

Birthdate and Student Achievement

The Effects of School Grouping Practices in British Columbia

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EXECUTIVE SUMMARY

In recent years, a number of studies have begun to report long-term negative effects resulting from the traditional practice of using of a single cut-off date for kindergarten admission and organizing children in one-year age groupings for instruction.

In British Columbia, children may enter kindergarten in September if their fifth birthday occurs by December 31 of that calendar year. The oldest child in the kindergarten class was born on January 1 and the youngest on December 31. This means that kindergarten students are assembled in a class where the oldest child is twelve months older than the youngest, a 20% age difference at this level.

The purpose of this investigation was to examine the effects of these school admission and grouping practices on student learning in British Columbia schools.

The study focuses on all children born in 1990 who reached five years of age in calendar year 1995 and who enrolled in British Columbia kindergarten in September of that year. We follow the progress of this population of 46,968 students as they progressed in BC schools through to 2010, and compare the performance over time of the youngest students in the kindergarten class with that of the oldest students.

Results from this study suggest that a substantial number of students will fall behind their peers in meeting reading and numeracy standards and graduating from grade 12, simply because they are the youngest and most immature in their kindergarten class.

Based on the 1995-1996 cohort, December-born children are 12-15% less likely than their January counterparts to attain Grades 4 and 7 reading and numeracy standards on time, and they are 12% less likely to graduate on time. These "birthdate effects" are evident across the four sub-populations studied: males and females, and Aboriginal and non-Aboriginal students.

If all students enjoy the same rates of success as the January-born, an additional 1,700 students would graduate on time each year. This would represent a 4% increase in the

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on-time graduation rate for the province, and an annual saving of \$14 million. Not included in the analyses are the lost opportunity costs for individual students, and the province generally, resulting from failure to meet literacy standards and/or to graduate late, or not at all.

The study found that birthdate effects associated with reaching grade level on time are most pronounced among Aboriginal males. Younger Aboriginal males are 19% less likely than older Aboriginal males to reach grade 10 on time.

Results from this study reflect the findings of an earlier study carried out by University of California economists Kelly Bedard and Elizabeth Dhuey, who reported that the relatively youngest British Columbia students are 13% less likely to be university-bound than the relatively oldest.

Birthdate effects reported here underline the importance of moving toward some form of personalized approach to learning that aligns with the developmental stages of individual children. Not many organizations, other than schools and children's sports teams, organize people solely on the basis of age. That said, failed efforts in the early 1990s to shift to a non-graded primary program illustrates the difficulty of changing organizational structures that are imbedded in the province's educational culture.

One approach that could be considered is to uncouple the "foundation skills" -- reading, writing, numeracy -- from the traditional content-based graded system. These skills would be organized in a developmental structure, from basic to more complex, that would be used to tailor learning programs to the developmental needs of each student, independent of the student's grade placement. The study of other school subjects, such as science, social studies and the fine arts, would continue to be organized in a graded structure.

Successful approaches to organizing children for instruction, of which there may be many, would show all students having the same opportunity to achieve success, regardless of birthdate. Younger students in an age cohort should not be disadvantaged by the way schools group students for instruction.

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1. INTRODUCTION

In most jurisdictions, children start kindergarten when they meet the age requirement defined by a single cut-off date. In British Columbia, children may enter kindergarten in September if their fifth birthday occurs by December 31 of that calendar year.

Admitting children to school using a single cut-off date means that kindergarten students are assembled in a class where the oldest child is twelve months older than the youngest. In British Columbia, the oldest child in the kindergarten class was born on January 1 and the youngest on December 31.

For five-year olds, a one-year age difference represents a significant 20% of their lifespan. One would expect that, on average, the older child would be more mature -- physically, socially and cognitively -- than the youngest child in the same kindergarten class. If these developmental differences exist at the start of kindergarten, do they result in educational disadvantages for the younger child?

For many years, the general view among parents and educators was that while the older kindergarten children might enjoy initial advantages in the first few months of their schooling, these advantages quickly dissipate as all children become engaged in the range of school activities. In recent years, a number of studies have begun to report longer-term negative effects resulting from the traditional practice of using of a single cut-off date for kindergarten admission and organizing children in one-year age groupings for instruction.

We believe these studies are significant because, unlike other variables that affect student learning such as the child's home environment, policies and practices governing how children are grouped and taught are within the full control of the school system. They can be changed.

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Not many organizations, other than schools and children's sports teams, organize people solely on the basis of age. Successful approaches to organizing children for instruction, of which there may be many, would show no relationship between birthdate and performance.

The purpose of this investigation was to examine the effects of school admission and grouping practices on student learning in British Columbia schools.

Compared to other studies we have examined, this study is somewhat unique in that we have been able to examine birthdate effects of a population of students moving from kindergarten through to Grade 12. We examine the population of students who were born in 1990 and who began kindergarten in British Columbia schools in 1995. This was the first year the province's student information system was established, thus enabling us to track the progress of this cohort through to 2010.

2. RELATED DEVELOPMENTS

Research studies

Various studies have been published about the “birthday effect,” the “relative age effect,” or the “age position effect.” These terms have been used to refer to the effect produced when children, for administrative reasons, are grouped by age for school attendance or for other activities where performance is strongly related to physical, social, or cognitive development.

In sports such as hockey and soccer, a range of studies report that a disproportionate number of players in elite leagues, such as Canadian Junior A hockey and the National Hockey League, are among the oldest in their cohort^{1,2}. They trace this pattern back to cut-off dates used to classify youngsters by age into different leagues.

According to this research, players who are oldest in their cohort are physically more mature and are more likely to be selected for elite teams where they receive extra playing time and more intensive coaching. This, in turn, provides a significant advantage for that small group of older players born closest to the cut-off date, and that advantage persists through to the top level of their sport.

Economists Kelly Bedard and Elizabeth Dhuey at the University of California, Santa Barbara carried out the first in-depth study of birthdate effects in British Columbia schools³. Their research showed that birthdate effects in BC schools are prevalent through to university admission.

Using transcript data for the nine-year period 1995-2003, Bedard and Dhuey identified British Columbia students who entered Grade 9 for the first time from 1996 to 1998 and tracked their progress over a five-year period. By linking birthdates with school performance, they report that the oldest students (those born in January) are 13% more likely to be university-bound than the youngest (those born in December). They report similar results using university admission data in the United States.

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Bedard and Dhuey also examined birthdate effects across OECD countries using international test results reported by The International Mathematics and Science Studies (TIMSS). They found that the youngest students across OECD countries score substantially lower than the oldest students at both Grade 4 and Grade 8. Youngest members of each cohort score 4-12 percentiles lower than the oldest members in Grade 4 and 2-9 percentiles lower in Grade 8.

Similar findings are reported by other researchers using data from the Programme for International Student Assessment (PISA) and from national achievement test scores in England^{4,5}. Some studies note that birthdate effects appear to be greatly reduced in countries where formal education begins at a later age, such as in Finland where compulsory education does not begin until age seven⁶.

Other studies note birthdate effects in the identification of children with behavioural disorders. A Michigan State University study found that nearly one million children in the United States are potentially misdiagnosed with attention deficit hyperactivity disorder (ADHD) simply because they are the youngest, and most immature, in their kindergarten class⁷. According to the study, diagnoses of ADHD are determined largely by subjective comparisons across children in the same grade in school and many diagnoses may be driven by teachers' perceptions of poor behaviour among the youngest children in a classroom. The report states that the youngest children in Grades 5 and 8 are nearly twice as likely as their older classmates to regularly use stimulants to treat ADHD.

Other evidence suggests that leadership development is influenced by a child's relative age among the cohort^{8,9}. These studies report that older children within the cohort may be selected disproportionately to serve in school leadership positions due to their relative maturity rather than innate ability. These initial leadership experiences, according to the research, provide the older students with opportunities to develop leadership skills that persist into high school and into adulthood.

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Dual entry and ungraded primary:

Prior to the publication of much of the recent empirical research on birthdate effects, the 1988 Sullivan Royal Commission on Education, referring to a number of theoretical studies, recommended that developmental criteria, rather than chronological age, be used in selecting the educational placement of children when they enter school¹⁰.

According to the Commission, each child should be assessed and directed to the program best suited to that child's level of development. The Commission recommended that local schools and districts be permitted to establish ungraded primary (K-3) programs in order to accommodate the varied development of young children during the primary years.

