

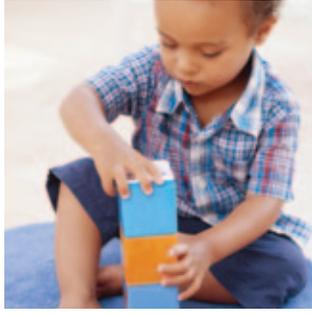
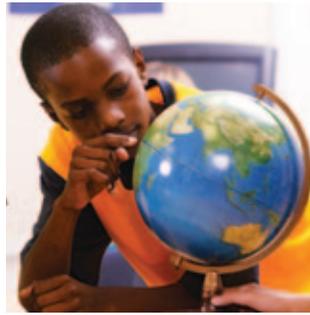
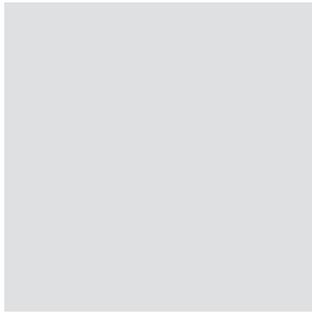
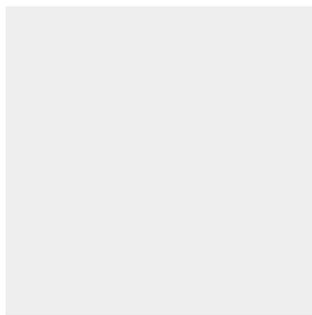
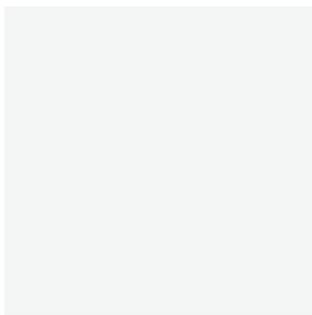
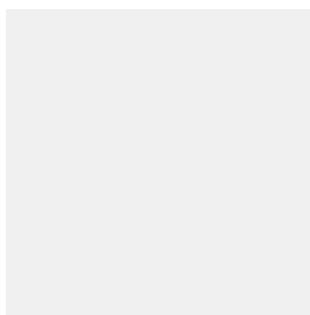
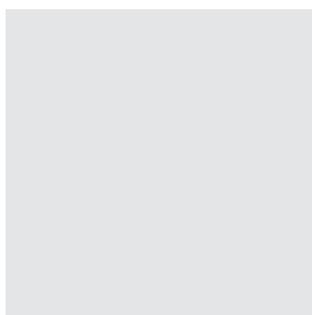
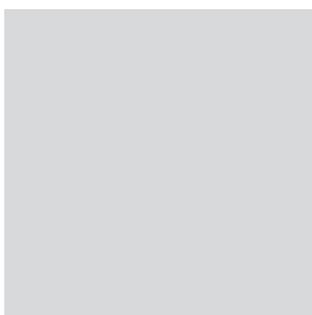
Starting Early: Teaching, Learning and Assessment

Linking early-childhood development with academic outcomes—a detailed look

Report prepared for the
Education Quality and Accountability Office (EQA) by

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About the Education Quality and Accountability Office

The Education Quality and Accountability Office (EQAO) is an independent provincial agency funded by the Government of Ontario. EQAO's mandate is to conduct province-wide tests at key points in every student's primary, junior and secondary education and report the results to educators, parents and the public.

EQAO acts as a catalyst for increasing the success of Ontario students by measuring their achievement in reading, writing and mathematics in relation to *Ontario Curriculum* expectations. The resulting data provide a gauge of quality and accountability in the Ontario education system.

The objective and reliable assessment results are evidence that adds to current knowledge about student learning and serves as an important tool for improvement at all levels: for individual students, schools, boards and the province.

About EQAO Research

EQAO undertakes research for two main purposes:

- to maintain best-of-class practices and to ensure that the agency remains at the forefront of large-scale assessment and
- to promote the use of EQAO data for improved student achievement through the investigation of means to inform policy directions and decisions made by educators, parents and the government.

EQAO research projects delve into the factors that influence student achievement and education quality, and examine the statistical and psychometric processes that result in high-quality assessment data.



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Purpose

This report presents detailed information and insights obtained from a research study in which the Education Quality and Accountability Office (EQAO) linked students' Early Development Instrument assessment results in kindergarten (Janus et al., 2007) to their provincial reading, writing and mathematics assessment results in Grade 3. An abbreviated version of this research can be found in the EQAO Research section at www.eqao.com.

“ The scientific evidence—ranging from behavioral genetics and neuroscience to policy analysis and intervention research—on the significant developmental impacts of early experiences, caregiving relationships, and environmental threats is incontrovertible. Virtually every aspect of early human development, from the brain's evolving circuitry to the child's capacity for empathy, is affected by the environments and experiences that are encountered in a cumulative fashion, beginning early in the prenatal period and extending throughout the early childhood years. ”

(Shonkoff and Phillips, 2000)

“ A child's early development is sensitive to socio-economic and environmental factors that contribute to inequalities in health, education and life. Comprehensive population-based assessments combined with other data can guide the creations of responsive public policies. ”

(McCain, Mustard and Shanker, 2007)



Effective teaching ensures the steady progress of all students, regardless of their starting point. Information about the early development of children who are entering the school system can provide important insights on how to structure programs and supports that will give all students the best possible start.

The Early Years

The substantive impact of early-life experiences on child development has been well documented in many studies over the years and across many different cultures and countries (Shonkoff and Phillips, 2000; OECD, 2006).

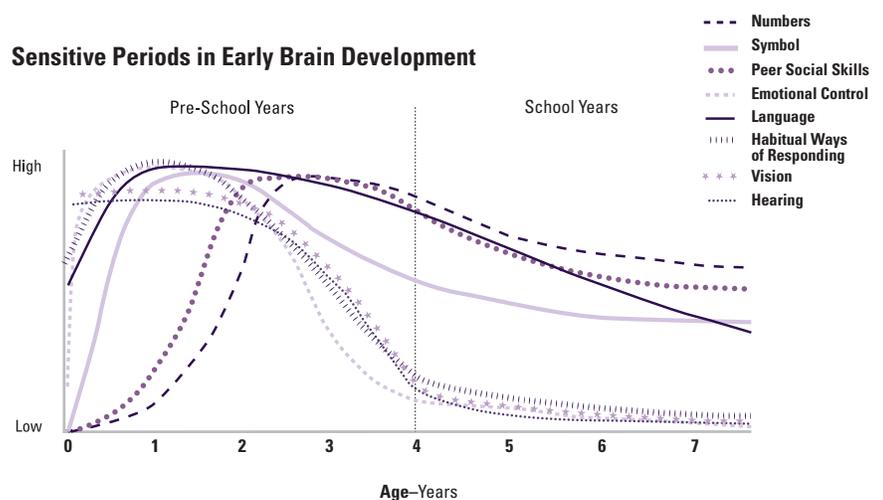
In Canada, two major studies (*Early Years Study: Reversing the Real Brain Drain, 1999* and *Early Years Study 2: Putting Science into Action, 2007*) have served not only to draw together research from many sources documenting the life-long impact of early-childhood experiences, but also to explain from a biological perspective how and why these early experiences shape the behaviour, health and learning capacities of our youth.

The relatively new field of epigenetics¹ has revealed that our genetic makeup is subject to modification based on experience and that brain development, or the neural wiring that takes place in the first few years of life, has life-long consequences in terms of behaviour, health and learning capacity. Science has developed to the point that we not only know that early-childhood stimulation is important, particularly during sensitive periods in brain development, but we can document precisely how this early stimulation affects neural pathways and, technically speaking, “genome functioning,” sometimes thought of as control switches that turn genes on or off. By providing nurturing and stimulating early-childhood experiences, we can significantly enhance genome functioning, thereby optimizing children’s learning capabilities.

Even more remarkable is the evidence that changes in genome function, affected by these early-life experiences, can be passed from one generation to the next. The old “nature-nurture” paradigm is now based on a new scientific understanding of the human genome. We are not simply the sums of the DNA that we inherit from our parents. Early-life experience impacts how our genome works. We can now measure these effects and we can modify them. (See McCain, Mustard and Shanker, 2007 for a more detailed review.)

Figure 1 depicts the sensitive periods of brain development. It suggests that the first two years of life are highly critical for developing vision and hearing capacity. It also indicates that areas pertaining to language, peer social skills and numbers have a longer sensitivity or brain plasticity period.

Figure 1



Graph developed by Council for Early Child Development (ref. Nash, 1997. *Early Years Study, 1999*. Shonkoff, 2000)

¹ Epigenetics can be defined as chromosome-based processes that control the expression of genes and that do not involve changes to the DNA sequence per se. In other words, epigenetics explains at the molecular level how nurturing and early-life environment interact with our static DNA genetic code. This new field provides us with an exciting new vantage point for understanding the connection between neural pathways and behaviour.

Integrated Preschool and Intensive Early-Years School Programs Make a Difference

An understanding of the importance of the early years has prompted a myriad of studies evaluating the impact of early interventions on child development, educational attainment and other short- and long-term outcomes of a social, economic and educational nature. Of particular interest are several longitudinal studies conducted over the past 20 years that have documented the positive effects of early-intervention programs on later educational attainment. These have included the Chicago Longitudinal Study of children ages three to nine, which offered child-parent centres in or near public elementary schools, and the Perry Preschool Project, which provided integrated preschool programs for three- and four-year-old African-American children born in poverty. Both studies documented higher levels of educational attainment for children who participated than for those in comparison groups (McCain et al., 2007).

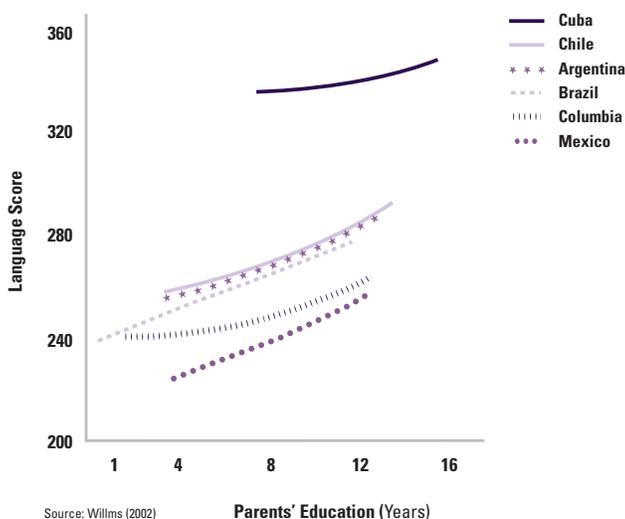
In addition, the landmark Abecedarian Project in North Carolina studied four cohorts of poor children who were randomly assigned as infants to an early-intervention educational group or a control group. Children's progress was monitored over time with follow-up studies conducted at ages 12, 15 and 21. Children

who participated in the early-intervention program had higher cognitive test scores from the toddler years to age 21, attained higher-level reading and math skills from the primary grades through young adulthood, and completed more years of education. The investigators also concluded that enhanced language development among the early-intervention group was instrumental in raising cognitive test scores (retrieved from: <http://projects.fpg.unc.edu/~abc/#home>).

Finally, and perhaps most dramatic of all, is the naturalistic cross-country comparison of Latin American countries that found that Cuba ranked highest in literacy and mathematics (Willms, 2002). The language data, which are paralleled by the mathematics data, are shown in Figure 2.

Figure 2

Sociocultural Gradients for Language Scores by Country





McCain et. al. 2007 accounted for these findings by noting that:

“ . . . Cuba introduced health, nutrition, and immunization programs for mothers and young children more than 30 years ago and also . . . a network of . . . child care centres for working mothers based on extensive research . . . The centres were so successful in promoting children’s early language development and literacy that . . . by the end of the century, 99% of young children and their families were taking part. In contrast, only 12% of Mexican children attend preschool. ” (p. 44)

In keeping with the above, Willms (2002) noted that Cuba’s Minister of Education attributed the country’s remarkable success first and foremost to the country’s early-childhood care centres.

Shonkoff and Phillips (2000), in their extensive child development literature review, acknowledged the remarkable importance of the early years and the preschool period in particular. They also argued, however, that while stimulating preschool experiences can have a powerful impact, they do not guarantee later success nor is there a sharp demarcation point as to when interventions can successfully compensate for lack of early-childhood stimulation.

