solving.

Finally, analyses conducted during the second phase of the study revealed a program effect on the language spoken by the mother at 36 months, in relation to the Comparison Daycare group, but this effect had disappeared by 48 months. The significant result at 36 months may be explained by the fact that this assessment period coincided with the children beginning grade one at a French school, when they were learning to read and their parents were having to get more involved in their learning process, particularly with respect to reading. No other significant impact on the language spoken by the mother or father emerged during the second phase. This result suggests a stability over time in the language behaviour of the fathers toward their child that is comparable between the experimental groups. This stability over time is worth further exploration since this factor has a direct impact on the child's mastery of the French language and his or her subsequent ability to learn in this language (see the theoretical model specifying the mechanisms through which the program is assumed to have an influence on child development, in Figure 2.1, Section 2.4).

Table 8.5 Program Impact on the Parents: Program Daycare Group versus Comparison Groups – Adjusted Results for the Four Years of the Project

Measurement Period	0 to 12 months	16 to 24 months	36 months	48 months
Measures				
Frequency of Literacy Activities				
G1 vs. G2	▲ (8m/12m)	<i>ns</i>	<i>ns</i>	<i>ns</i>
G1 vs. G3	▲	▲ (20m/24m)	▲	<i>ns</i>
Language Used During Literacy Activities				
G1 vs. G2	▲ (4m)	▲ (20m)	▲	▲
G1 vs. G3	▲ (4m/8m)	▲ (16m/20m)	▲	<i>ns</i>
Language Spoken by the Mother to the Child				
G1 vs. G2		<i>ns</i>	▲	<i>ns</i>
G1 vs. G3		<i>ns</i>	<i>ns</i>	<i>ns</i>
Language Spoken by the Father to the Child				
G1 vs. G2		<i>ns</i>	<i>ns</i>	<i>ns</i>
G1 vs. G3		<i>ns</i>	<i>ns</i>	<i>ns</i>

Note: m = months

Legend:

▲ = Significant result in favour of the Program Daycare group

● G3 = Significant result in favour of the Informal Care group

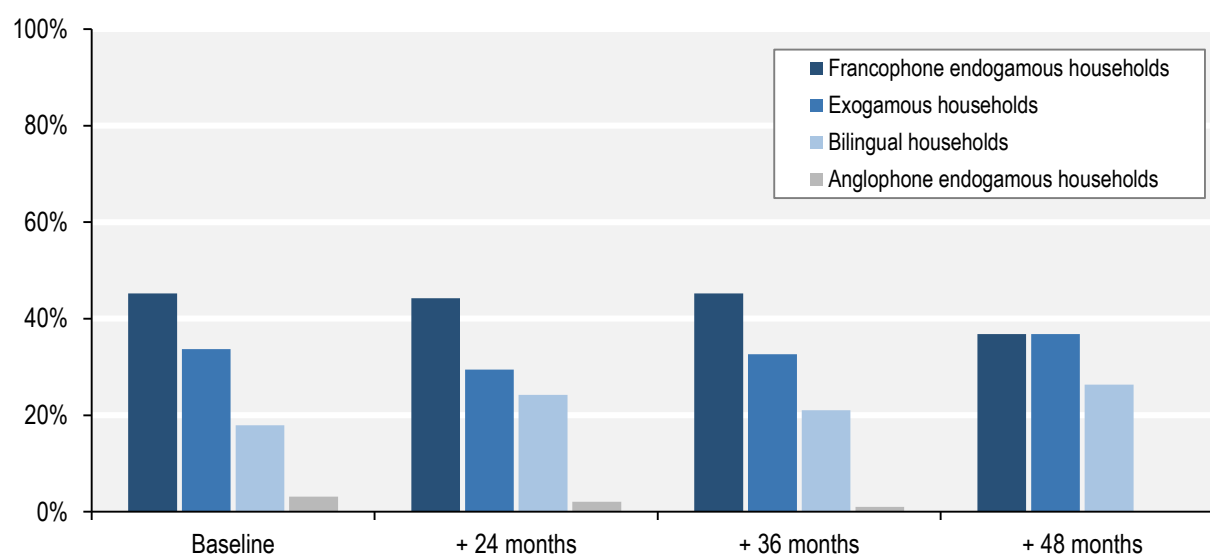
ns = No significant difference

Figure 8.1 presents the evolution of the household linguistic environment for the 95 members of the Program Daycare group included in the second phase analyses. Recall that the household linguistic environment is calculated by crossing the languages spoken by the mother and father to the child. According to the figure, the most noticeable change appears to have occurred between the 36 and 48 month assessment periods. More specifically, a drop was observed in Francophone endogamous households (from 45.3% to 36.8%), while at the same time, a slight rise was observed in exogamous households (from 32.6% to 36.8%) and bilingual households (from 21.1% to 26.3%)⁴⁷. Although one of the objectives of the Family Literacy program was to make parents aware of the importance of offsetting the powerful effects of an Anglo-dominant setting by modifying the child's linguistic setting, both in terms of literacy activities and the use of French at home, the results suggest that the program

⁴⁷ Bilingual households are households where the two parents communicate with the child in both French and English equally.

effect diminished over time. One particular change of interest that should be noted is the disappearance of Anglophone endogamous households by the end of the project. This change is associated with a change in the language usually spoken by the mother to the child in Anglophone endogamous households. Further analyses revealed that mothers alternated more often between French and English over time, rather than speaking English only. This result is encouraging since it suggests that an intervention with parents in a minority setting can affect the language used at home by Anglophone endogamous families.