In response, the Ministry of Education announced that a dual entry system would be used to admit children to kindergarten and that the first four years of schooling would consist of a non-graded primary program. In 1989, children whose fifth birthday fell between May 1 and October 31 started school in September while those whose fifth birthday fell between November 1 and April 30 began in January. The Ministry stated that the "the effect of this dual entry system will be to reduce the spread of ages in a given first year class, and thus make it possible to focus more on individual readiness needs".¹¹

Initial public response to dual entry and the non-graded program generally was very positive. Once the implementation process began, however, two major concerns surfaced.¹²

First, because the school system was organized around the traditional ten-month year, district officials noted that funding and employment agreements, which were linked to annual September enrolment data, would require revamping. In the context of a difficult labour climate, the prospect of opening up agreements for further negotiation was not well received by many administrators and union leaders.

Second, and perhaps most critical, parents were not provided with a clear understanding of how the new four-year ungraded program would be structured and how student learning would be assessed. Proponents argued that the new program was much better

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suited to the different ways that children learn and develop, but many parents and teachers were not convinced. Complaints over the added day-care costs for those children whose kindergarten entry was delayed to January added to the concerns. In 1991, faced with growing opposition, government announced that it would abandon the dual entry policy. Schools quickly returned to the traditional graded structure with a single cut-off date for admission to kindergarten.

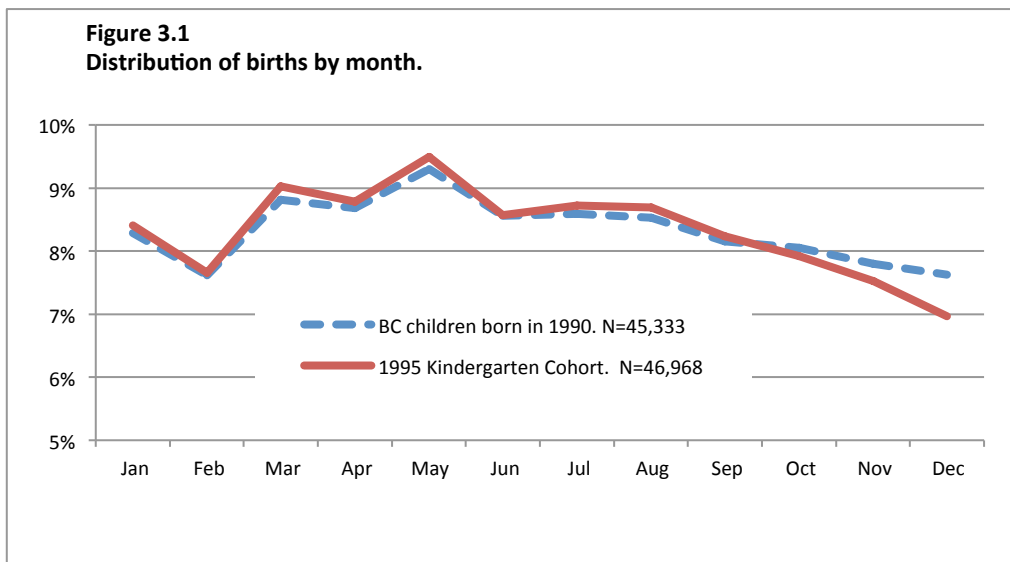
This paper summarizes the work we carried out to examine possible birthdate effects among students who were born in 1990.

3. THE 1995 KINDERGARTEN COHORT

Defining the Cohort

This study focuses on the population of children who were born in 1990, who reached five years of age in calendar year 1995, and who were enrolled in British Columbia kindergarten in September of that year. Only those students who met these criteria are included in this study. We define this group of students as the 1995 Kindergarten Cohort. We follow this cohort as it progresses through the grades to the year 2010.

The 46,968 children who form the 1995 Kindergarten Cohort consist mainly of children who were born in BC, but they also include children meeting the same criteria who migrated to the province from elsewhere and enrolled in a BC kindergarten. We use the 1990 monthly birth distribution for British Columbia as a benchmark to determine if there was anything unusual about the 1995 Kindergarten Cohort.¹³ (Figure 3.1, Table A1).



The monthly birth distributions for the two groups of children are almost identical for much of the year, but there is a growing gap over the last three months. The gap in the

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last quarter represents 1.5% of the five-year-old population. This group consists of 698 students, mainly boys, who were born late in 1990 but did not start kindergarten until 1996, one year later. For most of these youngsters, parents likely decided that their children were too young or immature to start kindergarten in 1995 and enrolled their child one year later with a younger cohort. The research appears unclear about the effectiveness of this strategy; time did not permit us to track the progress of this group.

Birthdate: an independent variable

Birthdate serves as a useful proxy for the physical, emotional and intellectual development of a child. The study of birthdate effects is particularly useful because there appears to be no evidence in the literature linking birthdate to other student variables associated with school achievement, such as socio-economic status, or gender, or ethnicity. This means that if students who were born in January perform, on average, at a different level than students born 12 months later in December, we can be reasonably confident that the performance gap is the result of the age difference between the two groups, not the result of some other variable.

Birthdate effect

The birthdate effect is defined here as the difference in performance between members of the 1995 cohort who were born early in the year (the older students) and those born in the latter part of the year (the younger students). We use two types of comparisons: i) students born in January versus those born in December, and ii) students born in the first quarter of the year (January to March) versus those born in the fourth quarter (October to December).

Performance indicators

We utilize three performance indicators to examine birthdate effects:

Grade Attainment: Percent of the cohort reaching the expected grade level on time.

In the early part of the province's history, only the best students were promoted from one grade to the next. Today, all students are expected to meet grade level standards and progress through to Grade 12.

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Graduation Rate: Percent of the cohort graduating from secondary school on time. Up until the middle part of the twentieth century, it was assumed that significant numbers of students would not graduate from secondary school; they would move directly into jobs in the province's resource sector. Today, graduation from secondary school is widely viewed as a minimum requirement to function effectively in society.

Skills Attainment: Percent of the cohort meeting reading and numeracy standards on time.

Reading and numeracy are key skills that help form the foundation for further learning in school and in society. In this study, we analyze reading and numeracy results from the Foundation Skills Assessment (FSA) administered to students in Grades 4 and 7.

Gender and Aboriginal Status

Various provincial and international assessments report that girls as a group outperform boys in reading, and that Aboriginal students as a group underperform other students in the province.^{14,15} The paper compares birthdate effects between males and females, and between Aboriginal students and other students in BC.

Examining organizational effects on Aboriginal students is important as part of the broader effort to improve success rates for First Nations students in the province. It is also important because the Aboriginal student population, whose families experience disproportionately high rates of poverty and poor literacy levels, can serve as a proxy for disadvantaged children in the province.

Generalizing results from this paper

Our attention in this paper focuses on the 1995 Cohort; sampling errors are not an issue since we use only population results in our analyses. To explore findings beyond the 1995 cohort, it will be important to examine results for other cohorts moving through the school system. Although student performance profiles for large populations change very slowly, it is possible that modifications to school policies and practices adopted since 1995, such as the introduction of new graduation requirements, may have affected student performance patterns for the more recent student cohorts moving through the school system.