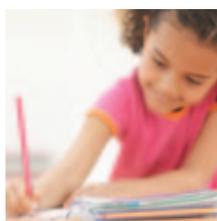
“ The early years of life are an important time of active development, foundation building, and clear periods of reorganization. There is, however, no sharp break at age 3 (or 5), and there is no scientific reason to believe that the behavioral consequences of negative early experiences cannot be ameliorated by interventions initiated in later childhood, or that positive early experiences provide permanent protection against later adversity. ” (p. 412)

Public Policy Response to Early-Years Research

The recognition of the importance of a child's early-life experiences has prompted governments to reconsider the services being offered to young children and their families. Recently, in a report commissioned by the Ontario government, Pascal (2009) cited the following rather alarming statistic.

“More than one in four children who enter Grade 1 are significantly behind their peers. Many never close the gap and go on to be disruptive in school, fail to graduate, and are unable to fully participate in and contribute to society. Ontario cannot adequately address the challenges of the new millennium while leaving a quarter of its children behind. We need to start earlier and do a better job of supporting children's learning.”
(Summary of the Report to the Premier by the Special Advisor on Early Learning)

Following a comprehensive review of the early-years literature and consultation with a wide array of early-childhood stakeholders, Pascal created a blueprint for addressing the needs of young children in Ontario through a series of 18 recommendations. The report, *With Our Best Future In Mind: Implementing Early Learning in Ontario*, 2009, and its recommendations have been praised by both



early-childhood education experts, including Margaret McCain and Fraser Mustard, authors of the early-years studies highlighted at the beginning of this report, and by school-based practitioners.

The Ontario government also responded positively to the recommendations and committed to improving the integration and delivery of services offered through its Best Start Centres for preschoolers and to implementing full-day kindergarten programs for children aged four and five. The government's full-day kindergarten implementation, begun in September 2010, included nearly 800 schools by September 2011. This program will be fully implemented in all schools by September 2014.

Ontario Early-Years Data: Collaborative Findings of EQAO and the Offord Centre, McMaster University

With more and more Ontario children starting full-day kindergarten, it is useful to consider what we know about children at this age and what this information suggests for school and teacher practice.

Since 2004, the Offord Centre for Child Studies at McMaster University has been measuring student readiness for school in schools across Ontario. Kindergarten teachers have completed the Early Development Instrument (EDI) checklist to assess children in five developmental domains: physical health and well-being, social competence, emotional maturity, language and cognitive development, and communication and general knowledge. Based on their EDI scores in each of the five EDI domains, students are classified as being *on track* or *not on track*. The *on-track* group consists of those at the top of the readiness continuum, or those who are considered *very ready*, and those in the middle of the continuum, considered *ready*. The *not-on-track* group is divided into those considered as *at risk* and, at the lowest end of the continuum, *vulnerable*.²

Group-level results of the EDI assessments, completed by teachers in senior kindergarten classes in each school once every three years, are provided to school boards and schools in addition to being used to examine student

readiness within communities and at the provincial level. These group-level data serve as a rich source of information for schools and communities.

For the past two years, with a view toward providing schools with information to assist in improvement-planning efforts, EQAO has been working in partnership with researchers from the Offord Centre to gain an enhanced understanding of the relationship between early-childhood development and the consequent pathways involved in student learning and achievement. Initial collaborative analyses have:

- provided a picture of the extent to which there are children who are *vulnerable* or *at risk* upon entering kindergarten and the particular areas of development that present the greatest challenges;
- demonstrated the importance of giving early and sustained attention to children who are *vulnerable* or *at risk* upon school entry, since the early school years provide the best opportunity of altering the academic trajectory of these students; and
- given some indication of factors that influence the academic achievement of primary school students.

The descriptive statistics that follow and that form the largest part of this report are based on a matched sample of 72 903 students aggregated over a four-year period to provide a provincial sample with broad school and board representation. Details of the matching process and variations in sampling procedures used by EQAO and the Offord Centre are provided in Appendix A. All data referenced in this report are derived from the matched sampling procedure described in Appendix A. The data are presented in three main sections:

- EDI information about Ontario kindergarten students;
- Tracking Ontario student performance; and
- Pathways to Grade 3.

² In establishing baseline data for the EDI, students who scored below the 10th percentile on a domain were assigned the designation *vulnerable* (not ready for school). Children between the 10th and 25th percentiles were considered *at risk*. Students scoring between the 25th and 75th percentiles were designated *ready* and those scoring beyond the 75th percentile were designated *very ready*.

EDI Information About Ontario Kindergarten Students in English-Language Schools

This section presents an overview of EDI results for all kindergarten students in the matched sample as well as a demographic analysis of EDI data based on gender, age, English language learner status and special education needs status.

Overview of EDI Kindergarten

Results: EDI data from the matched sample for Ontario covering the 2005–2008 period suggest that approximately 20% of students were in the *vulnerable* category in one or more domains. Throughout this report, the focus will be on students deemed to be *vulnerable* and those deemed to be *at risk* in kindergarten. Figure 3 shows the percentages of kindergarten students in the *vulnerable* or *at-risk* categories by number of low domain scores. Fifty-six percent of Ontario kindergarten students were *ready* or *very ready* in all domains. In other words, they were deemed to be *on track*. Eighteen percent were low in one domain and approximately 27% were in the *vulnerable* or *at-risk* categories in two or more of the five readiness-for-school domains.

Figure 4 shows the results by domain. It can be seen that the domain with the largest percentage of students within the *vulnerable* category was language and cognitive development (13%). This domain also had the highest percentage of students in the *at-risk* category for a total of 29% of students in the *vulnerable* and *at-risk* categories. These results are for the students in the matched sample, which is described in Appendix A.

Figure 3

Student Readiness Based on Number of Low Domain Scores

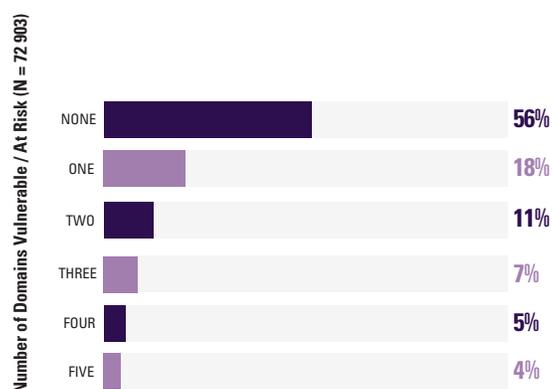
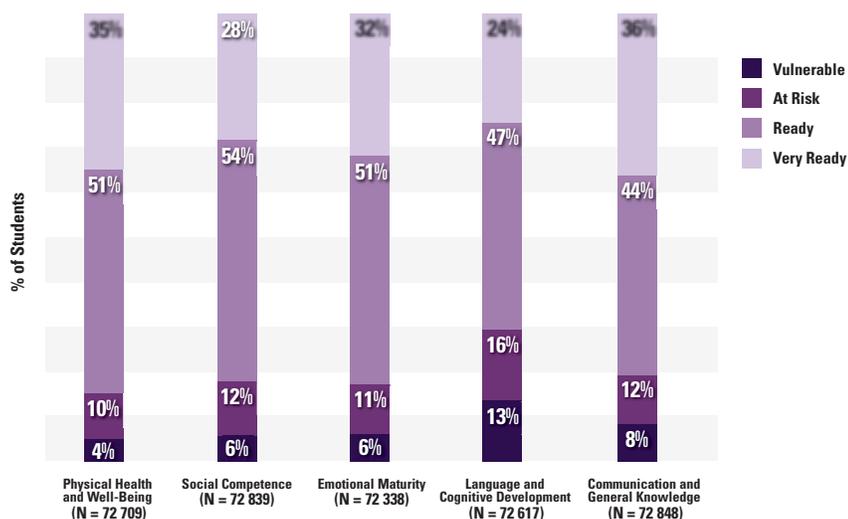


Figure 4

Student Readiness Based on EDI Scores in Five Domains



EDI Results by Gender and Age:

Further analyses revealed that there were proportionately more male kindergarten students as well as higher percentages of younger students in the *vulnerable* and *at-risk* categories across the five domains. (Age comparisons were based on birth quarter—those born in the first quarter [January to March], second quarter [April to June], etc.).

Figures 5 and 6 summarize results for gender and age, showing the percentages of students who were deemed *on track* (*ready/very ready* in all domains) or who were *not on track* (*vulnerable* or *at risk* in one or more domains) in kindergarten. Results here are startlingly clear for both gender and age. Whereas nearly two-thirds (65%) of female kindergarten students were *on track*, this was the case for less than one-half (47%) of male kindergarten students. A large disparity is also observed when age is considered, with 65% of the oldest group of kindergarten students found to be *on track* compared to 45% of those born between October and December, the youngest students.

The gender and age differences are particularly large when considering students in the *vulnerable* and *at-risk* categories in two or more domains (a 15- and 17-percentage-point gap for gender and age respectively) as compared with those *vulnerable* or *at risk* in only one domain (gaps of two to three percentage points).

Figure 5

Students On Track vs. Not On Track: By Gender

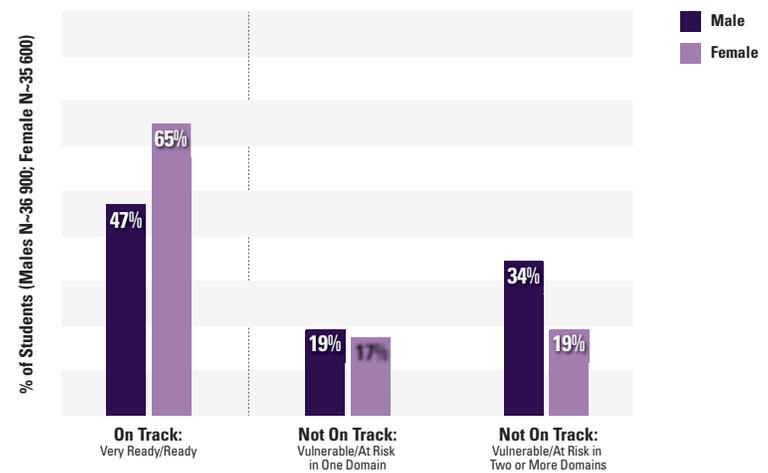
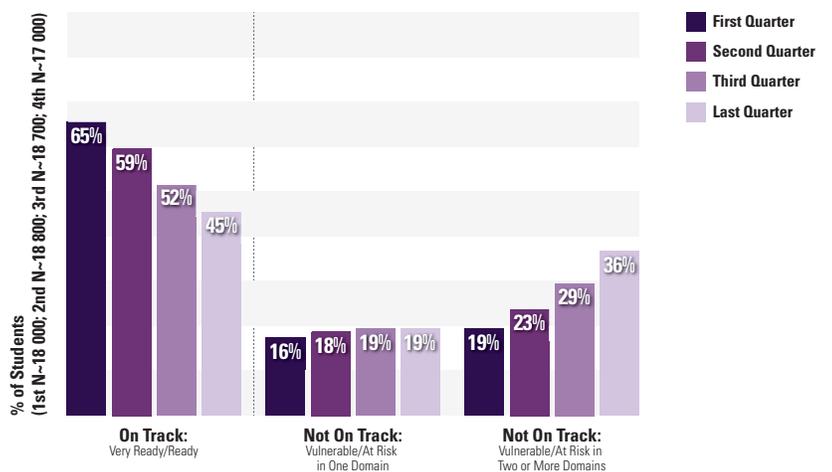


Figure 6

Students On Track vs. Not On Track: By Age (birth quarter)



Figures 7 and 8 examine gender and age gaps by domain. In examining the percentages of students who were *vulnerable* or *at risk*, the largest gaps between girls and boys were observed in the domains of emotional maturity (a 15-percentage-point gap), social competence (a 13-percentage-point gap) and language and cognitive development (a 12-percentage-point gap). The largest differences between the youngest and oldest students were for the domains of language and cognitive development (an 18-percentage-point gap) and communication and general knowledge (a 14-percentage-point gap).

Awareness of the greater incidence of vulnerability among boys and younger students serves as a reminder to pay particular attention to the development of these groups of students. Indeed, regular reviews of EDI data for children in their community may provide educators with useful insights into the strengths and challenges of students as they enter the school system. Early assessment of all kindergarten students informs individualized learning supports.

EDI Results for Students with an ELL or Special Education Needs

Background: As documented in Appendix A, students in the matched sample were deemed to be English language learners or to have special education needs based on Grade 3 EQAO records.

