

## Executive summary

Recent reports affirm concerns about the numeracy and math skills of Canadians, pointing to a decline in skills or performance at a level too low for what is needed for a productive labour force. Previous Canadian research indicates that math performance in high school is predictive of performance in postsecondary. Additionally, strong numeracy skills have been shown to be associated with stronger labour market outcomes including employment and earnings.

Most of these studies were conducted at a national or provincial level. They did not control for sociodemographic characteristics (such as gender, age, income, parental education) or math skills at college entry. In contrast, the current study examined the role of mathematics proficiency on the academic and labour market outcomes of students from a large Toronto college. This research has not been before done in Canada, and the approach undertaken is unique: the study tracks student-level data on math performance and course selection in in senior high school, college program selection and standardized math testing at entry, progress to college graduation, and labour market and further education outcomes post-graduation.

The current study's overall research question was: *What influence does mathematics proficiency have on academic and labour market outcomes of college students?*

The study addressed this question by investigating the following sub-questions:

- What role does high school math performance and course selection play in program choice in college, particularly in technology fields or other programs requiring math? Is there an independent effect of gender or socioeconomic status?
- What role does high school math background (grades and course selection) play in performance on standardized college math placement testing and overall academic outcomes in college?
- Do math skills at college entry predict college academic performance or overall persistence to graduation? Does language proficiency affect math performance?
- Does math proficiency affect transfer rates to university?
- Does math proficiency affect labour market outcomes such as employment rate, hourly wage, overqualification and job related to program of study?

**Methodology.** This study used a database containing several linked student-level data sources from within Seneca College, which enabled the tracking of individual students from the beginning of high school, through to college graduation and transition into the labour market or further education. The sample included students who entered Seneca College between 2007 and 2014 that were under 23 years of age at entry, were not enrolled in a college degree or graduate certificate program, and had completed the entering-student survey. The total sample contained 44,613 college entrants and 9,414 graduates (respondents of the Graduate Satisfaction Survey (GSS)). The study used both descriptive and regression techniques to estimate the effects of high school math achievement and math proficiency at college entry on college performance and post-graduation prospects.

**Results.** This report shows that students' math performance (course selection and grades) in high school strongly influences whether they select a program requiring math at college entry. Within the population of students who entered college programs requiring math, math proficiency has a major effect on

performance on college math placement testing, first-year college math grades, overall college Grade Point Average (GPA), rate of graduation and labour market outcomes.

Of the Seneca students who graduated from Ontario high schools, those who obtained a higher average in high school math and took university preparation math courses were more likely to select a college program requiring math and/or enter a technology program, to have higher scores on college math placement tests and a lower odds of placement in a college foundation math course, and to have higher first-year college math grades, higher overall college GPA, and higher graduation rates.

Higher scores on college math placement tests are associated with higher first-year math grades, overall college GPA and graduation rates. Graduates who had a higher first-year college math average were more likely to transfer to university and to be employed; if employed, this group of graduates were more likely to have a job related to their field of study and less likely to be overqualified. Math proficiency at college entry had no effect on their hourly wage.

As well, the study identified sociodemographic and other factors that interacted with program selection, math proficiency and graduate outcomes, as described below:

*Gender.* Male students are more likely than their female counterparts to take advanced math courses in high school, to enter a college program requiring math, and to enter a technology field even when controlling for high school background. Independent of high school background in math, males on average also achieve higher scores on college math placement tests. Yet, within programs requiring math, females generally obtain higher first-year college math grades and higher overall college GPAs, and are more likely to graduate. Among those employed, females are less likely than males to be overqualified for their job; however, they are more likely to earn a lower hourly wage.

*Aspirations for university.* Students who enter college with plans to go on to university are more likely to choose a program requiring math. However, among all college entrants who pursue a college program requiring math, students who aspire to later attend university generally have poorer academic outcomes.

*Canadian citizenship.* Seneca college students who are Canadian citizens are less likely than their non-citizen counterparts to select a program requiring math. Among Canadian citizens who do select a program requiring math obtain lower scores on college math placement tests, a lower college math average in first year, a lower overall college GPA, and a lower graduation rate compared with their non-citizen counterparts. Among Seneca graduates in the labour force, citizens are more likely than non-citizens to be employed, but less likely to have a job in their related field of study, and are more likely to be overqualified. Despite this, Canadian citizens still earn a higher hourly wage.

*Neighbourhood income and parental education.* Students from low income neighbourhoods and those with a university-educated parent are more likely to enter a technology field. On average, students from high income neighbourhoods perform better on college math placement tests; they obtain higher math grades in first year and a higher overall GPA, and graduate at a higher rate compared with students from low income neighbourhoods. Students who have a parent with a degree perform better on college math placement testing and generally obtain higher salaries compared with students whose parents do not have a degree, or whose parents' level of education is unknown.

**Time Trends.** Notable time trends were observed, even when controlling for any differences in the composition of entering students. In recent years, results on standardized math placement tests, college math averages, overall college GPA and graduation rates have all declined.

**Summary:** This study clearly shows the long-term repercussions of weak math proficiency on college program selection, academic performance and post-graduation outcomes. Students with weak math skills are less likely to enter college programs requiring math; they obtain lower college math and lower college grades overall, and are less likely to graduate and to obtain a job related to their program of study.

Overall, results of the current study suggest that students who obtain both higher grades in high school and take advanced high school math courses are more likely to perform better on required college math placement tests and to select college programs that require math. In turn, higher math proficiency at college entry is positively associated with better overall college performance and a higher likelihood of graduating from college, transferring to university, and finding a job post-graduation. As well, numerous sociodemographic factors — particularly gender, neighbourhood income, parental education, English-language ability, and Canadian citizenship — interact in complex ways with program selection, math proficiency and graduate outcomes, and require further research.