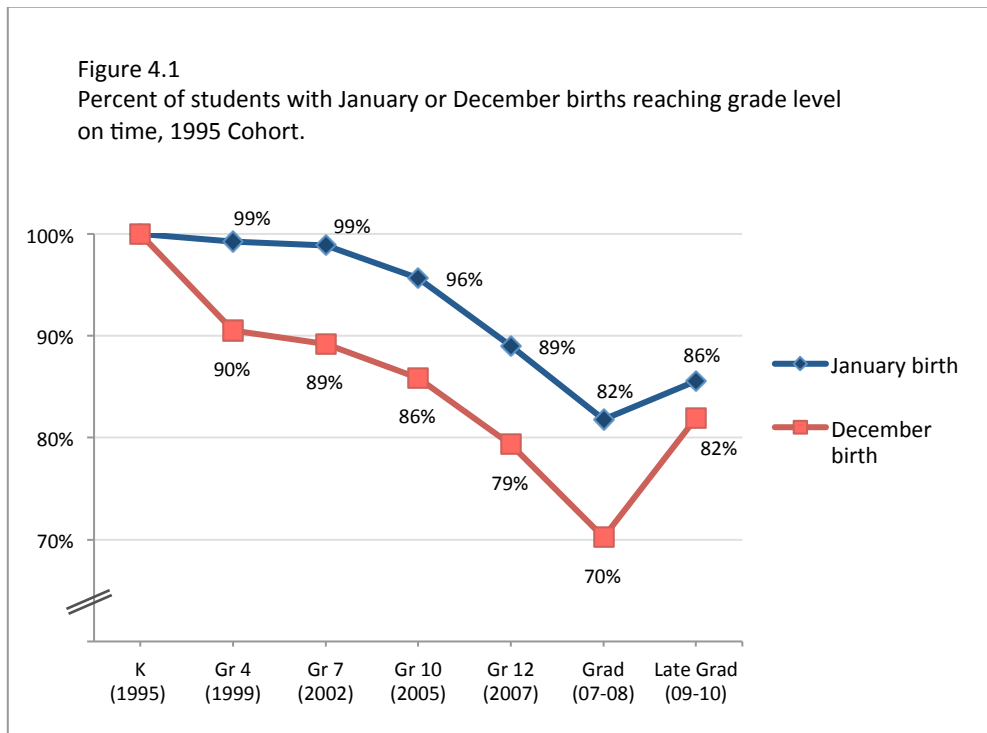
4. PROGRESSION FROM K TO 12

Reaching grade level.

In September 1995, 46,968 children -- the 1995 Cohort -- began Kindergarten in British Columbia schools. In 1999, four years later, the Cohort turned nine years of age and 43,548 were enrolled in BC schools -- 3,420 had left the BC system for other jurisdictions. At this point, most members of the Cohort resident in BC had reached Grade 4, the expected grade level for the group. (see Table A2)

Our interest lies with the group of students who did not reach the expected grade level on time. In 1999, this group consisted of 1,159 students, or 2.6% of the Cohort in BC schools, who were held back one or more grades and did not reach Grade 4 as expected that year. By 2008, this group expanded to 8,875 students, or 22.5% of the Cohort enrolled in BC schools, who did not graduate on time from Grade 12. Is there a performance difference between those in the cohort born in the early part of the year and those born in the latter part?

Figure 4.1 displays the percentage of the 1995 Cohort who reached the expected grade level on time (Table A3). In 2002, 99% of the January born compared to 89% of the December-born progressed to Grade 7 on time, a 10% difference. For graduation in 2007-08, the January advantage grows to 12%: 82% of the January born compared to 70% of the December-born graduated on time.



It is reassuring to note that many students in the cohort who did not graduate on time continued their schooling and were successful in meeting graduation requirements by 2009-10. It is also reassuring to see that, given an additional two years, graduation rates for the younger students jump to 82%, narrowing the birthdate effect to 4%.

On-time success and costs: While it is important to ensure that a variety of options are available for young adults to complete graduation, it is also important to note that the birthdate effect we see here has a negative impact on substantial numbers of students. It also leads to duplication of services and increased costs.

If all students in the 1995 Cohort enjoyed the same rates of success as the January born, an additional 1,696 students would have graduated on time in 2007-08. This would represent a 4 per cent increase in the on-time graduation rate for the Cohort, and an annual saving of \$13.6 million. This amount is based on the assumption that the 1,696 students who do not graduate on time at some point go on to enrol full time in some form of schooling (e.g. secondary school, adult upgrading, postsecondary literacy program) for one additional year at a taxpayer cost of \$8,000 per individual.

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The Ministry of Education estimates that 80% of students enrolled in Grade 8 in 2003 graduated from the K-12 system six years later in 2009-2010; these estimates take into account inter-provincial migration. This percentage may underestimate the actual graduation rate as some students who do not graduate on time from BC secondary schools may choose to enrol in a variety of public and private postsecondary programs that offer a range of upgrading courses and Grade 12 equivalency. Statistics Canada reports that over the period 2002-2005, 93% of 20 to 24 year-olds in British Columbia reported that they held a high school diploma; this percentage, however, could be an overestimate of the graduation rate as it is based on self-reported information.¹⁶

5. READING AND NUMERACY SKILLS

Reading and Numeracy results

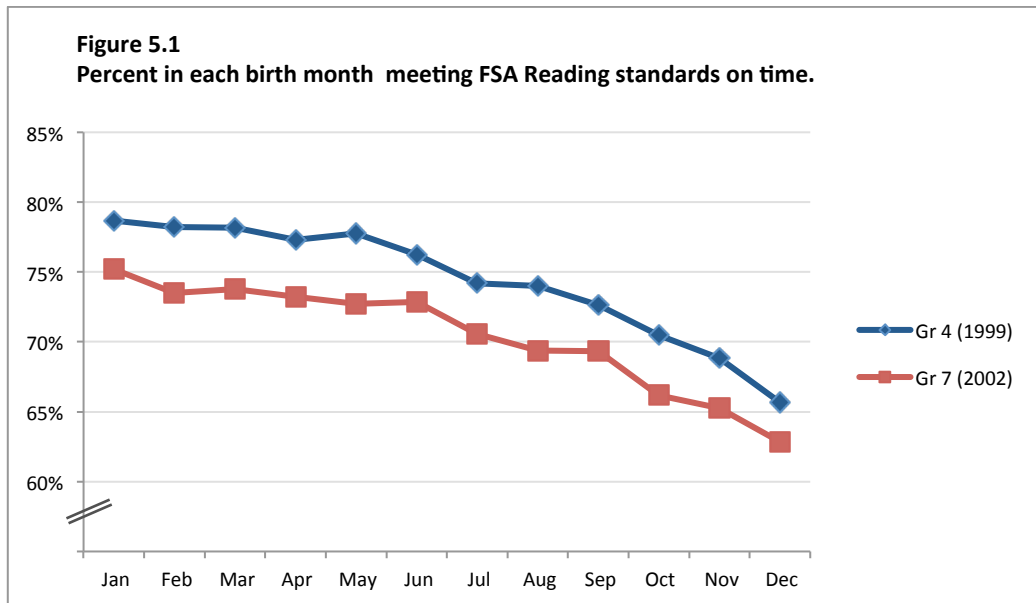
Each spring, students in grades 4 and 7 participate in the Foundation Skills Assessment (FSA), province-wide tests administered by the Ministry of Education. In this part of the paper, we examine the percentage of the 1995 Kindergarten Class who met the grade 4 and 7 reading and numeracy standards when as they were expected to do so. In 1999, the year they turned nine, these youngsters were expected to enrol in Grade 4; in 2002, the year they turned 12, they were expected to enrol in Grade 7.

In calculating FSA success rates, we take into account the entire 1995 Cohort enrolled in BC schools, regardless of grade enrolment. We first consider those in the cohort who were enrolled in the expected grade level and completed the FSA tests; for this group, we calculate the number of students who met FSA standards, and those who did not. In addition, we identify members of the Cohort enrolled below grade level and assume this group did not meet the FSA standards that year. We also consider those students beyond the expected grade level and assume that they had met the respective FSA standards.

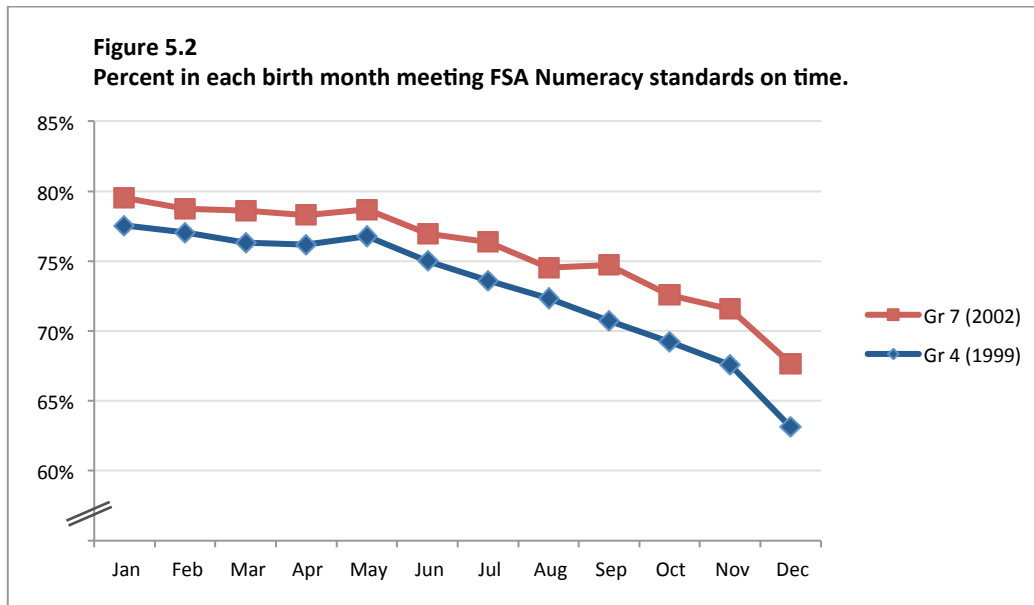
Figure 5.1 displays results for the percentage of the cohort in each birth month who met FSA Reading standards in the 1999-2000 and 2002-2003 school years (Table A4). Two observations can be made about the results. First, large numbers of the 1995 Cohort, regardless of birthdate, did not meet achievement standards when they were expected to do so. By 1999-2000, for example, 25% of the cohort did not meet Grade 4 Reading standards.