Figure 7

Students Vulnerable/At Risk: By Domain and Gender

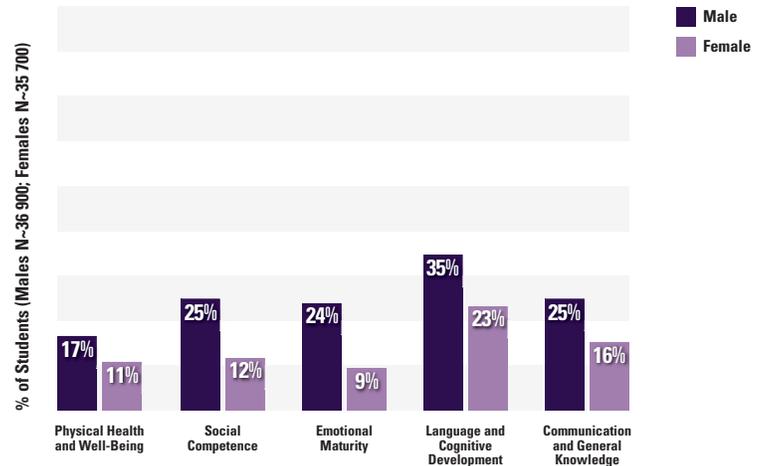
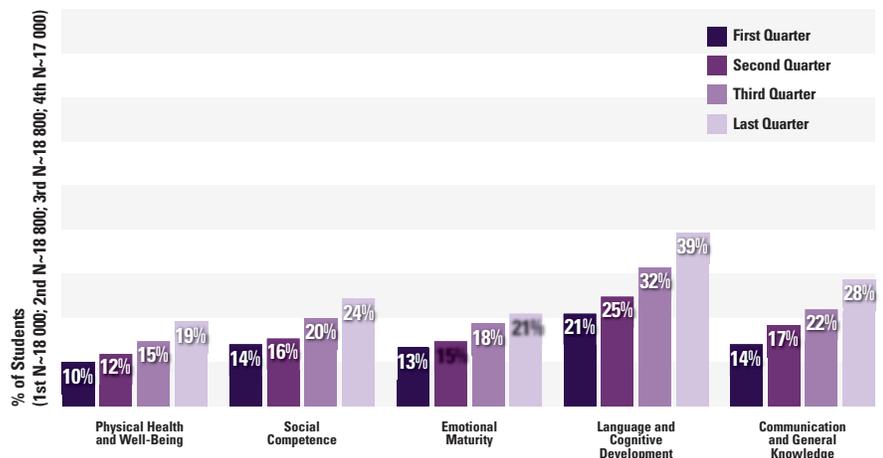


Figure 8

Students Vulnerable/At Risk: By Domain and Age (birth quarter)



In the case of students with special education needs, students whose sole exceptionality was giftedness were not included.

Also, by virtue of being in the matched sample and having been assessed with the EDI, all students within the matched sample had been in an Ontario school since kindergarten. This is of particular relevance for the ELL grouping, which is comprised of English language learners with at least three years of Ontario English language schooling; students with an ELL background but who arrived in Canada after kindergarten are not represented in the sample. Also excluded are students who were identified as ELLs in kindergarten but were no longer deemed to be in the ELL category in Grade 3.

Both English language learners and those with special education needs were more likely to fall within the *vulnerable* or *at-risk* groups than English-language speaking students or those without special education needs. As can be seen in Figure 9, only 35% of students designated as ELLs were in the *on-track* group in kindergarten as compared with 57% of English-speaking students; 44% of those in the ELL group were in the *vulnerable* or *at-risk* group in two or more domains as compared with 25% of English-speaking students.

As can be seen in Figure 10, the gap between students with special education needs and those without is particularly large—only 18% of students identified as having special education needs by the time they reached Grade 3 had been in the *on-track* group in kindergarten as compared with 61% of those who were not identified as having special education needs. That is to say, approximately four out of five students with special education needs were

Figure 9

Students On Track vs. Not On Track: By Language Background

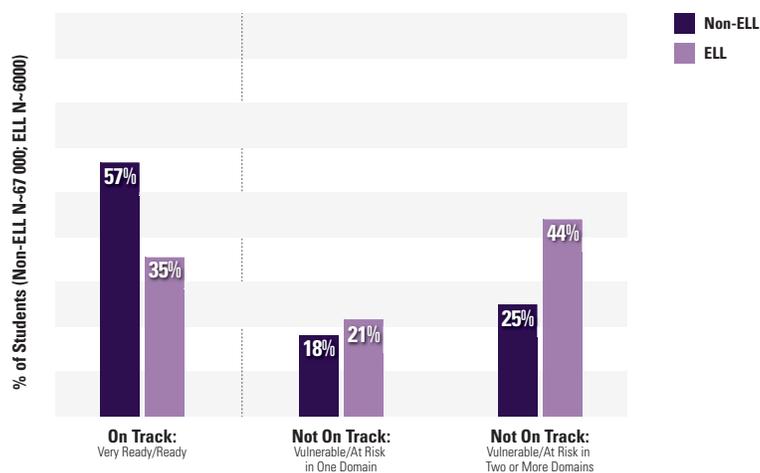
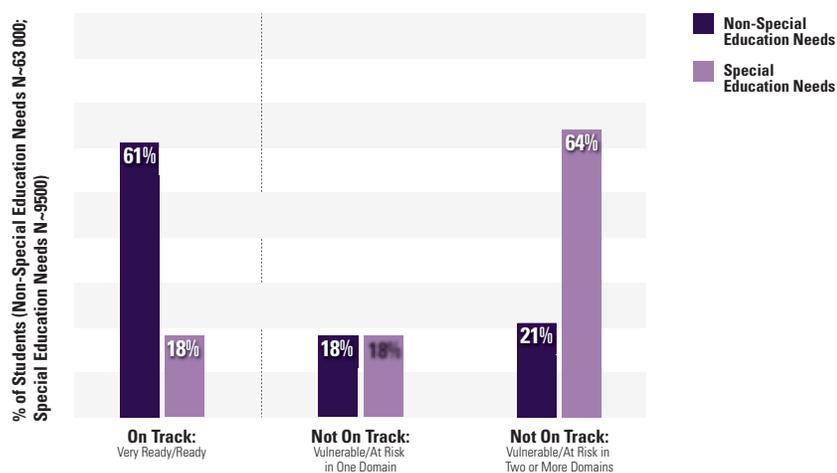


Figure 10

Students On Track vs. Not On Track: By Special Education Needs



deemed to be in the *vulnerable* or *at-risk* group in one or more domains when initially assessed in kindergarten. Almost two-thirds (64%) of students identified as having special education needs had been in the *vulnerable* or *at-risk* group in two or more domains.

In considering results by domain (Figures 11 and 12), it can be seen that the largest differences between ELLs and English-speaking students were, as one might have predicted, in the domains of communication and general knowledge (a 27-percentage-point gap) and language and cognitive development (a 21-percentage-point gap). The gaps in other domains were considerably smaller—from a low of two percentage points in the area of emotional maturity to eight points in social competence.³

The gap between those with and without a special education needs background was large in all five domains. The smallest gap (25 percentage points) was for physical health and well-being; the largest was in language and cognitive development (42 percentage points). For this latter domain, 65% of students having special education needs were in the *vulnerable* or *at-risk* category.

The data support and reinforce the current school practice of providing extra assistance to English language learners and those with special education needs.

Figure 11

Students Vulnerable/At Risk: By Domain and Language Background

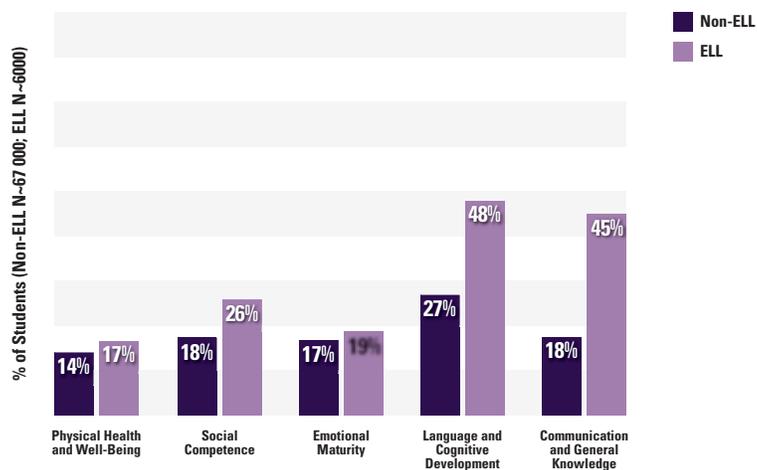
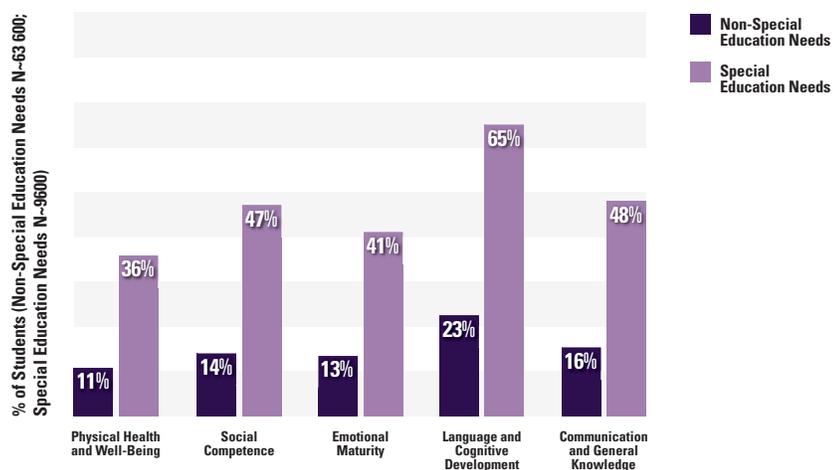


Figure 12

Students Vulnerable/At Risk: By Domain and Special Education Needs



³ These data are generally consistent with recent findings by Offord Centre researchers who looked at Canadian population data for 12 student groups, each with a different first-language background. As per the Ontario data reflected in this study's matched sample, the largest disparities between the ELL and the normative population in the cross-Canadian sample were observed for the domains of communications and general knowledge, and language and cognitive development (Janus, Duku & Hughes, 2010).

Tracking Ontario Student Performance

Based on a wide-ranging literature review, Shonkoff and Phillips (2000) concluded the following:

“ One of the most significant insights about educational attainment in recent years is that educational outcomes in adolescence and even beyond can be traced back to academic skills at school entry . . . At the same time, . . . it is important to note that children who start school lagging behind their peers in language and cognitive abilities are not doomed to be school failures and dropouts. To the contrary, early interventions can make substantial contributions to the academic skills of young children . . . Moreover, the associations found between early and later achievement leave substantial unexplained variance. This means that there is plenty of room for children to defy the odds, and many do. ” (p. 125)

students in relation to their assessed readiness in kindergarten. Students with high EDI scores in kindergarten—those deemed to be *on track*, or in the *ready* or *very-ready* categories—are much more likely to achieve the provincial standard on Grade 3 EQAO assessment than those students in the *vulnerable* or *at-risk* groups.

Figure 13 shows that whereas between 75% and 84% of students who were *on track* in kindergarten achieved the provincial standard on the Grade 3 EQAO assessment of reading, writing and mathematics, far fewer who were categorized as *not on track* did so. Among kindergarten students who were *vulnerable* or *at risk* in one domain, those achieving the provincial standard ranged from 57% in reading to 67% and 68% in writing and mathematics respectively. Of those *vulnerable/at risk* in more than one domain, the percentages fall to

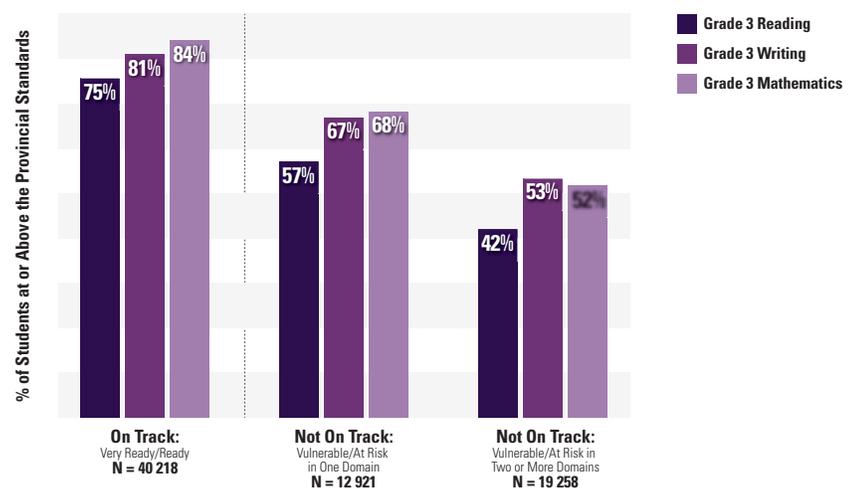
This section examines the relationship between EDI and EQAO assessment results⁴ and provides a demographic analysis of findings based on gender, age, English language learner status and students with special education need status.