Figure 8.1 Evolution of the Household Linguistic Environment for the Total Sample (N = 336) Over the Four Years of the Project



Note: Bilingual households are households where the two parents communicate with the child in both French and English equally.

These findings are reflected in the parents' responses to the questions on the 48 month survey regarding the program impact. In hindsight, many parents stated that the program had encouraged them to communicate in French more often and to engage in literacy activities more often with their child. Analyses therefore show that this component of the tested program achieved one of its goals, i.e. to inspire a change in the parents' knowledge, attitudes and behaviour.

8.4.3 Short, Medium and Long Term Indirect Effects of the Family Literacy Program on the Children

Mediation analyses were performed to determine the degree to which the program impact on the children can be attributed to an effect of the Family Literacy program on the parents. In other words, these analyses examine whether the impact of the Family Literacy program on the parents ultimately had a positive impact on the children's development.

During the first phase, the change in the parents' attitudes (i.e., feeling of effectiveness and awareness of the children's general development) appears to have been partially responsible for the children's cognitive development, but no other parental change linked to the Family Literacy program (e.g.,

Frequency of Literacy Activities, Language of Literacy Activities) appears to have affected the children's development. At the beginning of the second phase of the study (i.e., at 36 months), a positive program effect on the parents was observed in terms of the use of French at home (i.e., Language Spoken by the Mother to the Child and Language of Literacy Activities). Mediation analyses suggest that these changes in the parents are partially responsible for the children's language development. Furthermore, the program effect on the parents appears to have diminished at 48 months. The Language of Literacy Activities is the only significant parent outcome that emerges in favour of the Program Daycare group, and only in relation to the Comparison Daycare group.

Overall, the results of the mediation analyses suggest that during the first phase, the knowledge acquired by the parents in the family workshops was partially responsible for the children's cognitive development, and at the beginning of the second phase, the parents of the Program Daycare group were exposing their children to French more often at home, which appears to partially explain the children's language development. Compared to the effect of the Daycare program on the children's development, the indirect effect of the Family Literacy program on the children appears to be rather limited. In the first phase, the results of additional analyses appear to support the conclusion that the main driving force behind the reported effects was the Daycare program. Recall that analyses examining the mediating effects of the fidelity and quality of the Daycare program, presented in the *Report of Findings from the Preschool Phase*, revealed the positive and significant effects on all child outcomes (Legault et al., 2014). However, the complementary role of the Family Literacy program over the short, medium and long term cannot be dismissed. The family workshops most likely made a positive contribution, but if there was a link, it was not clearly and systematically demonstrated through the observed variables, as indicated by the above results.

A review of the program effect on the parents' language behaviour in relation to the evolution of contextual conditions enabled us to arrive at a possible explanation for the pattern of results over time. We found that during program delivery, the parents appeared to be more aware of the importance of using French for literacy activities. It is possible that, during the second year of the project, the child's participation in the Daycare program kept the parent engaged in school readiness activities. Added to that was the 36-month assessment period, when the children were beginning grade one and had French homework to complete for the first time. This period is generally characterized by greater parent involvement in the child's learning process at home. The mitigation of the results at 48 months may be explained by the fact that this final assessment period corresponded to the beginning of grade two, when the children were starting to complete their homework assignments more autonomously.

Some studies have shown that the impact of more targeted family literacy programs is generally positive yet small, $d = 0.18$ (see meta-analysis by Van Steensel, McElvany, Kurvers and Herppich, 2011). According to a meta-analysis conducted by Sénéchal & Young (2008), family literacy programs have a greater impact when the parents are provided with concrete strategies that they can use with their children, rather than simply general advice (for other examples, see Reese et al., 2010). In this project, it appears that the content of the Family Literacy program was too general to have a significant impact on the children's development.

In sum, we found that the program had some beneficial effects on the parents in the short term. However, the medium and long term results give rise to the following question: how can the program

effect on the parents be amplified and sustained? To sustain, and perhaps even increase, the effect of the Family Literacy program, workshops or other initiatives should ideally be offered to the parents during their children's first few years at school, with appropriate adjustments being made in the program content.

8.5 Summary Portrait of Results by Linguistic Profile since the Beginning of the Project

The hypothesis that the program effect would differ according to the children's linguistic profile (i.e. low/high exposure to French at baseline) was confirmed throughout the project. The results for the first phase of the project show that children from households characterized by a low exposure to French saw greater and more significant benefits in the development of their language skills. On the other hand, children from households characterized a high exposure to French primarily benefited from the program in terms of cognitive development.

During the second phase of the project, we observed a positive and significant program effect at 36 months for some of the linguistic variables in children from households with low exposure (e.g., Continuum of French Spoken by the Child and Ability to Communicate in French). It should be noted that these two measures were taken from the parents' survey. Furthermore, the positive and significant effects of the program on language skills and more complex skills, as measured directly in the children, were all more pronounced in the children from households with high exposure (i.e., Word Reasoning, Verbal Fluency, Backward Digit Span, Letter Sounds, Reading Simple Words and Knowledge of Numbers). Most of these effects only appear when the Program Daycare group is compared to the Comparison Daycare group.