Second, there is a gradual decrease, from January to December, in the percentage of students in each birth month who meet standards. Substantial performance differences are evident between the oldest students (those born in January) and the youngest (those born in December). In the 1999-2000 school year, 79% of January-born youngsters met Grade 4 FSA standards compared to 66% of those born in December, a 13% disadvantage

for the younger students. In 2002-03, when the cohort was expected to be enrolled in Grade 7, the January to December variation is 75% to 63%, a 12% birthdate effect.



In Numeracy, the results are similar (Figure 5.2; Table A5). Overall, 27% of the Cohort did not meet Grade 4 numeracy standards on time, and there is a significant decrease, from January to December, in the proportion of students meeting Numeracy standards on time. The proportion of students meeting Numeracy standards decreases from 78% of the January-born to 63% of the December-born, a 15% birthdate effect. In Grade 7, the January to December decline is 80% to 68%, a 12% effect.



Implications: If all students in the 1995 Kindergarten Cohort performed at the same level as the January born, the overall percentage of students meeting Grade 4 reading standards would increase by 4%, from 75% to 79%. In numeracy, there would be a 5% increase, from 73% to 78%.

If all nine-year olds in every cohort progress at the same rate as the January 1995 cohort, an additional 1,758 students each year would achieve on-time success in Grade 4 Reading and 1,864 would achieve on-time success in Grade 4 Numeracy. We can conclude that these students are not succeeding in the current school structure simply because they are not as mature as their older classmates, not because they lack the innate ability to meet these standards.

Ministry data show that Foundation Skills Assessment scores can help serve as an early warning about which students may be at risk of not graduating.¹⁷ For example, for all students enrolled in Grade 4 who did not meet expectations on the 2000 Grade 4 Reading Assessment, 68% graduated by 2008-09. For those who met or exceeded expectations, the completion rate is 90%. We suspect that younger students who did not meet FSA expectations are at even higher risk of not graduating, but we did not have time to carry out this analysis.

6. PERFORMANCE BY GENDER AND ABORIGINAL STATUS

In the following analysis, birthdate effects for the Class of 95 are displayed by gender and by Aboriginal status. Rather than comparing performance by birth month, in this section we compare results for those born in the first quarter of the year (Q1) with those born in the fourth quarter (Q4).

Grade Attainment

Figures 6.1 to 6.3 display on-time grade attainment -- at Grade 4, Grade 10 and Grade 12 graduation -- by gender and Aboriginal status (Table A6). The figures plot the percentage of students born in the first quarter (Q1) and those in the last quarter (Q4) who reach grade level on time. The goal of the education system is that all students reach the expected grade level on time, regardless of gender, Aboriginal status, and birthdate, so the plot lines should be high and flat.

We note that the overall success in reaching grade level drops for all groups between kindergarten and Grade 12 graduation, particularly for Aboriginal students. We also note that all plot lines have a negative slope. The negative slope indicates that the proportion of students reaching grade level on time is greater for those born in Q1 than for those born in Q4. These birthdate effects become evident for all groups in Grade 4 and continue through to graduation. The effects are evident for males and females, and for Aboriginal and non-Aboriginal students.

Overall, birthdate effects are most pronounced for Aboriginal males, followed by Aboriginal females and non-Aboriginal males. They are least pronounced for non-Aboriginal females. (see Table A6)

For Aboriginal males in 1999, 83% of those born in Q4 reached grade 4 on time, as compared to 97% of those born in Q1; this represents a 14% difference. In 2005, when they were expected to reach Grade 10, the birthdate effect grows to 19%. For non-

Figure 6.1
Percent 9 yr-olds in each birth quarter reaching grade 4 on time (1999).

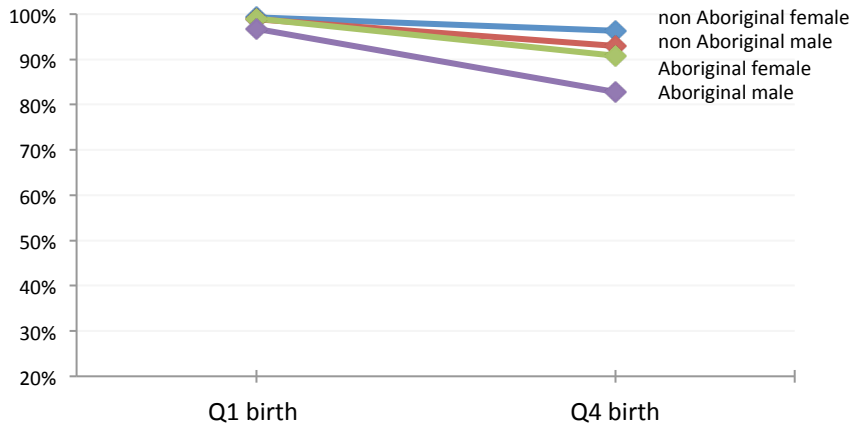


Figure 6.2
Percent 15 yr-olds reaching grade 10 on time (2005).

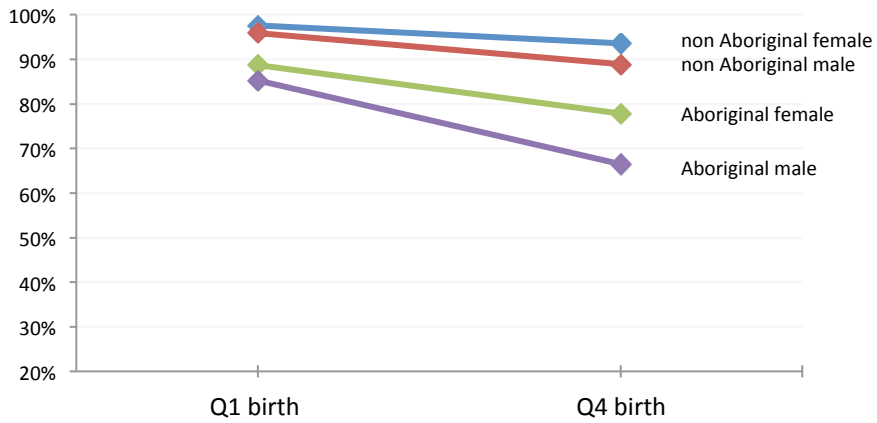
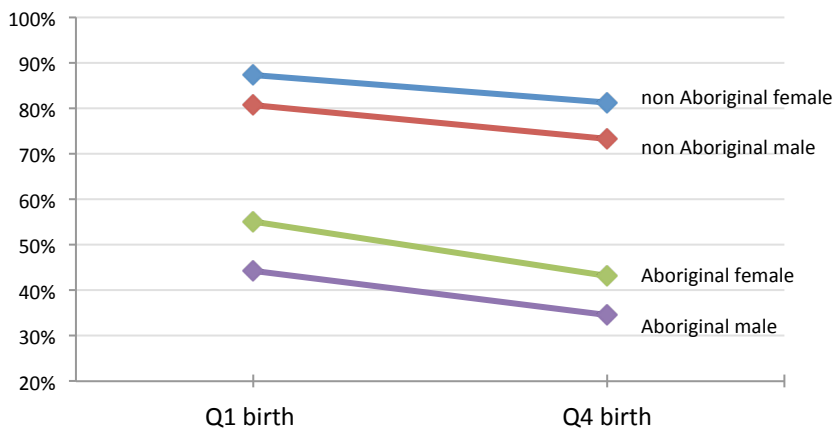