Relationship between EDI and EQAO

Results: Consistent with the foregoing conclusions of Shonkoff and Phillips are the EQAO/EDI research findings pertaining to the educational attainment of Grade 3 Ontario

Figure 13

Relationship Between EDI Scores and EQAO Achievement



⁴ EQAO assessments administered to students in Grades 3 and 6 measure core reading, writing and mathematics skills based on the learning expectations set out in *The Ontario Curriculum*. The reader is referred to EQAO (2012) for a detailed description of EQAO primary and junior division assessments.

42% for reading, 53% for writing and 52% for mathematics. These figures represent an achievement gap of 14 to 18 percentage points between those *on track* on the EDI and those who were *not on track* in one domain; there was an achievement gap of 28 to 33 percentage points between those *on track* and those *not on track* on two or more domains.

At the same time, not all students who were *on track* in kindergarten—*ready* or *very ready* in all five domains—achieved the Grade 3 provincial standards. Sixteen percent of students in this group did not achieve the mathematics standard, 19% did not achieve the standard in writing and 25% did not achieve it in reading.

Readiness for school does not guarantee academic achievement. Sustained attention, ongoing assessment and support are required for all students.

It is also important to acknowledge that many students who were *not on track* in kindergarten nevertheless were able to reach the provincial standards in Grade 3. Among students deemed *vulnerable/at risk* in one domain, 57%–68% achieved the provincial standards in Grade 3; 42%–53% of those considered *vulnerable/at risk* in two or more domains also achieved the standards. These data suggest that appropriate supports and interventions during the primary school years allowed many children who were *not on track* in kindergarten to address early challenges and proceed on a positive academic trajectory.

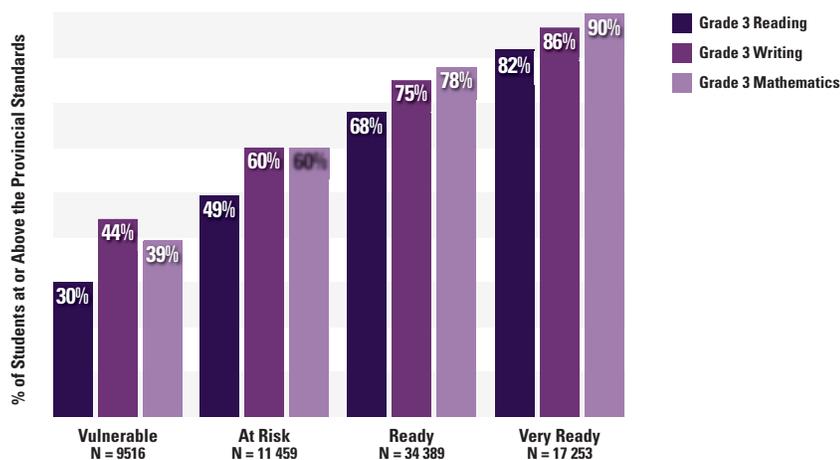
The research points to the need for early assessment, support and intervention for *vulnerable* and *at-risk* students beginning in kindergarten, if they are to close the learning gap and achieve the provincial standard in Grade 3. EDI assessment data are available to assist in the process by supplementing other forms of in-school teacher assessment.

In terms of the relationship between EDI domain scores and student achievement on Grade 3 EQAO assessment, the pattern of results is consistent with the foregoing observations based on the overall results. Students with low EDI scores in a particular domain—those in the *vulnerable* or *at-risk* groups—are much less likely to achieve the provincial standard on all components of the Grade 3 EQAO assessment than those who were deemed *ready* or *very ready* in kindergarten.

Figure 14 graphically depicts the relationship between EDI scores in the language and cognitive development domain and student achievement on the EQAO assessment. Clearly, the percentage of

Figure 14

EDI Language and Cognitive Development Domain and EQAO Achievement



students achieving the provincial standard consistently increases across the four score categories, from *vulnerable* to *very ready*. Figure 14 also demonstrates that many students in the *vulnerable* category for language and cognitive development in kindergarten “defy the odds” and are able to reach the provincial standards in Grade 3—30% achieved the standard in reading, 44% achieved it in writing and 39% achieved it in mathematics. An even higher proportion of those deemed *at risk* in this category, 49%–60%, achieved the provincial standards in Grade 3. (See Appendix B for results for all domains.)

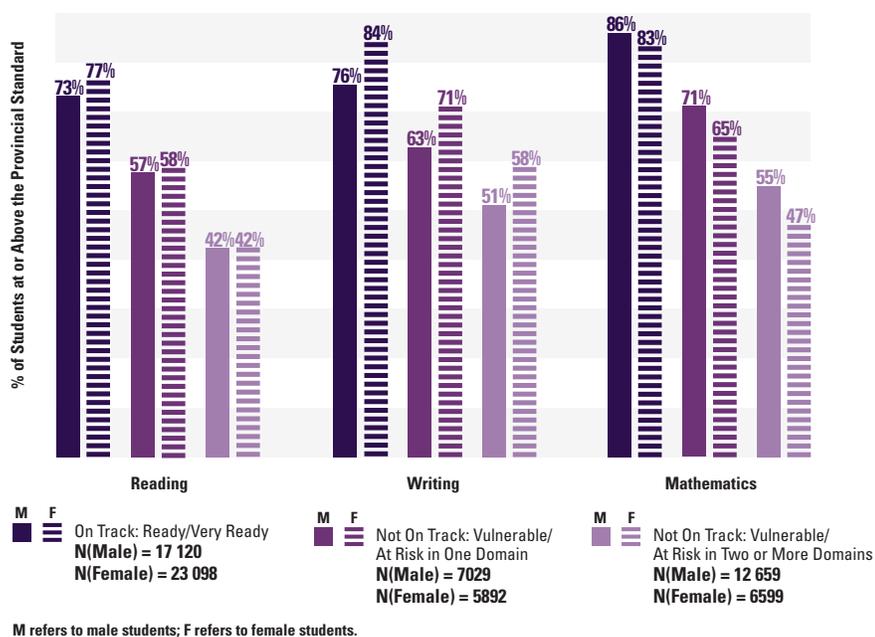
Examining the EDI-EQAO Relationship by Gender and Age:

In an earlier section, it was shown that a greater proportion of female than male students were deemed to be *on track* in kindergarten based on their EDI scores and, similarly, a greater percentage of older students were *on track* than younger students. It was further shown that gender and age differences of those *not on track* were particularly apparent when those who were *vulnerable* or *at risk* in two or more domains were examined.

What happens to these groups of students when they reach Grade 3? Figure 15 shows the achievement results for male and female students in relation to their kindergarten EDI groupings. Achievement levels are highest for both male and female students who were *on track* in kindergarten, as would be expected

Figure 15

Relationship Between EDI Scores and Grade 3 EQAO Achievement: By Gender



from the data in Figures 13 and 14. However, within this *on-track* group, there is a gap in male-female achievement favouring females in the areas of reading (four percentage points) and writing (eight percentage points). That is, not only are there more girls (23 098) than boys (17 120) *on track* in kindergarten, but by Grade 3 girls within the *on-track* group outperform boys in both reading and writing. In mathematics, the gender gap of three percentage points within the *on-track* group favours boys.

In considering those who were *not on track* in kindergarten, results show no gender gap for reading, a gender gap favouring females for writing (from seven to eight percentage points) and a gender gap favouring males for mathematics (from six to eight percentage points).

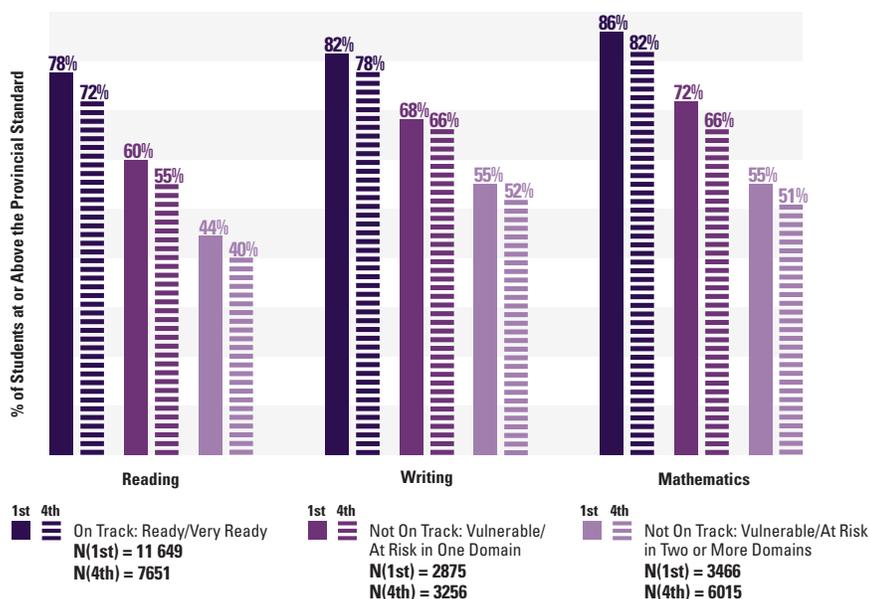
In summary, girls consistently outperform boys in writing across all three readiness groups; for reading, girls who were *on track* in kindergarten also outperform boys who were *on track*. In mathematics, although boys in all three readiness groups outperform girls, the overall percentage meeting the provincial standard in Grade 3 is slightly higher for girls than for boys. This is because of the considerably larger number of girls who were *on track* in kindergarten and the high percentage of students within the *on-track* group meeting the provincial standards.

Figure 16 shows the relationship between EDI kindergarten scores and Grade 3 achievement for older students (those born in the first quarter of the year) and younger students (those born in the last quarter). The pattern of results is consistent for both students who were *on track* in kindergarten and those who were *not on track* and across all subject areas. A higher percentage of older students consistently achieved the provincial standards than younger students. This pattern is apparent across all four birth quarters, although the figure compares only the youngest and oldest students.

For students who were *on track* in kindergarten, the achievement gap favouring older students ranges from four to six percentage points

Figure 16

Relationship Between EDI Scores and Grade 3 EQAO Achievement: By Age (based on birth quarter)



depending on subject area. The gap favouring older students is also apparent for students deemed *not on track* in kindergarten and ranges from two to six percentage points depending on subject area and/or number of domains in which students were deemed to be *vulnerable/at risk*.

In short, younger students were not only less likely to be *on track* in kindergarten, but were also less likely to achieve the provincial standards at Grade 3; this latter finding is evidenced across all three readiness groups.

Examining the EDI-EQAO Relationship by Language Background and Special Education Needs Status:

It was shown previously that both English language learners and those with special education needs were much more likely to be deemed *vulnerable/at risk* in kindergarten than other students.

Figures 17 and 18 show how these two groups fared in Grade 3 in relation to their kindergarten EDI scores.

Figure 17 demonstrates that, consistent with the general population, a larger proportion of the ELL group that was *on track* in kindergarten achieved the provincial standards than those who were *not on track*, and that this was the case across all subject areas. The greatest disparity in achievement levels between ELLs and English-speaking students is observed in reading. Differences in writing and mathematics assessments are small or non-existent across all three EDI readiness groupings.

These results suggest that English language learners who have been in the Ontario school system since kindergarten have greater difficulty achieving the provincial standard in reading than English-speaking students with a similar readiness status. The data further suggest that after three or more years in Ontario schools, ELL achievement is similar to that of English-speaking students in writing and mathematics.

Results for students with special education needs are consistent across the three EDI groupings, as shown in Figure 18. Considerably higher percentages of students without special education needs achieve the provincial standards in all three subject areas than do students with special education needs.