At 48 months, we basically observed the same results; in other words, the program appeared to primarily benefit children from households with high exposure in terms of language and reading skills, and to a lesser degree, executive functions (e.g., PPVT-R, Verbal Fluency, Reading Complex Words, Comprehension of Written Sentences, Backward Digit Span and Knock-Tap Test). Once again, the effects mostly appeared for comparisons with the Comparison Daycare group. The program effect was positive and significant for Receptive Vocabulary in children from households with low exposure, compared to their peers in the Comparison Daycare group. The children's use of French and three other measures associated with the academic achievement (i.e., Reading, Writing and Overall Performance) of the children (as perceived by the parents) are the only other variables that emerged in favour of the Program Daycare group for children from households with low exposure.

In sum, over the short term, the program appeared to have an effect on the language skills of children from households with low exposure, and conversely, on the cognitive skills of children from households with high exposure. Over the medium and long term, children from households with high exposure appear to have benefited more from the program in terms of language and reading skills and numeracy. The program effect on children considered to be "vulnerable", given the minority setting, was limited to certain language skills, including a greater use of the French language in interactions with others and the size of their Receptive Vocabulary. We did not find any significant program effect for more complex tasks. Children from households with low exposure perform as well as their counterparts in the Comparison Daycare group for more complex tasks essential to academic achievement, such as reading

skills (all three direct measures) and math skills (the single direct measure), and for executive functions (all three direct measures).

These results were also found in part in the Maltais study (2007). The author reported a significant boost in Receptive Vocabulary at the end of kindergarten and grade two in children from families that did not use French often and who were enrolled in a full-time junior kindergarten program. In addition, the author observed a significant boost in reading skills in both groups (low/high use of French) at the end of kindergarten, which persisted in grade two. Finally, Maltais observed that the full-time junior kindergarten program did not cause the children from low use households to perform at the same level as the children from high use households for more complex cognitive tasks (e.g. reading comprehension) in grade two. In both studies (Readiness to Learn project and the Maltais study), all of the children received positive and significant benefits from the program, in both kindergarten and grade two. However, the children from households with high exposure perform significantly better at more complex tasks in grade two.

8.6 Implications for the Generalization of Findings

The results of comparative analyses show that the study sample differs from the SVOLM sample mainly with respect to linguistic characteristics. However, we believe that the gap between the linguistic profile of this sample and that of the general population of minority Francophones is not an obstacle to the generalization of findings. If the population is comparatively more exposed to French at home, then the *short term* impact will be observed primarily in terms of cognitive development, and in the *medium and long term*, on all skills needed for academic achievement (e.g. language, reading and math skills). If, on the other hand, the population is comparatively less exposed to French at home, a greater impact on language skills is expected. Finally, if there is doubt regarding the validity of the analyses indicating a differentiation based on linguistic profile, then a generalized positive effect on school readiness is expected (in the short term) and the development of skills predictive of strong academic achievement is expected (in the medium and long term), based on key findings comparing the experimental groups. As such, there is no reason to believe the program impact would not be reproduced with a different sample of minority Francophone children.

8.7 Limitations of the Study and Strategies Used to Offset Them

The use of a quasi-experimental design with non-equivalent groups is generally accompanied by a number of concerns in regards to the validity of findings from such a study. Several strategies were applied to ensure valid results. Among the greatest threats to internal validity is that findings may result from a bias linked to group composition rather than from the program effect. This source of bias is diminished by the special attention given to recruiting members of the comparison groups with a socio-demographic profile similar to that of the Program Daycare group (e.g., socioeconomic level) and living in the same neighbourhood, thereby ensuring that they have comparable access to the same French-language resources and services as the Program Daycare group.⁴⁸ Thus, group composition was first controlled for when families signed up for the project, particularly as regards household location

⁴⁸ For more information, refer to the Revised Work Plan and Methodology Report submitted to HRSDC on March 30, 2007.

for potential members of the comparison groups. A second control was the use of pre-intervention measures which were used as covariates to offset the bias associated with the initial differences in the experimental group composition.

A second threat to the study's internal validity is that the evaluators, educators and parents were aware of who was receiving the treatment and who was not. This source of bias is inevitable when daycare status is known in the community (daycare offering the program, daycare not offering the program) and, by association, the status of children attending those daycares. This is less of a threat than one might first believe, since the daycares, rather than the children, were recruited and assigned to the experimental groups. The children who were already enrolled at these daycares (program or comparison) and their families found themselves as implicit members of an experimental group. It is nevertheless difficult to respond to criticisms that the results are due to a bias tied to this knowledge. However, it is difficult to imagine that these potential sources of bias would have, separately or combined, produced the pattern of results obtained. No one knew the relative level of program fidelity and quality available at program or comparison daycares. No one knew the hypotheses on the effect of linguistic profile. As such, it is unlikely that any bias (e.g., in group composition from evaluators) would have given responses consistent with our research hypotheses.