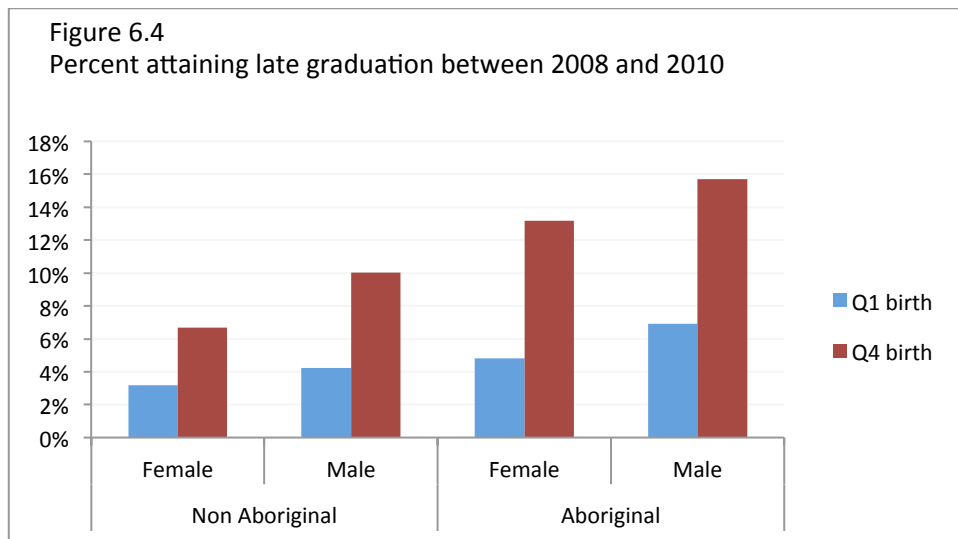
Figure 6.3
Percent in each birth quarter graduating on time. (2008)



Aboriginal females, the corresponding birthdate effects are 3% at grade 4, and 4% at grade 10.

The Q1-Q4 performance differences persist through to 2008, the target year for Grade 12 graduation. For Aboriginal males and females at this level, these birthdate effects are dwarfed by the very high non-completion rates, regardless of birthdate.

Late Graduation: Figure 6.4 identifies the percentage in each subgroup who did not meet graduation standards by June 2008 but did so between 2008 and 2010 (Table A7).



Earlier we noted that the birthdate effect for the overall cohort shrinks when we take into account those who graduated one or two years later than expected. Although it takes them longer, some of the younger students eventually do catch up with their older classmates. Here we see significant numbers of the younger students across all subgroups persisting in their studies and meeting graduation requirements by 2010. Results for Aboriginal males and females born in Q4 are noteworthy.

Some students who do not graduate from the K-12 system eventually move to the private or public post-secondary system and continue their education there. Data are not currently available for those students.

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On-time success and costs: In recent years, a number of strategies have been implemented to help improve success rates in schools. Data from this study suggests that efforts to improve student success should also closely consider the child's age and date of birth, particularly with Aboriginal students in the earlier grades.

We noted earlier that if all students in the 1995 cohort enjoyed the same success rate as those born in January, an additional 1,696 students would graduate on time, the graduate rate would increase by 4%, and annual savings of \$13.6 million would be achieved.

To extend this analysis further, consider what would happen if gender and Aboriginal differences were addressed and all students enjoyed the same success rates as the highest performing subgroup: non-Aboriginal females born in the first quarter of the year. In this scenario, an additional 3,892 students would graduate each year, the overall graduation rate would increase by 10%, and annual savings of \$31.1 million would result. As with the earlier calculation, we assume that all students who do not graduate on time go on to enrol full-time in some form of schooling for one additional year at a taxpayer cost of \$8,000 per individual. These estimates do not take into account the social and economic costs associated with low literacy levels.

Reading and Numeracy

Reading: Figures 6.5 and 6.6 display the percentage of the 1995 Cohort who meet Grades 4 and 7 FSA Reading standards on time, by gender and Aboriginal status (Tables A8, A9). Overall, females outperform males, and Aboriginal students, as a group, underperform other students.

Birthdate effects are evident across all subgroups at both grade levels. Students born in the first quarter of the year consistently outperform those born in the fourth quarter. Birthdate effects, at 8 to 10%, are similar for all subgroups, except for Aboriginal females where the effects range between 12 and 14%.

Figure 6.5
Percent meeting Grade 4 Reading standards on time, 1999-2000.

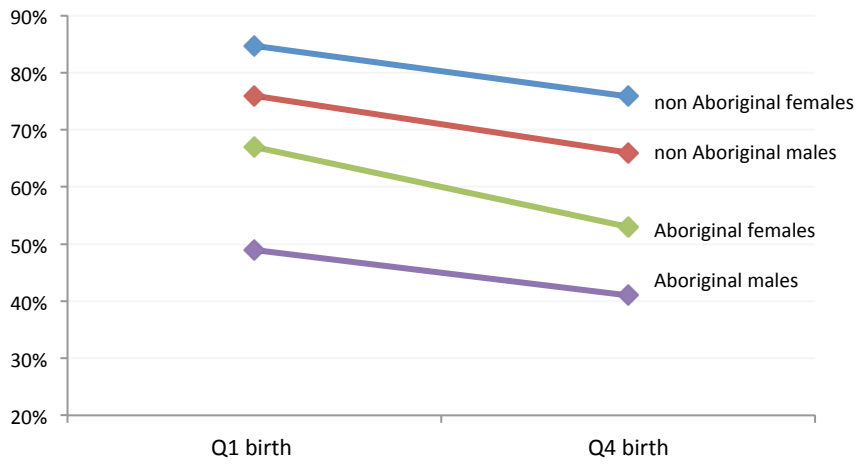
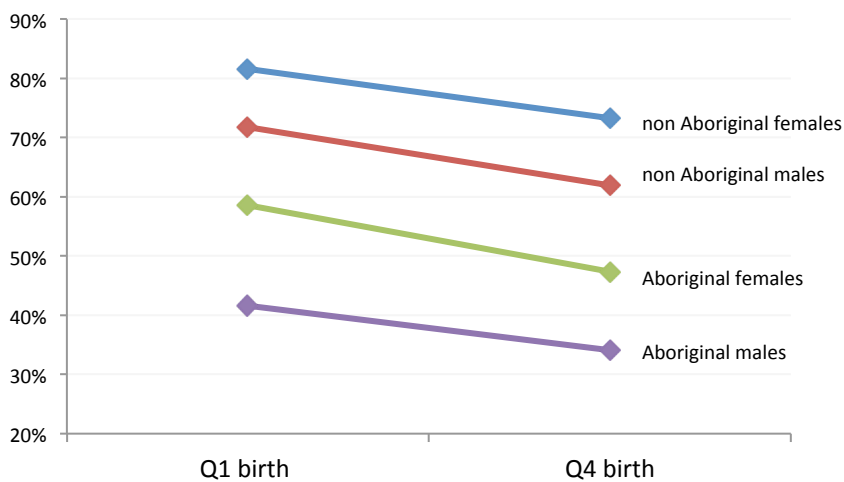