Figure 17

Relationship Between EDI Scores and Grade 3 EQAO Achievement: By Language Background

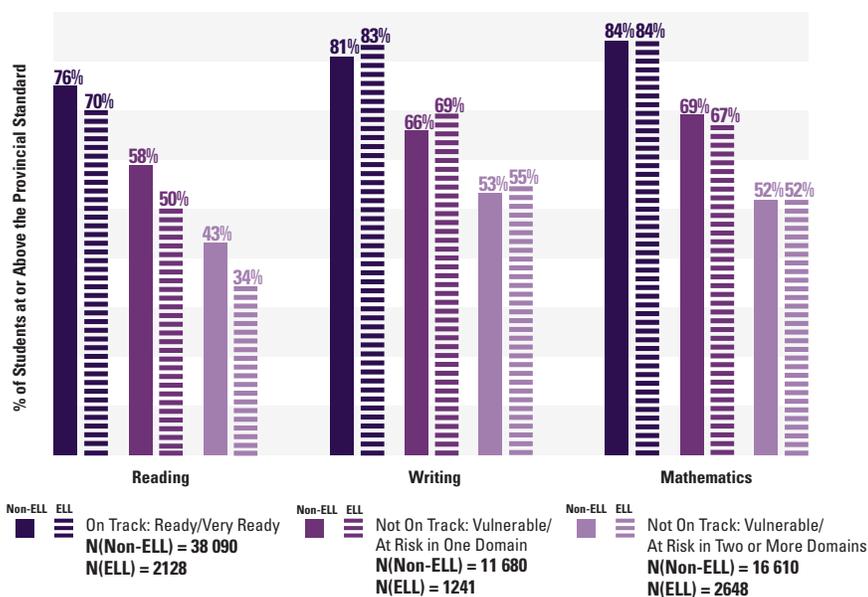
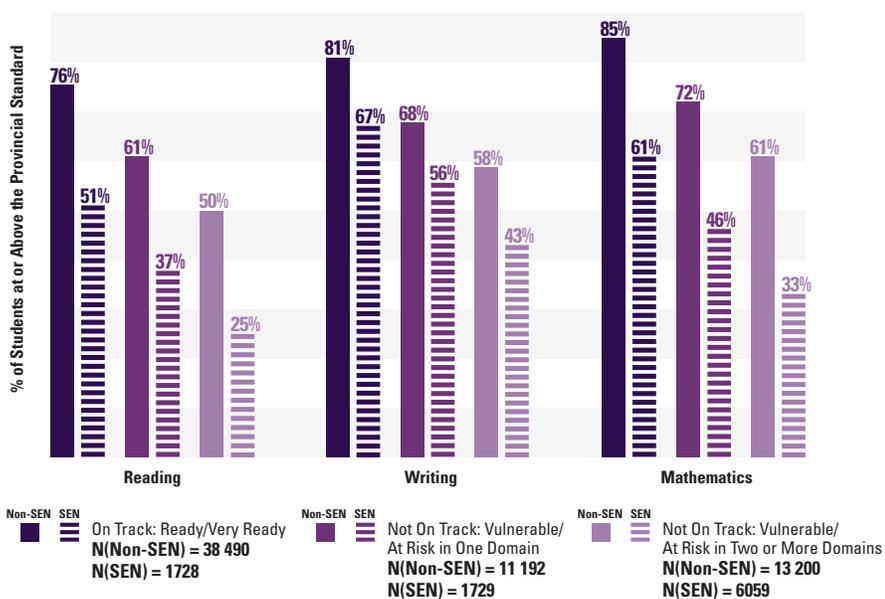


Figure 18

Relationship Between EDI Scores and Grade 3 EQAO Achievement: By Special Education Needs



The gap between students with special education needs and those without is approximately 25 percentage points in reading and mathematics. This is the case when with both groups of students who were deemed *on track* in kindergarten as well as those *not on track*. For writing, the gap between those with and without special education needs ranges from 12 to 15 percentage points depending on readiness status in kindergarten.



Understanding Student Achievement:

Clearly, there are many different factors that impact students' academic performance. These include readiness for school as well as student experiences both in and out of school during the primary years. Teachers, family and peer support all play a part, as do health and economic factors. While the Offord and EQAO teams did not undertake a study to explain primary school progress, some initial investigative analyses by the two research teams have provided useful insights.

Absenteeism. Considerable evidence points to poor school attendance as being associated with lower school achievement. Analysis of the current data by the Offord Centre researchers determined that a higher absenteeism rate in kindergarten was associated with lower achievement in Grade 3. On average, Grade 3 students who did not meet provincial standards had missed about one more day of school in kindergarten than those who met the standards. While missing just one day of kindergarten seems an unlikely cause of future academic difficulties, it is perhaps an early indicator of a tendency toward increased

absenteeism—a hypothesis requiring further study. However, establishing a pattern of regular attendance when students start school is likely to be beneficial.

The data confirm the importance of communicating to parents the need to ensure regular school attendance, right from the beginning of kindergarten.

Moving to a New School. The Offord Centre analysis also revealed that students who changed schools between kindergarten and Grade 3 were less likely to achieve the provincial standard on EQAO's primary-division assessment. While educators generally have little influence on decisions by parents to move, knowing that moving to a new school represents an area of potential vulnerability is valuable information for educators. Principals and teachers will want to ensure that special efforts are made to assist with the transition process when new students arrive and that extra support is provided as needed.

Children who begin in a new school will benefit from transition plans to ensure that their progress is well monitored and that support is provided as required.

Gender. The gender gap observed in the EDI assessment persists after kindergarten insofar as females outperform males on EQAO student achievement measures in reading and writing in not only Grade 3 but also Grade 6 and into high school, as evidenced on the 2011 Ontario Secondary School Literacy Test (OSSLT). However, while a gender gap in literacy has existed since the inception of EQAO assessments, it appears to have gradually narrowed in the last three years of Grade 3 EQAO results. (For more detail, see EQAO provincial reports.⁵)

Age. A further examination of age effects demonstrated that as with gender, the age disparities favouring older students that were observed in kindergarten persist not only into the primary division but through to Grade 6 and high school. The results of these analyses, which do not appear in current provincial reports, follow.

Figures 19 and 20 show 2011 EQAO achievement results by age for both Grades 3 and 6. At Grade 3, the gap between the oldest and youngest students ranged from eight to 10 percentage points depending on subject area. As can be seen in Figure 20, the 2011 Grade 6 data suggest that the gap between older and younger students narrowed slightly but still persisted (gap of seven to eight percentage points).

Figure 19

Grade 3 2011 EQAO Achievement: By Age (based on birth quarter)

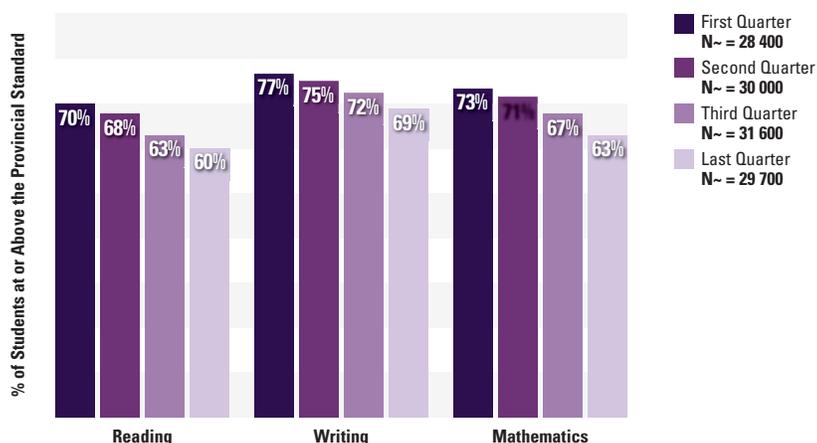
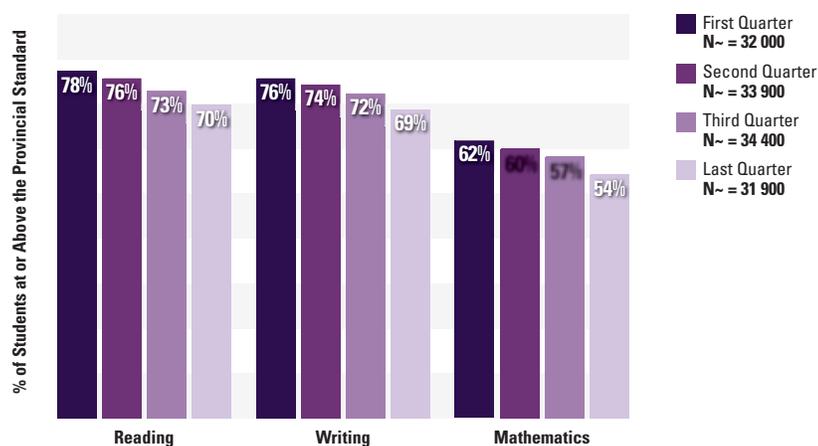


Figure 20

Grade 6 2011 EQAO Achievement: By Age (based on birth quarter)



⁵ Gender differences in achievement in the primary division over a five-year period can be seen on page 31 (Grade 3) and page 38 (Grade 6) of the 2010-2011 EQAO's *Provincial Elementary School Report*. http://www.eqao.com/pdf_e/11/EQAO_ProvincialReport_Elementary2011.pdf.

Gender differences on the OSSLT over the past five years are shown on page 64 of the 2011 EQAO's *Provincial Secondary School Report*: http://www.eqao.com/pdf_e/11/EQAO_ProvincialReport_Secondary2011.pdf.

While it is not the purpose here to study age effects on achievement, the data raised the question as to how long age effects on learning might be observed. A preliminary analysis of both EQAO's Grade 9 mathematics results and findings for the Grade 10 OSSLT suggested that these age effects, although attenuated by the time students reach high school, do persist.

In the case of Grade 9 mathematics, Figure 21 shows that there are no age-related differences in considering the percentages of students who achieved the provincial standard for either the academic or applied course. However, there is an age effect in considering the participation rates of students in these two types of mathematics courses. Older students are more highly represented in academic mathematics, which is the more theoretical of the two courses. Younger students are more highly represented in the applied course, which has the more practical curriculum. As shown in Figure 22, the participation-rate gap in these courses between oldest and youngest is about five percentage points. In other words, nearly three-quarters (72%) of all students born in the first quarter were taking academic Grade 9 mathematics in 2011, while only two-thirds (67%) of those born in the fourth quarter had opted for the academic course.

Figure 21

Grade 9 2011 EQAO Mathematics Achievement: By Age (based on birth quarter)

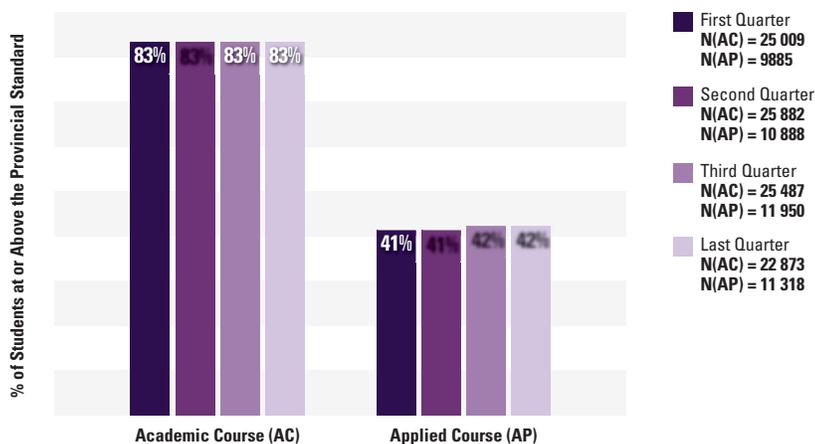
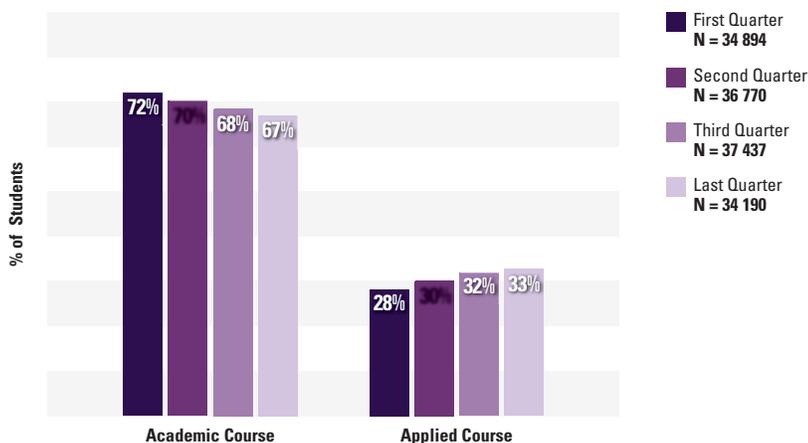


Figure 22

Grade 9 2011 EQAO Mathematics Academic and Applied Course Participation Rates: By Age (based on birth quarter)

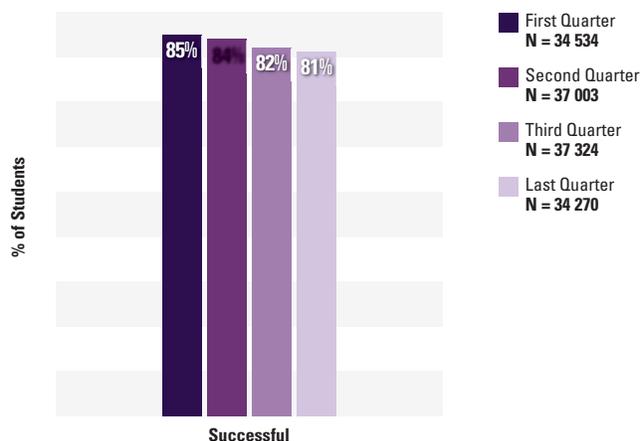


Results for the 2011 OSSLT presented in Figure 23 show a four-percentage-point gap between students born in the first quarter and those born in the fourth quarter; 85% of students born in the first quarter completed the OSSLT successfully compared to 81% born in the last quarter.