One possible research limitation is the modest size of the sample on which the findings are based ($N \approx 336$), since statistical analyses are most robust with very large samples ($N > 1000$). Several strategies were used to verify the robustness of findings, particularly with respect to the analyses. The analyses by experimental group were accompanied by complementary analyses (e.g., analysis by linguistic profile, effect size). This series of complementary analyses enabled us to verify the findings using different conceptualizations of the program (by group, by linguistic profile) and different sources (e.g., parent surveys, children assessments). We favoured an interpretation of findings based on the pattern of all results, not just one result in particular. At the community level, it is important to note that the findings may be generalized only to the communities studied or to similar communities.⁴⁹

8.8 Conclusion

The purpose of the Readiness to Learn project was to document the impact of a new preschool program on young minority Francophone children and their parents over a period of four years, extending from preschool to grade two. The main finding of this longitudinal study was the positive and significant effect of the program on all of the children. Overall, a review of the children's developmental trajectory suggests a boost in the development of language skills for children in the Program Daycare group during the first phase of the project compared to children in the comparison groups. The boost in the trajectory continued into the first year of the second phase. However, the nature of the benefit depends on the child's exposure to French at the beginning of the project.

Children from households characterized by a high initial exposure to French benefited more in terms of language skills, in addition to fully benefiting from the program for the majority of skills linked to academic achievement. These positive and significant benefits, both for language skills and the

⁴⁹ The "community" factor was considered a fixed factor in the impact analyses due to the small number of communities.

development of more complex skills, emerged early on and continued to increase in the second phase (e.g., language skills, reading skills, executive functions). These results suggest that children whose lives unfold primarily in French during the preschool years are better equipped to learn and to fully benefit from the activities presented in the tested program, and continue to develop in an accelerated manner during the first few years in school.

Among the children in the Program Daycare group, it was noted that the children from households with low exposure experience positive and significant benefits in their language skills over the short, medium and long term. The same trend is not as pronounced over the medium and long term for complex skills that are essential to academic achievement (e.g., reading and math skills, and executive functions). In other words, the language benefits experienced by the children in the Program Daycare group with low exposure to French did not seem to translate into an accelerated development of the complex skills involved in the predictors of academic achievement when these children were compared to the comparison groups.

The fact that the program was of more benefit to children from households with high exposure, particularly with respect to more complex skills, is consistent with models that recognize how important language mastery is to academic achievement (Cummins, 1979; Doherty, 1997; Hindman et al., 2010). This advantage in favour of the children in the Program Daycare group with high exposure confirms the importance of exposing children to a high degree of French to offset the majority Anglophone setting of the community in which the children are being raised.

The reported effects have a practical significance; not only do they promote the children's academic achievement, they also strengthen the vitality of the minority Francophone communities. Together, the findings point to the importance of providing a quality Francophone environment which will foster mastery of the French language, thereby ultimately improving chances of academic achievement and the development of a Francophone cultural identity.

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Appendix A : Result of the Confounding Variables Analysis

Table A1 Relevance of Demographic and Family Composition Variables

Covariate	Significant Correlations ($p < .10$) with Dependent Variables at +48 months												Association Tests with Experimental Group Membership				
	Freq. Lit.	Language Lit.	Child's Language	Forward Digit Span	Backward Digit Span	« Knock-Tap » Test	Verbal Fluency	PPVT-R	Reading Complex Words	Reading Sentences	Comprehension of Written Sentences	Knowledge of Numbers	Sample Parameter % or M (SD)	Group Association Test	Program Daycare group % or M (SD)	Comparison Daycare group % or M (SD)	Informal Care group % or M (SD)
Gender (+Girl) ^a	-	-	-	-	-	-	0.13	0.11	0.11	0.12	-	-	50.9%	$X^2(2) = 0.73$	47.4%	53.1%	51.4%
Child's Age (in months) ^b	-	-	-0.11	0.16	0.22	0.10	0.18	0.18	0.29	0.35	0.27	0.30	38.4 (3.65)	$F(2, 333) = 0.18$	38.46 (3.81)	38.51 (3.54)	38.23 (3.65)
Twins (Baseline)	-	-	-	-0.09	-	-	-	-	-	-	-	-	2.4%	$X^2(2) = 1.93$	4.2%	1.5%	1.8%
Twins (+48 months)	-	-	-	-0.11	-	-	-	-	-	-	-	-	2.0%	$X^2(2) = 0.17$	2.5%	1.7%	2.0%
Older Siblings (Baseline)	-0.13	-	-0.10	-	-	-	-0.16	-	-	-	-	-	51.8%	$X^2(2) = 3$	45.3%	56.9%	51.4%
Older Siblings (48 months) ^c	-0.14	-	-0.09	-	-	-	-0.17	-	-0.11	-	-	-	53.3%	$X^2(2) = 4.67^*$	44.2%	58.5%	55.0%
Younger Siblings (Baseline) ^d	-	-	-	-	-	-	-	-	-	-	-	-	34.5%	$X^2(2) = 15.01^{***}$	25.3%	29.2%	48.6%
Younger Siblings (+48 months)	-	-	-	-	-	-	0.10	-	-	-	-	-	46.1%	$X^2(2) = 6.69^{**}$	38.9%	43.1%	55.9%
Single-Parent Home (Baseline) (+single-parent) ^a	-0.17	-	-	-	-	-	-	-	-	-	-	-0.09	8.6%	$X^2(2) = 5.85^*$	7.4%	13.1%	4.5%
Single-Parent Home (+48 months) (+single-parent) ^a	-	-	-	-	-	-	-	-	-	-	-	-	14.2%	$X^2(2) = 2.59$	17.5%	15.8%	9.8%
Household Size (Baseline) ^d	-	-0.12	-0.18	-	-	-	-0.15	-	-0.11	-	-	0.13	3.99 (0.88)	$F(2, 333) = 5.27^{***}$	3.81 (0.8)	3.95 (0.93)	4.2 (0.86)
Household Size (+48 months)	-	-0.14	-0.23	-	-	-	-	-	-	-	-	-	4.17 (0.94)	$F(2, 299) = 4.71^{***}$	3.91 (0.86)	4.2 (0.95)	4.33 (0.96)
Health Problems	-	-	-	-0.12	-	-	-	-	-	-0.11	-	-0.10	34.4%	$X^2(2) = 3.21$	27.5%	34.2%	40.2%