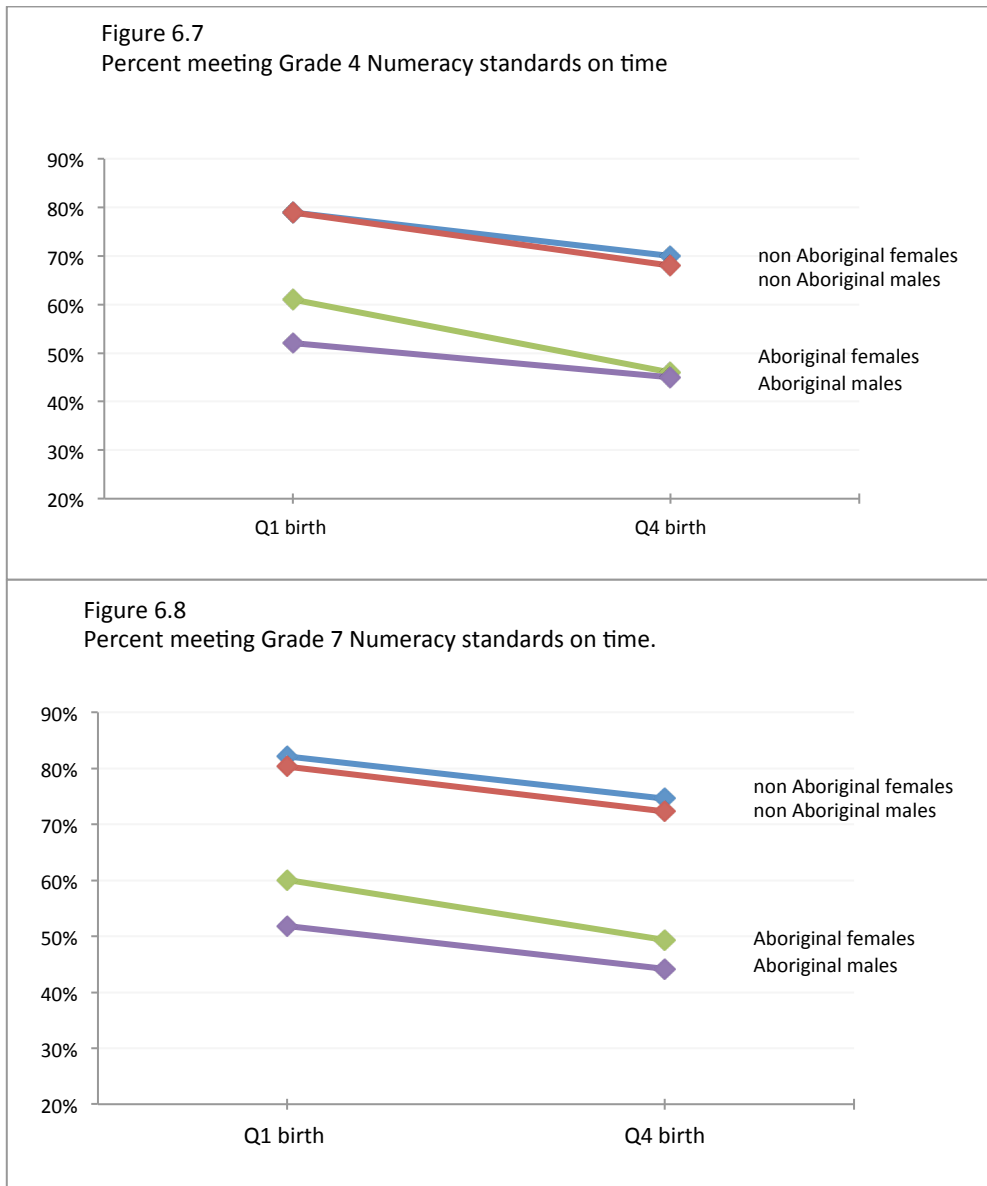
Figure 6.6
Percent meeting Grade 7 Reading standards on time, 2002-03.



Non-Aboriginal females born in the first quarter of the year score best: 85% and 82% of this subgroup meet Grades 4 and 7 Reading standards on time, respectively. Aboriginal males born in the fourth quarter have the lowest percentage meeting standards on time: 41% at Grade 4 and 34% at Grade 7.

Numeracy: Birthdate effects for Numeracy are similar to those for Reading. Figures 6.7 and 6.8 display the percentage of the 1995 Cohort who meets Grades 4 and 7 FSA Numeracy standards on time, by gender and Aboriginal status.

Overall, females outperform males, and Aboriginal students, as a group, underperform other students. Students born in the first quarter of the year consistently outperform those born in the fourth quarter. Birthdate effects range between 7% and 15%.



Birthdate effects are evident across all subgroups at both grade levels. Students born in the first quarter of the year consistently outperform those born in the fourth quarter. As

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with reading, birthdate effects in Numeracy, at 11% to 15%, are greater for Aboriginal females than for other subgroups where the range is 7% to 11%.

Non-Aboriginal males and females born in the first quarter of the year score best: 79% to 82% of these subgroups meet grade 4 and 7 Numeracy standards on time. Aboriginal males born in the fourth quarter have the lowest percentage meeting standards on time: 45% for Grade 4 and 44% for Grade 7.

Implications: As noted earlier, if all students in the 1995 Kindergarten Cohort performed at the same level as the January born, the overall percentage of students meeting Grade 4 reading standards on time would increase by 4%, from 75 to 79%. In Numeracy, there would be a 5% increase, from 73% to 78%.

In addition to birthdate effects, consider what would happen if gender and Aboriginal differences were also addressed in Grade 4 Reading and all students performed at the same level as the highest performing subgroup: non-Aboriginal females born in the first quarter of the year. In this scenario, an additional 4,843 students would meet Grade 4 reading standards on time, an increase of 11% for the cohort. In Grade 4 Numeracy, the highest performing subgroups are non-Aboriginal males and females born in the first quarter. Using these groups as a target, an additional 2,844 students would meet Numeracy standards on time, an increase of 6% for the cohort. Similar results for Reading and Numeracy are found at Grade 7.

7. DISCUSSION

The birthdate effects reported here could be viewed as the logical consequence of how schools are structured. A single cut-off date is used to admit five year olds to school, resulting in the oldest child in the kindergarten class being 20% older than the youngest. The children are then organized and taught in one-year age groupings called grades, and are expected to move in unison from one grade to the next and reach key education milestones at the same time. The data reported here, along with findings from other studies, indicate that the younger members of the cohort are less likely to meet those expectations.

This study shows that a substantial number of students, simply because they are younger and less mature than their age group, will fall behind their peers and experience the related negative academic and social consequences.

Based on the 1995 Kindergarten Cohort, younger students are 12-15% less likely than their older counterparts to meet Grade 4 and 7 reading and numeracy standards on time, and they are 12% less likely to graduate on time. These results reflect the findings of an earlier study carried out by Bedard and Dhuey who reported that the relatively youngest British Columbia students are 13% less likely to be university-bound than the relatively oldest¹⁸.

If all students enjoy the same rates of success as the January born, an additional 1,700 students would graduate on time each year. This represents a 4% increase in the on-time graduation rate and annual savings of \$14 million in operating costs. Not included in the analyses are the lost opportunity costs for individual students, and the province generally, resulting from those students who do not meet literacy standards and those who graduate late, or not at all.

It was noted at the outset of this paper that 698 children, mainly boys, who were born in the latter part of the year, started kindergarten in 1996, one year later than normal. The research literature so far appears inconclusive on the effectiveness of delaying a

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child's entry to kindergarten¹⁹. Some studies suggest that children who started school later than normal were likely to achieve at a rate comparable to age peers who entered on time. Other studies suggest that older children showed more behaviour problems.²⁰

In the United States, 38 states have moved cut-off dates for kindergarten from December 31 back to September 30²¹. In these states, children whose fifth birthdays fall in October, November or December start kindergarten in September of the following year. This policy shift is based on the view that children whose fifth birthdays fall late in the year are too young to start formal kindergarten in September when they are still four years of age. Opponents of the policy argue that increases in the age of school entry intensify socioeconomic differences in educational attainment, since lower-income children are at greater risk of dropping out of school²².

Changing the cut-off date for admission by two or three months does not change the fact that there will still be a one-year age difference in the traditional kindergarten class. We would argue that a better approach is to change the way schools organize children for instruction.

The birthdate effects reported in this study, along with the broader literature on the topic, should oblige schools to move toward a more personalized approach to instruction, one that adapts to the developmental needs of individual children. Successful approaches to organizing students for instruction, of which there may be many, would show all children having the same opportunity to achieve success, regardless of birthdate. Younger students in an age cohort should not be disadvantaged by the way schools group students for instruction.

It is worth noting that not many organizations, other than schools and children's sports teams, organize people solely on the basis of age. That said, the failed efforts in the early 1990s to shift to an ungraded primary program illustrates how difficult it is to change organizational structures that are imbedded in the province's educational culture.

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It is encouraging to see that recent discussions among educators in the province are calling for new ways to personalize educational services for children. As a start, one approach that could be considered within the current structure is to uncouple the “foundation skills” – reading, writing, numeracy -- from the traditional content-based graded system. These foundation skills would be organized in a developmental structure, from basic to more complex, that would be used to design learning programs that align with the developmental needs of each child, independent of grade placement. The study of other school subjects, such as science, social studies and the fine arts, would continue to be organized in a graded structure.