This age-achievement pattern is not unique to Ontario students. A recent B.C. Ministry of Education study also pointed to an age-achievement gap favouring older students that persisted to the end of high school (Musio & McCrea, 2011).

Figure 23

OSSLT 2011 EQAO Results for First-Time Eligible Fully Participating Students: By Age (based on birth quarter)



Differentiated instruction ensures that students are provided with the opportunity to learn at a pace congruent with their developmental stage and educational progress. While this benefits all students, it is particularly important for those at greater risk of not meeting curriculum expectations, particularly boys and younger students.

Pathways to Grade 3

Another way of examining the data, as suggested by Offord Centre researchers, is to consider the four different pathways by which students can reach Grade 3.

The first two groups highlighted below, *resilient* and those *continuing on track*, represent the pathways of those who successfully achieved the provincial standards in Grade 3; the second two groups, *continuing at risk* and *newly at risk*, did not meet these standards.

- **Resilient:** Students deemed *not on track* in kindergarten (i.e., *vulnerable* or *at risk* in one or more domains) but subsequently achieved the provincial standards in Grade 3.
- **Continuing on Track:** Students deemed *on track* in kindergarten (i.e., *ready* or *very ready* in all five domains) and achieved the provincial standards in Grade 3.
- **Continuing at Risk:** Students deemed *not on track* in kindergarten and did not achieve the provincial standards in Grade 3.
- **Newly at Risk:** Students deemed *on track* in kindergarten but did not achieve the provincial standards in Grade 3.

In the following section, we examine pathways for the total matched sample and for the following six subgroups: male students; female students; older students; younger students; English language learners and students with special education needs.

Pathways to Grade 3—Total Group: Of the total student population in the matched sample, the largest group by far consists of those who are *on track* in kindergarten and *continue on track* into Grade 3, as demonstrated by their meeting the provincial standards (42%–47% of the population depending on subject area, as illustrated by Figure 24). There are also significant percentages in the *resilient* group (21%–26%), who, together with the *continuing-on-track* group, account for the approximately 63%–73% of the total population who achieve the provincial standards in Grade 3.

In our examination of those students who did not achieve the provincial standards, it can be seen that they account for approximately 27%–37% of the total population; they are comprised of 18%–23% who were *continuing at risk*, another large grouping, and, also of concern, an additional 9%–14% who were *newly at risk* as of Grade 3.

Figure 24

**Pathways from Kindergarten to Grade 3:
2011 Reading, Writing and Mathematics Achievement (N = 72 397)**



Pathways to Grade 3 by Gender:

Figures 25 and 26 show the pathways for male and female students respectively. For both boys and girls, the largest grouping again consists of those who enter school *on track* and are *continuing on track* into Grade 3. This was the case across all subject areas. However, it should be noted that this grouping is generally larger for female students (50%–55% across the three subject areas) than for male students (34%–40%).

For male students, the subject area with the highest resiliency rate is mathematics (33%). Greater male success in mathematics, as compared with reading and writing, is also reflected in the fact that this subject area has the lowest percentage of *newly-at-risk* male students (7%). On the other hand, reading among boys is the subject area with both the lowest resiliency rate (25%) and the highest percentage of males *newly at risk* (13%).

For female students, writing has the highest resiliency rate (23%), and while this subject area also has the lowest percentage of *newly-at-risk* female students (10%), the percentage is still quite high (10%). As was the case for male students, reading among females is the subject with both the lowest resiliency rate (17%) and the highest percentage *newly at risk* (15%).

Figure 25

Pathways from Kindergarten to Grade 3 for Male Students: 2011 Reading, Writing and Mathematics Achievement (N = 36 808)

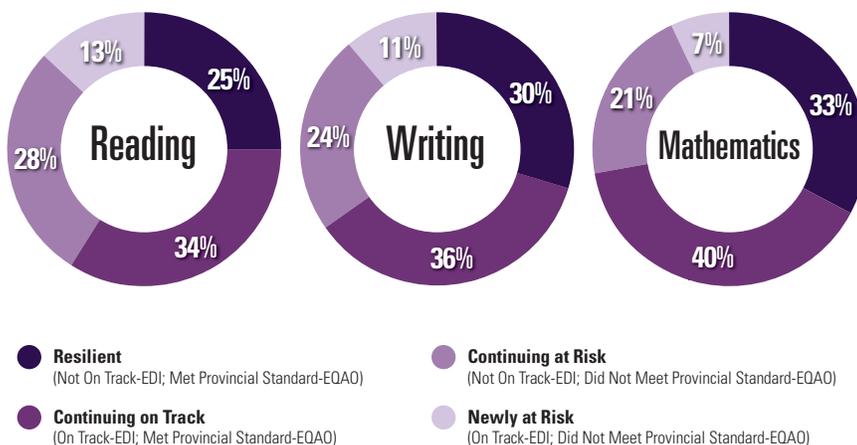
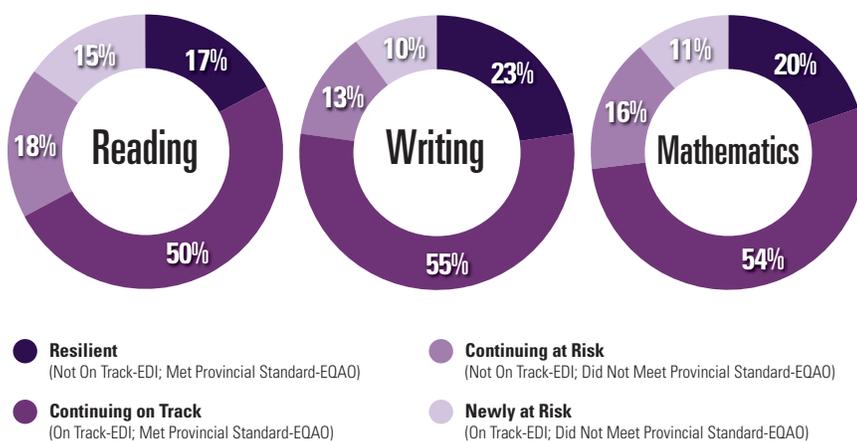


Figure 26

Pathways from Kindergarten to Grade 3 for Female Students: 2011 Reading, Writing and Mathematics Achievement (N = 35 589)



Pathways to Grade 3 by Age:

Interestingly, the pathways findings for all students born in the first quarter of the year, as shown in Figure 27, resemble somewhat those of female students alone. Approximately one-half of the older students (50–56%) are *continuing on track*, as measured by meeting the Grade 3 provincial standards. Resiliency rates for older students are highest for writing and mathematics and lowest for reading. Reading also has the highest percentage of *newly-at-risk* students (14%).

Whereas approximately one-half of the older students (50–56%) entered school *on track* and *continued on track* through to Grade 3, Figure 28 shows that only about one-third of students born in the last quarter of the year (32%–37% depending on subject area) were and remained *on track*. Resiliency rates for younger students were highest for writing and mathematics (31%) and lowest for reading (25%). It is also interesting to note that resiliency rates for younger students are higher than those for older students across all subject areas. This finding is consistent with common sense expectations that younger students will “catch up” to older students as they age and a nine-month age gap becomes less meaningful.

As with all demographic groups discussed thus far, younger students were most likely to be *newly at risk* in reading (13%); they were least likely to be *newly at risk* in mathematics (8%).

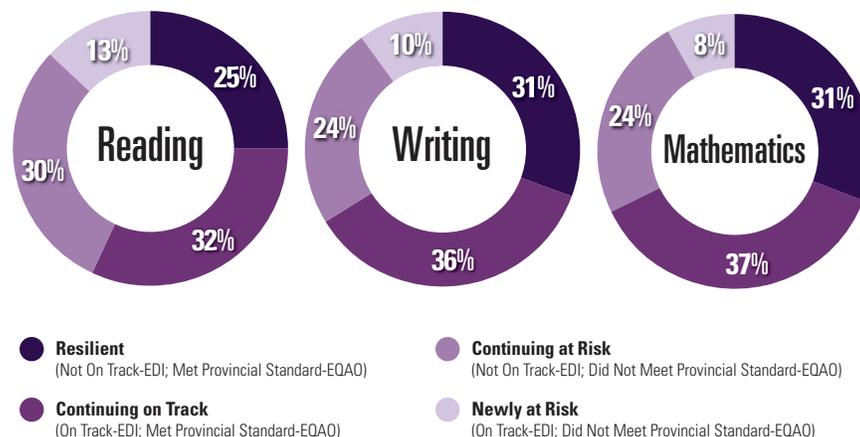
Figure 27

Pathways from Kindergarten to Grade 3 for Students Born in the 1st Quarter: 2011 Reading, Writing and Mathematics Achievement (N = 17 990)



Figure 28

Pathways from Kindergarten to Grade 3 for Students Born in the Last Quarter: 2011 Reading, Writing and Mathematics Achievement (N = 16 922)



Pathways to Grade 3 by Language Background and Special Education Needs Status:

Figure 29 suggests that while the percentages of English language learners who begin school *on track* and continue *on track* are quite low (25%–30%), this group demonstrates a relatively high degree of resiliency in writing (38%) and mathematics (37%). Also, the percentages of English language learners falling in the *newly-at-risk* category is low for both writing and mathematics (6%). These findings are in keeping with earlier results indicating that English language learners have achievement levels similar to their English-speaking counterparts in writing and mathematics by the time of the Grade 3 assessment.

In reading, however, the resiliency rate for English language learners is relatively low (25%), while the percentages of these students *continuing at risk* (39%) and *newly at risk* (11%) are quite high, again suggesting that reading is an area where English language learners continue to have difficulties as of Grade 3.

Figure 30 shows the pathways to Grade 3 for students identified as having special education needs at the time of their Grade 3 EQAO assessment. The largest grouping of these students is found in the *continuing-at-risk* category; 44%–59% of students with special education needs were *continuing at risk* in terms of their being unable to achieve the provincial standards in Grade 3. The resiliency rate for this group of students was highest for writing (38%).

Figure 29

Pathways from Kindergarten to Grade 3 for English language learners: 2011 Reading, Writing and Mathematics Achievement (N = 6017)



Figure 30

Pathways from Kindergarten to Grade 3 for Students with Special Education Needs: 2011 Reading, Writing and Mathematics Achievement (N = 9515)



The percentages of students with special education needs in the *continuing-on-track* (9%–12%) and *newly-at-risk* (6%–9%) groups are quite small, suggesting that the vast proportion of students with special education needs had been having difficulties from early on in their schooling.

Summary and Conclusions

The current research confirmed our thinking on a number of issues, provided new insights and raised questions for further study.

The data confirmed that there are a substantial number of Ontario students who are *vulnerable* or *at risk* in kindergarten and that students' readiness at this stage of their schooling is related to their later school achievement. However, the data also clearly indicated that lack of readiness does not in and of itself mean that students will not, or cannot, succeed. Conversely, the study confirmed that school readiness in kindergarten does not guarantee subsequent academic success.

Nor was it surprising to learn that boys and younger students are more likely to be *vulnerable* or *at risk* in kindergarten than girls and older students. There have been a considerable number of recent studies looking at the relationship between gender and achievement in particular, and our research confirmed that gender differences in terms of school readiness begin in kindergarten. Gender-achievement differences favouring female students were also shown to persist into the junior division and through into high school in the area of literacy.

What was of some surprise was the finding that differences in readiness between older and younger students in kindergarten have

an achievement impact that persists not only into Grades 3 and 6 but also to some extent right through to high school. Furthermore, while lack of school readiness in kindergarten clearly is related to later achievement, this lack of readiness on the part of younger students only partly accounted for the differences in achievement observed between older and younger Grade 3 students. The cohort-tracking aspect of our research demonstrated that age effects can be observed independent of school readiness status, at least up until the end of Grade 3.

One obvious question that arises from the current findings of persistent age effects is the following: To what extent are age effects absolute or relative? That is to say, if the starting age for kindergarten were changed so that the cut-off date was June 30 instead of December 31, would age effects largely be eliminated since the cohort would now be comprised of slightly older students with presumably correspondingly higher levels of readiness for school as measured by the EDI?

We cannot conclusively answer this question for many reasons, and it is a question that clearly warrants further study. However, we can say that the current study's data suggest that changing the cut-off date would increase the proportion of students who are *on track* in kindergarten, thereby likely increasing the chances of success for the overall cohort. At the same time, the data suggest that relative age is a factor that is independent of readiness status in kindergarten—the youngest students would in all likelihood continue to evidence lower levels of achievement as a group than older students.

In conclusion, please find a summary of our major findings on the following pages.