Note: Variables retained as covariates for the impact analyses are in boldface. ^aAll categorical variables are binary (codes 0, 1) and the reported percentages are for category "1" indicated between parentheses and preceded by the (+) symbol. M = Mean; SD = Standard Deviation; N=338; Significance levels set at: *** $p < 1\%$; ** $p < 5\%$; * $p < 10\%$. Freq. lit. = Frequency of literacy activities, Language lit. = Language of literacy activities, Child's language = Language spoken by the child. ^bExceptionally, this variable was retained as a covariate even though it is not associated with membership in the treatment conditions. This decision is justified by its very strong association with several of the dependent variables. ^cThis variable was redundant given the inclusion of the variables Household size and Younger siblings.

Table A2 Relevance of Socioeconomic Variables

Covariate	Significant Correlations ($p < .10$) with Dependent Variables at +48 months												Association Tests with Experimental Group Membership				
	Freq. Lit.	Language Lit.	Child's Language	Forward Digit Span	Backward Digit Span	« Knock-Tap » Test	Verbal Fluency	PPVT-R	Reading Complex Words	Reading Sentences	Comprehension of Written Sentences	Knowledge of Numbers	Sample Parameter % or M (SD)	Group Association Test	Program Daycare group % or M (SD)	Comparison Daycare group % or M (SD)	Informal Care group % or M (SD)
Mother's Age at First Birth	-0.12	-0.10	-0.10	-	-	-	0.10	0.15	-	-	-	0.18	2.44 (0.92)	F(2 .332) = 4.3**	2.64 (1.03)	2.44 (0.86)	2.27 (0.85)
Income Baseline	-	-	-	-	0.20	0.12	0.19	0.14	0.12	0.16	0.19	0.27	5.13 (1.5)	F(2 .333) = 0.07	5.12 (1.54)	5.17 (1.48)	5.1 (1.5)
Income (24 months post)	-	-	-	-	0.11	-	0.19	0.12	-	-	0.10	0.18	7.43 (2.7)	F(2 .333) = 1.53	7.34 (2.77)	7.74 (2.66)	7.14 (2.67)
Mother Ed. Baseline (+min. college dip.) ^a	-	-	0.11	0.15	0.17	-	0.28	0.27	0.22	0.24	0.24	0.26	79.8%	X ² (2) = 0.23	81.1%	80.0%	78.4%
Mother Ed. 24 months post (+min. college dip.) ^a	0.10	0.12	0.15	0.13	-	-	0.18	0.23	0.13	0.18	0.16	0.17	82.6%	X ² (2) = 1.1	82.1%	85.2%	80.0%
Father Ed. Baseline (+min. college dip.) ^a	-	-	-	0.12	0.10	0.12	0.16	0.21	0.14	0.12	0.19	0.19	66.6%	X ² (2) = 2.49	70.7%	68.5%	60.9%
Father Ed. 24 months post (+min. college dip.) ^a	-	-	-	0.11	0.13	0.13	0.11	0.15	0.10	0.11	0.13	0.16	67.6%	X ² (2) = 3.06	71.6%	70.0%	61.3%
Immigrant Status	-0.11	-0.11	-	-	-	-	-	-	-	-	-	-	4.5%	X ² (2) = 0.36	4.2%	3.8%	5.4%
Social Capital	-	-	-	-	-	-	-	-	-	-	-	-	15.42 (3.93)	F(2 .332) = 0.82	15.68 (3.91)	15.56 (3.95)	15.04 (3.91)

Note: Variables retained as covariates for the impact analyses are in boldface. ^aAll categorical variables are binary (codes 0, 1) and the reported percentages are for category "1" indicated between parentheses and preceded by the (+) symbol. M = Mean; SD = Standard Deviation; N=338; Significance levels set at: *** $p < 1\%$; ** $p < 5\%$; * $p < 10\%$. Freq. Lit. = Frequency of literacy activities, Language Lit. = Language of literacy activities, Child's Language = Language spoken by the child, Ed. = Education, dip. = diploma.