Instructional services for these foundation skills would include up-to-date teaching methods coupled with the use of technology-based learning services tailored to the individual’s stage of development. The use of community volunteers, under the guidance of teachers and drawn especially from the well-educated population entering retirement, could provide much needed personal support, particularly for young children. The province’s highly respected “Performance Standards” would be used to assess and monitor the progress of each student and form the basis of reporting to parents. Student information systems would be modified to enable easy access to key data about each student’s progress.

No doubt, there are many other strategies that could be used to personalize learning in schools. Whatever approaches are taken, the Ministry’s student information system will be an important source of information to monitor student outcomes and to evaluate the effectiveness of new reforms.

Further research

Results for this study are based on the analysis of one cohort, the 1995 Kindergarten Cohort. Using this study as a starting point, it should be relatively straightforward to examine results for other cohorts to determine the extent of the birthdate effect across different populations over time.

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Requiring further study are the performance patterns of two groups of students. The first is the group of 698 children, mainly boys, whose entry to kindergarten was delayed for one year to 1996.

The second group of students requiring analysis of birthdate effects are those who left secondary school and did not return to complete their graduation requirements in the K-12 system. Based on census data, it appears that some of these young men and women eventually chose other educational options available in the postsecondary system to complete Grade 12 equivalency, or simply chose to ignore graduation formalities and enrolled directly in public or private postsecondary career programs. Still others did not continue their schooling. Does the birthdate effect surface in these important life decisions?

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8. TABLES

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Table A9

Percent of Cohort 95 meeting Grade 7 Reading and Numeracy standards on time

Table A1
Distribution of 1990 births and 1995 Kindergarten Cohort, by month

	1990 live births British Columbia*		1995 Kindergarten Cohort**	
	N	%	N	%
Jan	3758	8.3%	3948	8.4%
Feb	3450	7.6%	3596	7.7%
Mar	3995	8.8%	4238	9.0%
Apr	3933	8.7%	4127	8.8%
May	4217	9.3%	4460	9.5%
Jun	3878	8.6%	4025	8.6%
Jul	3893	8.6%	4097	8.7%
Aug	3868	8.5%	4083	8.7%
Sep	3696	8.2%	3868	8.2%
Oct	3650	8.1%	3722	7.9%
Nov	3536	7.8%	3532	7.5%
Dec	3459	7.6%	3272	7.0%
Total	45333	100%	46968	100%

* Ministry of Health

** The 1995 Kindergarten Cohort is defined as those children born in 1990 who enrolled in BC kindergarten in the school year 1995-1996. This includes children born elsewhere who migrated to the province.

Table A2
1995 Cohort: Progression from Kindergarten to Graduation

School Year	1995 Cohort Age ¹	Expected Grade	Kindergarten enrolment	Left BC system	Enrolled in BC schools	Below expected grade level	Enrolled at expected grade	Enrolled above grade	Grade unknown
1995-1996	5	Kindergarten	46,968	0	46,968	0	46,968	0	0
1999-2000	9	4		3,420	43,548	1,159 (2.6%) ²	41,967 (96.4%)	150 (.3%)	272 (.6%)
2002-2003	12	7		4,545	42,423	1,374 (3.2%)	40,593 (95.7%)	215 (.5%)	241 (.6%)
2005-2006	15	10		5,267	41,349	2,725 (6.5%)	38,381 (92%)	243 (.6%)	352 (.8%)
2007-2008	17	12		7,170	39,798	5,473 (13.8%)	33,971 (85.4%)	unknown	354 (0.9%)
2008-2009 Graduation	18	Graduation		--	--	8,875 (22.5%) ²	30,569 (77.5%) ²	--	--
2009-2010 Graduation (2 yrs late)	20	Graduation		--	--	6,577 (16.6%) ²	32,887 (83.4%) ³	--	--

¹ The student reaches this age in the calendar year when school year begins.

² Percentages expressed in relation to Enrolment in BC schools for that year. For graduation years 2008 and 2010 percentages are expressed in relation to school enrolment for 2007-2008.

³ Actual graduation rate for the cohort is higher as some students not completing graduation on time in K-12 system move on to complete graduation equivalency at regional colleges; data for those students are not available.

Table A3:
Percent of 1995 Cohort reaching grade level on time.

	January birth			December birth			Birthdate effect
	N	At grade level	%	N	At grade level	%	Jan – Dec
K (1995)	3948	3948	100.0%	3272	3272	100.0%	0.0%
Gr 4 (1999)	3646	3619	99.3%	2997	2712	90.5%	8.8%
Gr 7 (2002)	3562	3522	98.9%	2915	2600	89.2%	9.7%
Gr 10 (2005)	3482	3332	95.7%	2862	2458	85.9%	9.8%
Gr 12 (2007)	3247	2891	89.0%	2763	2192	79.3%	9.7%
Grad (2007-2008)	3247	2656	81.8%	2763	1940	70.2%	11.6%
Late Grad (2009-2010)	3247	2779	85.6%	2763	2263	81.9%	3.7%

¹ Excludes children who are home-schooled and students in ungraded programs.

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Table A4
Percent of 1995 Cohort meeting reading standards on time, by birth month.

Grade 4 FSA (1999-2000)					Grade 7 FSA (2002-03)				
	N	Meets standards	%	Birthdate effect (Jan%-specified month%)		N	Meets standards	%	Birthdate effect (Jan%-specified month%)
Jan	3646	2868	78.7%	0%	Jan	3562	2679	75.2%	0%
Feb	3336	2610	78.2%	.4%	Feb	3247	2386	73.5%	1.7%
Mar	3909	3055	78.2%	.5%	Mar	3818	2816	73.8%	1.5%
Apr	3790	2930	77.3%	1.4%	Apr	3712	2719	73.2%	2.0%
May	4143	3222	77.8%	.9%	May	4009	2916	72.7%	2.5%
Jun	3730	2844	76.2%	2.4%	Jun	3639	2652	72.9%	2.3%
Jul	3778	2803	74.2%	4.5%	Jul	3675	2594	70.6%	4.6%
Aug	3757	2780	74.0%	4.7%	Aug	3659	2539	69.4%	5.8%
Sep	3525	2560	72.6%	6.0%	Sep	3430	2378	69.3%	5.9%
Oct	3413	2405	70.5%	8.2%	Oct	3326	2201	66.2%	9.0%
Nov	3252	2239	68.8%	9.8%	Nov	3190	2081	65.2%	10.0%
Dec	2997	1968	65.7%	13.0%	Dec	2915	1832	62.8%	12.4%

¹ Excludes children who are home-schooled and students in ungraded programs.

Table A5
Percent of 1995 Cohort meeting numeracy standards on time, by birth month.

Numeracy									
Grade 4 FSA (1999-2000)					Grade 7 FSA (2002-03)				
	N	Meets standards	%	Birthdate effect (Jan%-specified month%)		N	Meets standards	%	Birthdate effect (Jan%-specified month%)
Jan	3646	2827	77.5%	0%	Jan	3562	2832	79.5%	0%
Feb	3336	2570	77.0%	0.5%	Feb	3247	2557	78.7%	0.8%
Mar	3909	2983	76.3%	1.2%	Mar	3818	3001	78.6%	0.9%
Apr	3790	2887	76.2%	1.4%	Apr	3712	2906	78.3%	1.2%
May	4143	3181	76.8%	0.8%	May	4009	3155	78.7%	0.8%
Jun	3730	2797	75.0%	2.6%	Jun	3639	2801	77.0%	2.5%
Jul	3778	2782	73.6%	3.9%	Jul	3675	2807	76.4%	3.1%
Aug	3757	2718	72.3%	5.2%	Aug	3659	2727	74.5%	5.0%
Sep	3525	2494	70.8%	6.8%	Sep	3430	2562	74.7%	4.8%
Oct	3413	2363	69.2%	8.3%	Oct	3326	2413	72.5%	7.0%
Nov	3252	2197	67.6%	10.0%	Nov	3190	2282	71.5%	8.0%
Dec	2997	1892	63.1%	14.4%	Dec	2915	1973	67.7%	11.8%

¹ Excludes children who are home-schooled and students in ungraded programs.

Table A6
Percent reaching expected grade level on time.