Data Highlights

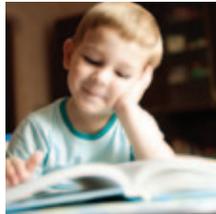
EDI Information About Ontario Kindergarten Students in English-Language Schools

- Approximately one in four kindergarten students in Ontario are in the *vulnerable* or *at-risk* categories in two or more of the five EDI domains.
- The domain of language and cognitive development had the largest percentage of students in the *vulnerable* and *at-risk* categories.
- There are proportionately more male kindergarten students as well as younger students in the *vulnerable* and *at-risk* categories in kindergarten across the five EDI domains.
- English language learners are more likely to fall into the *vulnerable* or *at-risk* groups than English-speaking students.
- Approximately four out of five students designated as having special education needs based on Grade 3 EQAO records had been assessed in kindergarten as being *vulnerable* or *at risk* in one or more of the five domains; approximately two-thirds were in the *vulnerable* or *at-risk* group in two or more domains.

Tracking Ontario Student Performance

- Of the total student population included in the matched sample, 63%–73% achieved the provincial standards in the Grade 3 EQAO assessment of reading, writing and mathematics. This group included the 42%–47% who had been rated *on track* in kindergarten and were *continuing on track*. The remaining 21%–26% of students achieving the provincial standards comprised a grouping considered *resilient*—while they were deemed *vulnerable* or *at risk* in at least one domain in kindergarten, they had overcome earlier challenges to achieve the provincial standards.
- Students with low EDI scores—those in the *vulnerable* or *at-risk* groups—are much less likely to achieve the provincial standard on the Grade 3 EQAO reading, writing and mathematics assessment than those with high EDI scores—those students deemed to be *ready* or *very ready* in kindergarten. This general finding applied regardless of gender, age, language background or special education needs status.
- Many students in the *vulnerable* and *at-risk* categories defy the odds and are able to reach provincial standards in Grade 3.
- Of those students who were considered *ready* in kindergarten, a large percentage did not meet the provincial standards on the Grade 3 EQAO assessment (16% to 25%).
- Female students across all three readiness groups are more likely to achieve the provincial standard in Grade 3 writing; male students within each readiness group are more likely to achieve the standard in Grade 3 mathematics, although, as noted earlier, because there are more girls in the *on-track* group overall, slightly more girls achieve the standard than boys.

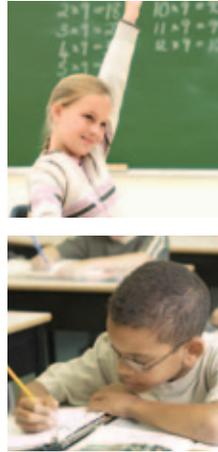
- A gender gap is also observed in Grade 3 reading achievement favouring female students who had been *on track* in kindergarten. In contrast, both male and female students with low EDI scores in kindergarten had similar reading-achievement levels in Grade 3.
- Older students have higher achievement than younger students in all Grade 3 subject areas. This is true when considering students who were *on track* in kindergarten as well as those who were *not on track* at school.
- English language learners have greater difficulty achieving the provincial standard in Grade 3 reading than English-speaking students who have a similar readiness status in kindergarten. However, this is not the case for either Grade 3 writing or mathematics; after three or more years in Ontario schools, English language learners attain a level of achievement in these two subject areas that is similar to that of their English-speaking counterparts.
- Considerably fewer students with special education needs meet provincial standards in Grade 3 than those without special education needs. This is true for students with special education needs who were *on track* in kindergarten as well as for those who were *not on track*. The disparity is greatest in the areas of reading and mathematics.



- Longitudinal analysis suggests that patterns of poor school attendance, which are associated with poor school achievement, begin as early as kindergarten.
- Students who switched schools between kindergarten and Grade 3 were less likely to achieve the provincial standards in EQAO's Grade 3 assessment.
- The gender gap observed in the EDI assessment persists insofar as girls outperform boys on EQAO student-achievement measures in reading and writing in Grades 3 and 6 and on the OSSLT in high school.
- The age gap favouring older students in the same grade was also shown to persist—the proportion of older students who achieved the provincial standards was larger than that of younger students in Grades 3 and 6. Other data suggest that age effects persist into high school. Notably, older students were more likely to succeed on the OSSLT than younger students. As well, older students were more highly represented in the Grade 9 academic mathematics program; younger students were more highly represented in the Grade 9 applied mathematics program.

Pathways to Grade 3

- The largest proportion of students who achieve the provincial standards in reading, writing and mathematics in Grade 3 were *on track* in kindergarten.
- Of concern were the 9%–14% of Grade 3 students who were *newly at risk*, having been deemed *ready* in kindergarten, but who were unable to achieve the provincial standards in Grade 3, particularly in reading.
- Also of concern were the 18%–23% of the population who were *not on track* in kindergarten and *continued at risk* in Grade 3 (i.e., were unsuccessful in meeting the Grade 3 provincial standards).
- Reading is the subject area with the lowest rate of resiliency and highest percentage of students in the *newly* and *continuing-at-risk* categories.
- Resiliency rates and percentages of *newly-at-risk* students suggest that mathematics is the area where male students achieve best during the primary division; female students appear to do best in writing.



- While the pathways data confirm the persistence of the age gap favouring older students over younger students, the results also show a higher degree of resiliency among younger than older students. These data suggest that many younger students who were behind in kindergarten catch up to their older peers by the time they reach Grade 3.
- Reading is the area where English language learners have the greatest difficulties in the primary division.
- Approximately half of the students with special education needs fall into the *continuing-at-risk* category; they were *not on track* in kindergarten and did not meet the provincial standards in Grade 3. They demonstrated the highest degree of resiliency in the area of writing; reading is the subject that appears to present the most challenge, as was the case for most other groups of students.

Questions for Educators to Reflect On

Primary school educators face both a considerable professional challenge as well as a remarkable opportunity to make a substantive difference in the lives of their young students.

In the foregoing, we have highlighted some research and associated implications that educators of young children may wish to reflect on. Following are some questions to consider in determining possible actions for a school or for teaching practices.



1. What early-years programs and resources are available in the community to support learning for young children and their parents?
2. How are students assessed in kindergarten? What do the most recent assessments reveal about the support children require in this stage of their development? What areas of their development display the greatest need for focused support?
 - Physical development?
 - Social skills?
 - Language development?
 - Emotional maturity?
 - Cognitive development?
3. Based on the results of a school's last two EDI assessments, are there particular groups of students who seem to require intervention and support?
 - Boys?
 - Girls?
 - Younger students?
 - Students whose first language is other than English?

4. What intervention strategies are being used to meet the needs of students in the primary division? Are there particular approaches to be considered for boys? For girls? For younger students? For English language learners? For students with special education needs? What insights does the kindergarten curriculum provide about individualized, developmentally appropriate teaching and learning approaches for young students?

Links: *Full-Day Early Learning Kindergarten for Four- and Five-Year-Olds: A Reference Guide for Educators*

Both the program and reference guide for educators can be found at:

www.edu.gov.on.ca/eng/curriculum/elementary/kindergarten.html.

5. What support and guidance can be given to parents of students who require additional support? Has the school emphasized the value of parent engagement and provided opportunities for parents to become involved in their children's education? Has it communicated clearly to parents the importance of regular school attendance, and does it consistently follow up with students who are absent?

6. How can one share the following documents with parents?

- "Tips and Tools for Parents"
- "Parenting and Family Literacy Centres"
- *Reading and Writing with Your Child*
- *Doing Mathematics with Your Child*

These resources can be found at www.edu.gov.on.ca.

7. Are parents and educators aware of EQAO resources available at www.eqao.com?

References

Calman, R. C. (2012). *Starting early: Teaching, learning and assessment*. Research Bulletin. Toronto, ON: Education Quality and Accountability Office.

Education Quality and Accountability Office. (2011). *Ontario student achievement: EQAO's provincial elementary school report—Results of the 2010–2011 Assessments of Reading, Writing and Mathematics, Primary Division (Grades 1–3) and Junior Division (Grades 4–6)*. Toronto, ON: Queen's Printer for Ontario.

Education Quality and Accountability Office. (2011). *Ontario Student Achievement: EQAO's Provincial Secondary School Report: Results of the Grade 9 Assessment of Mathematics and the Ontario Secondary School Literacy Test, 2010–2011*. Toronto, ON: Queen's Printer for Ontario.

Education Quality and Accountability Office. (2012). *EQAO's technical report for the 2010–2011 assessments*. Toronto, ON: Queen's Printer for Ontario.

Janus, M., Duku, E., & Hughes, D. (2010). *Patterns of school readiness among selected groups of Canadian children: Children with special needs and children with diverse language backgrounds*. Ottawa, ON: Canadian Council for Learning. Retrieved from <http://www.ccl-cca.ca/>.

Janus, M., Brinkman, S., Duku, E., Hertzman, C., Santos, R., Sayers, M., & Schroeder, J. (2007). *The early development instrument: A population-based measure for communities. A handbook on development, properties, and use*. Hamilton, ON: Offord Centre for Child Studies. Retrieved from http://www.offordcentre.com/readiness/pubs/2007_12_FINAL.EDI.HANDBOOK.pdf

McCain, M. N., & Mustard, J. F. (1999). *Reversing the real brain drain. Early years study*. Toronto, ON: Ontario Children's Secretariat.

McCain, M. N., Mustard J. F., & Shanker, S. (2007). *Early years study 2: Putting science into action*. Toronto, ON: Council for Early Childhood Development.

Ministry of Education, Ontario. (2007). *English language learners: ESL and ELD programs and services: Policies and procedures for Ontario elementary and secondary schools, kindergarten to Grade 12*. Toronto ON: Queen's Printer for Ontario.

Musio, J., & McCrea, P. (2011). *Birthdate and student achievement: The effects of school grouping practices in British Columbia*. Victoria, BC: British Columbia Ministry of Education.

Organisation for Economic Co-Operation and Development. (2006). *Starting Strong II: Early childhood education and care*. Paris: Directorate for Education.

Pascal, C. E. (2009). *With our best future in mind: Implementing early learning in Ontario. Summary of the Report to the Premier by the Special Advisor on Early Learning*. Toronto, ON: Government of Ontario.

Shonkoff, J. P., & Phillips, D. (Eds.). (2000). *From neurons to neighbourhoods: The science of early childhood development*. Washington, DC: National Academy Press.

Willms, J. D. (2002). *Standards of care: Investments to improve children's educational outcomes in Latin America*. In M. E. Young (Ed.), *From early child development to human development* (pp. 81–122). Washington, DC: The World Bank.

Appendix A: Details of Matching and Sampling Procedures

EDI and EQAO databases were matched over a period of three to four years in order to acquire a representative student sample from English-language schools across the province.

Work was begun in the late fall of 2010, using the provincial EDI kindergarten sample from 2004–05 to 2006–07. These records were matched to Grade 3 EQAO provincial data from 2008 to 2010. These three years were selected, as they represented the most recent three-year grouping for which Grade 3 data were available and are referred to below as the Year One Matched Sample. The following is a description of the matching process.

Matching EDI and EQAO Results⁶

1. The set of student ID numbers, by board, in the EDI data files were provided to EQAO. These ID numbers had been submitted by school boards for the collection of the EDI data.
2. EQAO checked the ID numbers in the Grade 3 EQAO data files (both Ontario Education Number and school-board assigned numbers) to determine which matched the numbers in the EDI file. In some cases, the school board had modified the ID numbers provided for the EDI data collection so that matches were not possible.
3. The EDI records were matched to EQAO records using student ID numbers. Staff from the Offord Centre and EQAO met to conduct the matching. Once the merged data file was created, the student ID numbers were removed.
4. The following two merged data files were created:
 - a file retaining school and board number, but with personal information removed that might identify an individual student (e.g., birth date and special education needs category).
 - a file with school and board ID removed, but retaining all information on individual students.
5. Some additional data checks were conducted on the merged records for individual students (e.g., birth date data from EDI and EQAO files), and students with mismatches were removed.

The Year One Matched Sample consisted of the following cohorts by EDI year: N (2005) = 15 562; N (2006) = 32 604; N (2007) = 16 592 for a total of 64 758. Both the Offord Centre and EQAO researchers independently analyzed the matched data sets. EQAO concentrated on descriptive population statistics with a focus on demographic analyses, while Offord researchers conducted statistical analyses to investigate EDI's predictive aspects.

⁶ The description of the matching sample was provided by Dr. Michael Kozlow, Director, Data and Support and Services, EQAO.