Table A1 Relevance of Linguistic Variables

Covariate	Significant Correlations ($p < .10$) with Dependent Variables at +48 months												Association Tests with Experimental Group Membership				
	Freq. Lit.	Language Lit.	Child's Language	Forward Digit Span	Backward Digit Span	« Knock-Tap » Test	Verbal Fluency	PPVT-R	Reading Complex Words	Reading Sentences	Comprehension of Written Sentences	Knowledge of Numbers	Sample Parameter % or M (SD)	Group Association Test	Program Daycare group % or M (SD)	Comparison Daycare group % or M (SD)	Informal Care group % or M (SD)
Frequency of Literacy Activities (Baseline)	-	-0.14	-0.12	-	0.14	-	-	-	-	0.10	0.13	-	15.1 (2.95)	$F(2, 333) = 4.1^{**}$	15.31 (2.59)	14.55 (3.02)	15.59 (3.07)
Language of Literacy Activities (Baseline) ^b	-	0.50	0.58	-	-	0.20	0.22	0.36	0.22	0.13	0.14	-	19.97 (5.98)	$F(2, 333) = 2.17$	18.99 (6.45)	20.04 (5.59)	20.72 (5.93)
Language Spoken to Child by Mother (Baseline)	0.11	0.50	0.54	-	-	0.18	0.20	0.34	0.19	0.10	-	-	4.07 (1.35)	$F(2, 333) = 2.84^{*}$	3.84 (1.45)	4.05 (1.36)	4.29 (1.22)
Language Spoken to Child by Father (Baseline)	-	0.45	0.60	0.15	-	0.10	0.16	0.38	0.30	0.17	0.20	-	3.69 (1.64)	$F(2, 333) = 3.8^{**}$	3.38 (1.73)	3.65 (1.66)	4 (1.5)
Continuum of French Spoken by the Child	-	0.50	0.64	0.13	-	0.16	0.29	0.45	0.32	0.18	0.20	-	3.79 (1.48)	$F(2, 333) = 3.25^{**}$	3.47 (1.57)	3.86 (1.43)	3.97 (1.42)
Language of Care (0-12)	-	-	0.19	-	-	-	-	-	0.12	-	-	-0.11	2.33 (0.85)	$F(2, 331) = 0.05$	2.31 (0.86)	2.34 (0.88)	2.34 (0.83)
Language of Care (13-24)	-	0.10	0.25	-	-	-	-	-	0.13	-	-	-	2.25 (0.86)	$F(2, 331) = 0.76$	2.18 (0.85)	2.22 (0.89)	2.32 (0.83)
Language of Care (25-36)	0.10	0.15	0.30	-	-	0.11	-	0.11	0.17	-	-	-0.09	2.24 (0.88)	$F(2, 331) = 0.19$	2.24 (0.86)	2.21 (0.89)	2.28 (0.89)
Household Type based on FOLS (+Endogamous -French) ^a	-	0.37	0.52	-	-	0.11	0.15	0.28	0.22	0.11	0.11	-	50.1%	$X^2(2) = 1.06$	47.4%	48.8%	54.1%
Household Type based on Language Spoken to the Child (+Endogamous-French) ^a	-	0.44	0.58	0.11	-	0.11	0.14	0.31	0.25	0.12	0.15	-	52.2%	$X^2(2) = 2.26$	46.3%	52.7%	56.8%

Note: Variables retained as covariates for the impact analyses are in boldface. ^aAll categorical variables are binary (codes 0, 1) and the reported percentages are for category "1" indicated between parentheses and preceded by the (+) symbol. M = Mean; SD = Standard Deviation; N=338; Significance levels set at: *** $p < 1\%$; ** $p < 5\%$; * $p < 10\%$. Freq. lit. = Frequency of Literacy Activities, Language Lit. = Language of Literacy Activities, Child's Language = Language Spoken by the Child, ^b Exceptionally, this variable was retained as a covariate since it was assessed as a dependent variable during the +48 months evaluation period.

Table A2 Relevance of Sociolinguistic Variables

Covariate	Significant Correlations ($p < .10$) with Dependent Variables at +48 months												Association Tests with Experimental Group Membership				
	Freq. Lit.	Language Lit.	Child's Language	Forward Digit Span	Backward Digit Span	« Knock-Tap » Test	Verbal Fluency	PPVT-R	Reading Complex Words	Reading Sentences	Comprehension of Written Sentences	Knowledge of Numbers	Sample Parameter % or M (SD)	Group Association Test	Program Daycare group % or M (SD)	Comparison Daycare group % or M (SD)	Informal Care group % or M (SD)
Vitality (Baseline) ^b	0.12	0.28	0.58	-	-	0.14	0.13	0.29	0.29	0.12	-	-	15.59 (5.35)	$F(2, 284) = 2.4^*$	15.12 (5.14)	15.15 (5.36)	16.65 (5.45)
Vitality	0.14	0.29	0.53	-	-	0.12	0.20	0.32	0.23	0.10	0.11	-	16.09 (4.6)	$F(2, 298) = 3.9^{**}$	14.96 (4.47)	16.19 (4.63)	16.85 (4.55)
Engagement in Francophone Culture	-	0.14	0.20	0.11	-	-	-	0.20	0.13	-	-	-	15.93 (3.17)	$F(2, 302) = 0.1$	16 (3.05)	15.83 (3.1)	16 (3.36)
Sense of Belonging	-	0.37	0.45	0.14	-	0.19	0.20	0.41	0.26	0.16	0.15	-	2.42 (0.75)	$F(2, 331) = 1.62$	2.31 (0.83)	2.45 (0.73)	2.49 (0.7)

Note: Variables retained as covariates for the impact analyses are in boldface. ^aAll categorical variables are binary (codes 0, 1) and the reported percentages are for category "1" indicated between parentheses and preceded by the (+) symbol. M = Mean; SD = Standard Deviation; N=338; Significance levels set at: *** $p < 1\%$; ** $p < 5\%$; * $p < 10\%$. Freq. Lit. = Frequency of Literacy Activities, Language Lit. = Language of Literacy Activities, Child's Language = Language Spoken by the Child. ^bThe most recent measure, the one at 24 months post-program, is used when the variable meets the selection criteria for the baseline measure and at 24 months post.