9 year-olds: Grade 4, 1999

		Q1 birth			Q4 birth			Birthdate effect
		N	on time	%	N	on time	%	Q1 - Q4
Non-Aboriginal	Female	4,787	4,755	99.3%	4,274	4,116	96.3%	3.0%
	Male	4,966	4,912	98.9%	4,272	3,971	93.0%	6.0%
Aboriginal	Female	593	587	99.0%	619	562	90.8%	8.2%
	Male	629	608	96.7%	581	481	82.8%	13.9%

15 year-olds: Grade 10, 2005

		Q1 birth			Q4 birth			Birthdate effect
		N	on time	%	N	on time	%	Q1-Q4
Non-Aboriginal	Female	4,565	4,453	97.5%	4,090	3,827	93.6%	4.0%
	Male	4,741	4,546	95.9%	4,058	3,608	88.9%	7.0%
Aboriginal	Female	532	472	88.7%	573	446	77.8%	10.9%
	Male	558	476	85.3%	540	359	66.5%	18.8%

18 year-olds: Graduation, 2008

		Q1 birth			Q4 birth			Birthdate effect
		N	on time	%	N	on time	%	Q1 - Q4
Non-Aboriginal	Female	4,346	3,797	87.4%	3,973	3,226	81.2%	6.2%
	Male	4,452	3,590	80.6%	3,928	2,878	73.3%	7.4%
Aboriginal	Female	479	264	55.1%	547	236	43.1%	12.0%
	Male	493	218	44.2%	490	169	34.5%	9.7%

Table A7
Percent attaining late graduation over the period 2009 – 2010.

		Q1 birth			Q4 birth		
		N	late grad	%	N	late grad	%
Non Aboriginal	Female	4346	139	3.2%	3973	265	6.7%
	Male	4452	189	4.2%	3928	394	10.0%
Aboriginal	Female	479	23	4.8%	547	72	13.2%
	Male	493	34	6.9%	490	77	15.7%

Table A8
Percent of 1995 Cohort meeting Grade 4 Reading and Numeracy standards on time.

Reading - Grade 4

		Q1 birth			Q4 birth			Birthdate effect Q1-Q4
		N	Meets standards	%	N	Meets standards	%	
Non-Aboriginal	Female	4,787	4,053	84.7%	4,274	3,240	75.8%	8.9%
	Male	4,966	3768	75.9%	4,272	2801	65.6%	10.3%
Aboriginal	Female	593	396	66.8%	619	329	53.2%	13.6%
	Male	629	308	49.0%	581	238	41.0%	8.0%

Numeracy - Grade 4

		Q1 birth			Q4 birth			Birthdate effect Q1-Q4
		N	Meets standards	%	N	Meets standards	%	
Non-Aboriginal	Female	4,787	3,785	79.1%	4,274	2,980	69.7%	9.3%
	Male	4,966	3,900	78.5%	4,273	2,922	68.4%	10.2%
Aboriginal	Female	593	364	61.4%	620	287	46.3%	15.1%
	Male	629	325	51.7%	581	259	44.6%	7.1%

¹ Excludes children who are home-schooled and students in ungraded programs.

Table A9
Percent of 1995 Cohort meeting Grade 7 Reading and Numeracy standards on time.

Reading - Grade 7

		Q1 birth			Q4 birth			Birthdate effect Q1-Q4
		N	Meets standards	%	N	Meets standards	%	
Non-Aboriginal	Female	4,672	3,812	81.6%	4,167	3,053	73.3%	8.3%
	Male	4,836	3,472	71.8%	4,165	2,579	61.9%	9.9%
Aboriginal	Female	579	339	58.5%	606	287	47.4%	11.2%
	Male	612	255	41.7%	566	193	34.1%	7.6%

Numeracy - Grade 7

		Q1 birth			Q4 birth			Birthdate effect Q1-Q4
		N	Meets standards	%	N	Meets standards	%	
Non Aboriginal	Female	4,672	3,838	82.1%	4,167	3,106	74.5%	7.6%
	Male	4,837	3,884	80.3%	4,165	3,011	72.3%	8.0%
Aboriginal	Female	579	348	60.1%	606	299	49.3%	10.8%
	Male	612	317	51.8%	566	250	44.2%	7.6%

¹ Excludes children who are home-schooled and students in ungraded programs.

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9. END NOTES

¹ Roger H. Barnsley and A.H. Thompson, "Birthdate and success in minor hockey: The key to the NHL," *Canadian Journal of Behavioural Science*, 1988, 20, 167-176.

² Werner Helsen, Jan Vanwinckel, and A. Mark Williams, "The relative age effect in youth soccer across Europe," *Journal of Sports Sciences*, June 2005; 23(6): 629-636.

See also: Malcolm Gladwell, *Outliers. The Story of Success*. (Little, Brown and Company, New York, 2008), 15-34.

³ Kelly Bedard and Elizabeth Dhuey, "The Persistence of Early Childhood Maturity: International Evidence of Long-Run Age Effects," *Quarterly Journal of Economics*, 2006, 121(4): 1437-1472.

⁴ Bjarne Strom, "Student achievement and birthday effects," CESifo-Harvard University Conference on Schooling and Human Capital in the Global Economy: Revisiting the Equity-Efficiency Quandary, Munich, September 3-4, 2004.

⁵ Claire Crawford, Lorraine Dearden and Costas Meghir, "When You Are Born Matters: The Impact of Date of Birth on Child Cognitive Outcomes in England," The Institute for Fiscal Studies, Working Paper W10/06, April 2010.

⁶ Elizabeth D.A. Sykes, John F. Bell, Carmen Vidal Rodeiro, "Birthdate Effects: A Review of the Literature from 1990-on," Unpublished paper, University of Cambridge, February 2009.

⁷ Todd Elder, "The Importance of Relative Standards in ADHD Diagnoses: Evidence Based on a Child's Date of Birth," *Journal of Health Economics*, 2010, 29(5): 641-656.

⁸ Elizabeth Dhuey and Stephen Lipscomb, "What Makes A Leader? Relative Age and High School Leadership," *Economics of Education Review*, 2008 27(2), 173-183.

⁹ See also:

Qianqian Du, Huasheng Gao and Maurice D. Levi, "Born Leaders: The Relative-Age Effect and Managerial Success", Sauder School of Business, University of British Columbia, 2008.

Angus H. Thompson, Roger H. Barnsley and James Battle, "The relative age effect and the development of self-esteem," *Educational Research*, Vol. 46, No.3, Winter 2004.

¹⁰ British Columbia Royal Commission on Education, *A Legacy for Learners* (Province of British Columbia. Queen's Printer, 1988).

¹¹ Anthony Brummet, "Policy Directions. A Response to the Sullivan Royal Commission on Education by the Government of British Columbia". Ministry of Education, Victoria, British Columbia, January 1989.

¹² Jerry Mussio was the Ministry's director of policy during the period of the Royal Commission. Observations also based in part on communications with Thomas Fleming, member of the 1988 Royal Commission, and Barry Anderson, a senior Ministry official at the time.

¹³ British Columbia Ministry of Health, "Vital Events-Related Statistics, 1990" (Table 2: Live Births, Deaths, Marriages and Stillbirths by Month), p.16.

¹⁴ "Measuring Up: Canadian Results of the OECD PISA Study, 2009 First Results for Canadians Aged 15," Statistics Canada 2010.

¹⁵ Foundation Skills Assessment, Reports, February 2010, British Columbia Ministry of Education.
www.bced.gov.bc.ca/reports/pdfs/fsa/prov.pdf

¹⁶ Geoff Bowlby, "Provincial Drop-out Rates -- Trends and Consequences", Labour Force Survey, Statistics Canada, December 2008.

¹⁷ Ministry of Education, Internal note, April 2011.

¹⁸ Bedard and Dhuey, "The Persistence of Early Childhood Maturity ...

¹⁹ Illinois Early Learning Project. What are the effects of academic redshirting?
<http://illinoisearlylearning.org/faqs/redshirting.htm> April 15, 2011.

²⁰ Elizabeth Gaue and James DiPerna, Redshirting and early retention: Who gets the "gift of time" and what are its outcomes? *American Educational Research Journal*, 37(2), 509-34, 2000.

²¹ Winnie Hu, "Too Young for Kindergarten? Tide Turning Against 4-Year-Olds", *New York Times*, May 28, 2011.

²² David Deming & Susan Dynarski, "The Lengthening of Childhood," *Journal of Economic Perspectives*, American Economic Association, vol. 22(3), pages 71-92, Summer 2008.