These two slightly different research tasks resulted in slightly different databases being used by EQAO and Offord Centre researchers. The Offord researchers used a very stringent selection procedure that involved dropping cases with certain types of missing data to ensure that statistics from different analysis models could be compared directly and excluding students with no school data and those with a special education or inconsistent gender designation. EQAO retained almost the entire data set in conducting descriptive statistics. Cases were dropped as required for a particular analysis in instances of specific missing data. Differences between the two databases employed are highlighted below:

- **EQAO** retained all students in the database and dropped cases on an analysis-by-analysis basis if data were missing; **Offord** excluded students for whom data were missing on one or more variables used in the analyses (n = 45 509).
- **EQAO** retained students with mismatched gender data and used EQAO gender information verified by principals; **Offord** excluded students with different gender designations between senior kindergarten and Grade 3 along with students missing gender at senior kindergarten (n = 1441).
- **EQAO** included students with special education needs based on Grade 3 EQAO records if required data elements were on file; **Offord** excluded children with EDI special education needs designations or in cases where the special education needs variable was missing (n = 2266).
- **EQAO** used students' Grade 3 home school information as a referent where required, but since school was not a variable in the descriptive analyses, no cases were dropped for lack of school data; **Offord** excluded children with no school data in the 2006 school census data file (n = 3122).

Both EQAO and the Offord Centre researchers included only students in publicly funded schools.

All analyses conducted by the Offord researchers and referenced in this report are based on their final matched sample of 45 509 students from the Year One Matched Sample. EQAO's first set of detailed descriptive analyses, conducted in the winter and spring of 2011, were also based on the Year One Matched Sample and included 60 192 students. However, in January of 2012, with 2011 Grade 3 EQAO data available, EQAO added additional students to the database in time for this report release.

The creation of the Year Two Matched Sample followed exactly the same procedures as described above for the Year One Matched Sample. The Year Two Matched Sample broadened the sample by using data from a four- rather than a three-year period by adding data from EDI 2007–2008 and EQAO 2010–2011. If a school board was added that had been included previously based on an earlier EDI/EQAO match, only the most recent data were used so that no board was represented more than once.

All descriptive statistics are based on the Year Two Matched Sample—the results obtained with the Year Two Matched Sample mirrored very closely those in the Year One Matched Sample. The Year Two Matched Sample comprised a total of 72 903 students or 58% of the average EQAO provincial reporting population for the years 2009–2011. A total of 2485 schools (or 74% of all English-language schools) and 41 school boards (or 68% of all English-language school boards) were represented in the Year Two Matched Sample that was used for the vast majority of analyses referenced in this report.

Table A1 below provides a demographic comparison of the EQAO Grade 3 population (pooled data for 2008–2011), the EDI provincial sample from 2004–2005 to 2006–2007 and the Year Two Matched Sample upon which the descriptive analyses in this report are based.

Table A1

		EQAO Grade 3 Population ⁷	EDI Population ⁸	Matched Year-Two Sample
Gender	Male	51%	51%	51%
	Female	49%	49%	49%
Age	First Quarter	24%	25%	25%
	2 nd Quarter	26%	25%	26%
	3 rd Quarter	26%	25%	26%
	Last Quarter	24%	25%	24%
English Language Learner Status	ELL	9%	11%	8%
	Non-ELL	91%	89%	92%
Special Education Need Status	Special Education Needs	15%	4%	13%
	Non-Special Education Needs	85%	96%	87%
Grade 3 EQAO Achievement: % Meeting Provincial Standard	Reading	62%	N/A	63%
	Writing	69%	N/A	71%
	Mathematics	69%	N/A	73%
TOTAL		126 511		72 903

The three populations are very similar, particularly with regard to gender and age distribution. Achievement levels for the Year Two Matched Sample and the general population were also similar in reading and writing although less so for mathematics.

However, for two demographic groups, ELLs and students with special education needs, there are some known differences. For the matched sample, both the ELL and the special education variables were derived from the Grade 3 EQAO database. More specifically, students were categorized as ELL or as having special education needs based on information provided by their school at the time of the Grade 3 EQAO assessment.⁹ The sample ELL group differs from

⁷ The data represent a four-year pooled average from 2008–2011.

⁸ The data are based on three years of cumulative data from 2004–2005 to 2006–2007.

⁹ All ELL identifications were made by school personnel in accordance with the following Ontario Ministry of Education definition: “English language learners” are students in provincially funded English-language schools whose first language is a language other than English, or is a variety of English that is significantly different from the variety used for instruction in Ontario’s schools, and who may require focused educational supports to assist them in attaining proficiency in English. These students may be Canadian-born or recently arrived from other countries. They come from diverse backgrounds and school experiences, and have a wide variety of strengths and needs.” Ontario Ministry of Education, 2007, p. 8.

the ELL population referenced in Grade 3 EQAO provincial reporting because, by virtue of being in the matched sample and having been assessed with the EDI, all students within the matched sample had been in an Ontario school since kindergarten. The ELL grouping is comprised of English language learners with at least three years of Ontario English-language schooling. Students with an ELL background who arrived in Canada after kindergarten are not represented in the sample but are included in the EQAO Grade 3 population database. The matched sample ELL grouping referenced in this report also may differ from the ELL grouping in EDI files based on the timing of data collection. A student deemed ELL in kindergarten may not have been identified as ELL at Grade 3.

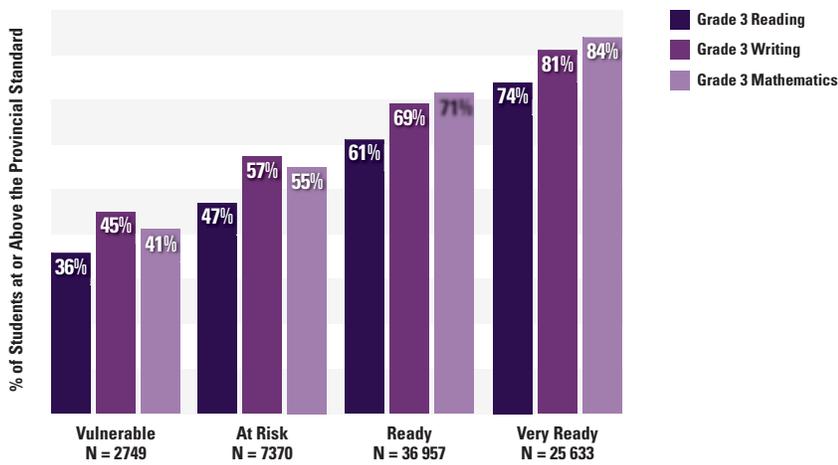
Similarly, students in the matched sample were categorized as having special education needs based on information provided by schools at the time of the Grade 3 EQAO assessment. All

students with special education needs had been formally identified by an Identification, Placement and Review Committee or had an Individual Education Plan. Students whose sole exceptionality was giftedness were not included. In contrast, EDI data pertaining to students with special education needs likely includes only those with very serious exceptionalities evidenced prior to school entry. Therefore, it is not surprising to see in Table A1, that whereas only 4% of students were identified in EDI student records as having special education needs, this figure rises to 15% in Grade 3 EQAO database records. This is likely accounted for by the fact that while students with severe exceptionalities may be identified immediately upon school entry, identification of special education needs typically does not take place until late in kindergarten or in Grade 1. Hence, data in this report will vary from data in EDI reports pertaining to the demographic special education needs variable.

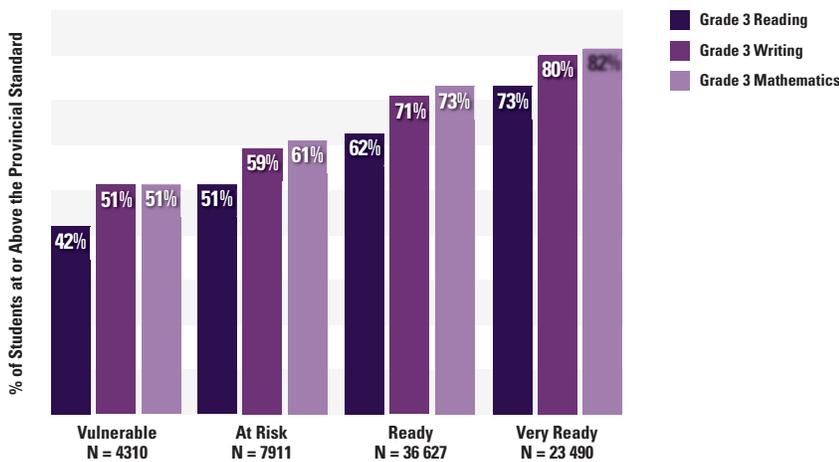
While the matched sample is clearly not perfectly representative of the total population, and an understanding of the definition of the demographic subgroups is required to interpret results, given the sample size and the understandings gleaned from the foregoing analysis, it appears to be a reasonable approximation of the total population.

Appendix B: Relationship Between EDI Domain Results and Grade 3 EQAO Achievement

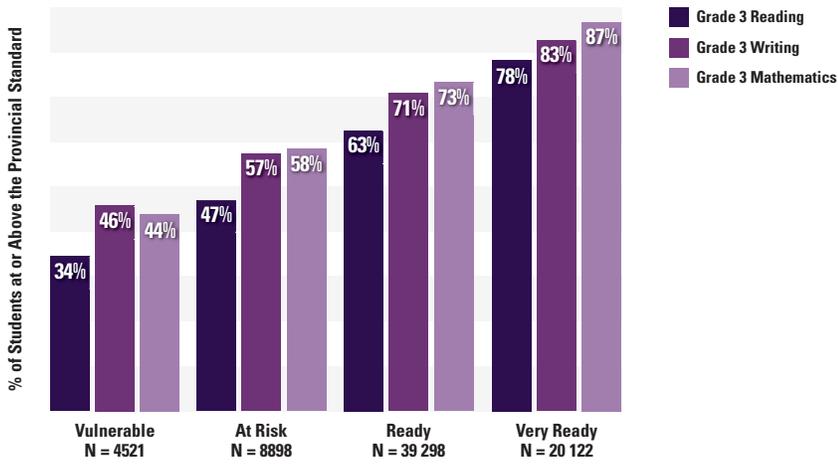
EDI Physical Health and Well-Being Domain and EQAO Achievement



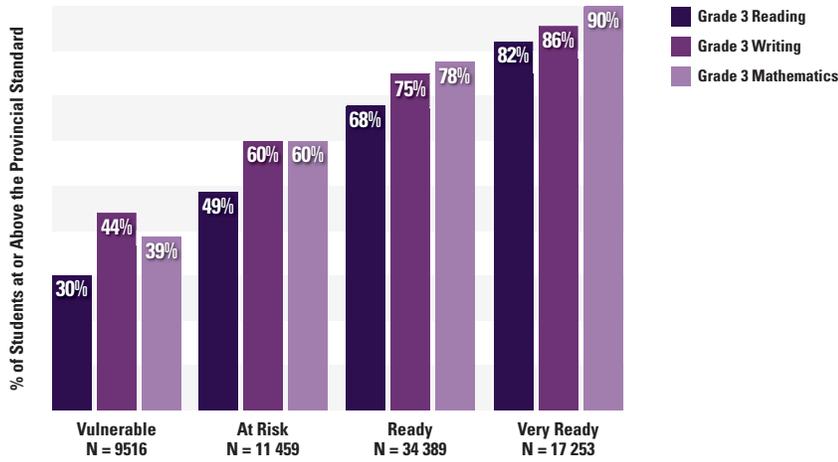
EDI Emotional Maturity Domain and EQAO Achievement



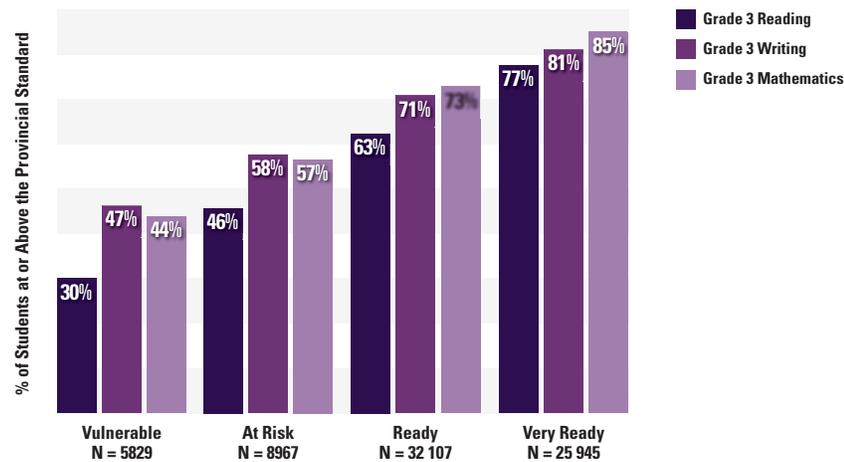
EDI Social Competence Domain and EQAO Achievement



EDI Language and Cognitive Development Domain and EQAO Achievement



EDI Communication and General Knowledge Domain and EQAO Achievement





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