Table A3 Relevance of Parenting Variables

Covariate	Significant Correlations ($p < .10$) with Dependent Variables at +48 months												Association Tests with Experimental Group Membership				
	Freq. Lit.	Language Lit.	Child's Language	Forward Digit Span	Backward Digit Span	« Knock-Tap » Test	Verbal Fluency	PPVT-R	Reading Complex Words	Reading Sentences	Comprehension of Written Sentences	Knowledge of Numbers	Sample Parameter % or M (SD)	Group Association Test	Program Daycare group % or M (SD)	Comparison Daycare group % or M (SD)	Informal Care group % or M (SD)
Family Functioning	-	-	-	-	0.15	-	-	-	0.1	0.09	-	-	29.75 (3.17)	$F(2, 331) = 3.52^{**}$	29.02 (4.21)	30.01 (2.6)	30.06 (2.63)
Depression	-	-	-	-	-0.14	-	-	-0.13	-0.14	-0.15	-0.14	-0.10	10.42 (3.23)	$F(2, 325) = 3.76^{**}$	10.84 (3.5)	9.82 (2.53)	10.79 (3.63)
Positive Parenting Practices	-	-	0.14	-	-	-	-	-	0.12	-	-	-0.10	23.09 (1.91)	$F(2, 330) = 1.72$	22.92 (2.02)	22.98 (1.98)	23.36 (1.7)
Authoritarian Parenting Practices	-	-	0.13	0.12	-	-	-	0.12	0.14	0.12	0.13	0.10	12.95 (2.1)	$F(2, 330) = 10.71^{***}$	12.16 (2.29)	13.41 (1.97)	13.11 (1.91)
Empowerment	-	-	-0.16	-	-	-	-0.11	-0.11	-	-	-	-	16.64 (2.32)	$F(2, 283) = 1.07$	16.34 (2.34)	16.69 (2.2)	16.84 (2.42)

Note: Variables retained as covariates for the impact analyses are in boldface. ^aAll categorical variables are binary (codes 0, 1) and the reported percentages are for category "1" indicated between parentheses and preceded by the (+) symbol. M = Mean; SD = Standard Deviation; N=338; Significance levels set at: *** $p < 1\%$; ** $p < 5\%$; * $p < 10\%$. Freq. Lit. = Frequency of Literacy Activities, Language Lit. = Language of Literacy Activities, Child's Language = Language Spoken by the Child.

Table A4 Relevance of Methodological Factors

Covariate	Significant Correlations ($p < .10$) with Dependent Variables at +48 months												Association Tests with Experimental Group Membership				
	Freq. Lit.	Language Lit.	Child's Language	Forward Digit Span	Backward Digit Span	« Knock-Tap » Test	Verbal Fluency	PPVT-R	Reading Complex Words	Reading Sentences	Comprehension of Written Sentences	Knowledge of Numbers	Sample Parameter % or M (SD)	Group Association Test	Program Daycare group % or M (SD)	Comparison Daycare group % or M (SD)	Informal Care group % or M (SD)
Change in Group During First Year (+Change) ^a	-	-	-	-	-	-	-	-	-	-	-	-	4.2%	$X^2(2) = 9.95^{***}$	1.1%	2.3%	9.0%
Cohort ^a (+ 1 st) ^b	-	-	-0.14	-	-	-	-	-	-0.12	-	-	-	29.2%	$X^2(2) = 0.46$	28.4%	27.7%	31.5%
Community ^b	-0.10	0.13	-	-	-	-	0.16	0.20	-	0.16	0.11	0.09	10.7%	$X^2(6) = 5.97$	13.7%	11.5%	7.2%
Orléans	-0.12	0.15	0.11	-	-	0.11	0.20	0.23	0.12	0.15	0.18	0.1	30.7%	$X^2(2) = 0.25$	29.5%	30.0%	32.4%
Cornwall	-	-0.23	-0.41	-	-	-0.24	-0.19	-0.34	-0.31	-0.17	-0.21	-0.12	33.9%	$X^2(2) = 1.5$	38.9%	32.3%	31.5%
Durham	-	-0.15	-0.26	-	-	-	-	-	-	-	-	0.14	10.7%	$X^2(2) = 2.4$	13.7%	11.5%	7.2%
Edmundston	0.18	0.20	0.52	-	-	-	-	0.19	0.24	-	-	-	24.7%	$X^2(2) = 3.53$	17.9%	26.2%	28.8%
Child's Behavior During Evaluation	-	0.13	0.11	0.15	0.21	0.26	0.19	0.19	0.16	0.27	0.20	0.28	8.91 (0.4)	$F(2, 311) = 1.73$	8.94 (0.24)	8.86 (0.53)	8.94 (0.31)
Evaluation Environment	-	-	-0.11	-	-	-	-	-	-	-	-	0.14	11.91 (0.43)	$F(2, 310) = 0.53$	11.94 (0.32)	11.88 (0.45)	11.91 (0.48)

Note: Variables retained as covariates for the impact analyses are in boldface. ^aAll categorical variables are binary (codes 0, 1) and the reported percentages are for category "1" indicated between parentheses and preceded by the (+) symbol. M = Mean; SD = Standard Deviation; N=338; Significance levels set at: *** $p < 1\%$; ** $p < 5\%$; * $p < 10\%$. Freq. lit. = Frequency of Literacy Activities, Language Lit. = Language of Literacy Activities, Child's Language = Language Spoken by the Child. ^bExceptionally, this variable was retained as a covariate even though it is not associated with membership in the treatment conditions. This decision is justified by its very strong association with several of the dependent variables.

Table A5 Relevance of School Variables

Covariate	Significant Correlations ($p < .10$) with Dependent Variables at +48 months												Association Tests with Experimental Group Membership				
	Freq. Lit.	Language Lit.	Child's Language	Forward Digit Span	Backward Digit Span	« Knock-Tap » Test	Verbal Fluency	PPVT-R	Reading Complex Words	Reading Sentences	Comprehension of Written Sentences	Knowledge of Numbers	Sample Parameter % or M (SD)	Group Association Test	Program Daycare group % or M (SD)	Comparison Daycare group % or M (SD)	Informal Care group % or M (SD)
School Enrolment (Year 2) ^b	-0.16	-0.1	-0.37	-	-	-	0.10	-	-0.10	0.13	-	0.17	65.5%	$X^2(2) = 1.94$	70.5%	65.4%	61.3%
Full-time (+ Full-time) ^a	-0.10	-	-	-	-	0.15	0.22	0.20	0.13	0.19	0.23	0.22	36.0%	$X^2(2) = 0.23$	36.8%	36.9%	34.2%
Part-time (+Part-time) ^a	-	-0.15	-0.37	-	-	-	-0.13	-0.29	-0.24	-	-0.17	-	29.5%	$X^2(2) = 1.19$	33.7%	28.5%	27.0%
French Program (24 months post) (+French Program) ^b	-	-	-0.24	-	-	-	-0.18	-0.23	-0.21	-	-0.12	-0.11	10.9%	$X^2(2) = 2.45$	13.8%	7.5%	12.7%
Tutoring (24 months post) (+Tutoring)	-	-	-	-0.10	-0.14	-0.12	-0.28	-0.26	-0.26	-0.22	-0.23	-0.33	13.6%	$X^2(2) = 2.47$	17.5%	10.0%	14.7%
Homework Frequency (24 months post) (+Every day)	0.16	0.17	-	-	-	-	-0.11	-	-	-	-0.15	-	80.1%	$X^2(2) = 0.14$	81.3%	79.2%	80.4%
Computer (24 months post) (+Computer)	-	0.12	-	-	-	-	0.14	0.19	-	0.13	0.11	0.14	75.5%	$X^2(2) = 1.26$	71.3%	75.8%	78.4%
Perception of the School (24 months post)	-	-	-	-	0.10	0.10	-	-	-	-	-	-	17.83 (2.09)	$F(2, 299) = 0.88$	17.6 (2.32)	18 (2.03)	17.81 (1.97)
Perception of the Teacher (24 months post)	-	-	0.15	-	-	-	-	-	-	-	-	-	10.56 (1.51)	$F(2, 299) = 1.68$	10.41 (1.64)	10.76 (1.45)	10.45 (1.48)

Note: Variables retained as covariates for the impact analyses are in boldface. ^aAll categorical variables are binary (codes 0, 1) and the reported percentages are for category “1” indicated between parentheses and preceded by the (+) symbol. M = Mean; SD = Standard Deviation; N=338; Significance levels set at: *** $p < 1\%$; ** $p < 5\%$; * $p < 10\%$. Freq. Lit. = Frequency of Literacy Activities, Language Lit. = Language of Literacy Activities, Child's Language = Language Spoken by the Child

Appendix B : Measure Timetable

Figure B.1 presents the name of the construct and the measures used to follow the developmental trajectory of children. N.B. The measures' administration timetable for the second cohort is shifted by 12 months.

Figure B1 Updated Timetable of Administration of Measures in Preschool and in School for the First Cohort of the Readiness to Learn Project

Phase 1 Preschool Administrations			Phase 2 School Administrations		
October 2007	February 2009	June 2009	October 2009	October 2010	October 2011
School Readiness					
Initial ÉPE–AD		Modified ÉPE–AD			
			Receptive and Expressive Vocabulary		
			EOWPVT	PPVT-R	PPVT-R
			Knowledge of Sounds		
			Phoneme Isolation		
			Fluency		
			Rapid Naming	Verbal Fluency	
			Comprehension		
			Word Reasoning		
			Knowledge of letters		
			Letter Names and Sounds		
			Reading skills		
			Reading Simple Words		Reading Complex Words
					Reading Sentences
					Comprehension of Written Sentences
			Mathematics Skills		
			Knowledge of Number		
			Executive Functions		
			Digit Span Test		
			Dots Test		
			Knock-Tap Test		

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