

A Calculated Risk: Is Arithmetic Skill Declining in Canada?

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Have arithmetic skills of Canadian undergraduates changed over the last 15 years?

We have conducted many studies on mathematical cognition since 1992. Routinely, the participants have completed a speeded paper-and-pencil test of arithmetic fluency. We analyzed these fluency scores to determine whether performance has changed over time. This hypothesis was based on our perceptions that samples of participants taken from the introductory psychology population have had lower scores in recent years as compared to the past.

Method

We selected the 461 individuals who had been educated in Canada and were between the ages of 17 and 22 (i.e., undergraduates) at time of testing. They were tested between 1993 and 2005 and had started grade 1 between 1982 and 1993.

Participants solved four pages of arithmetic under speeded instructions: three-term addition problems (e.g., $34 + 56 + 92$), two-term multiplication problems (e.g., 45×9) and two-term subtraction problems (e.g., $45 - 19$). Total correct across the four pages was analyzed by grade 1 year. Performance represents speeded accuracy, because participants rarely made mistakes.

Results

As shown in Figure 1, fluency scores declined across years. Relative to students who were educated in the 1980s, students who were educated in the 1990s had scores that were lower by over 20%.

Figure 1. Fluency scores by Grade 1 year (bars are standard errors).

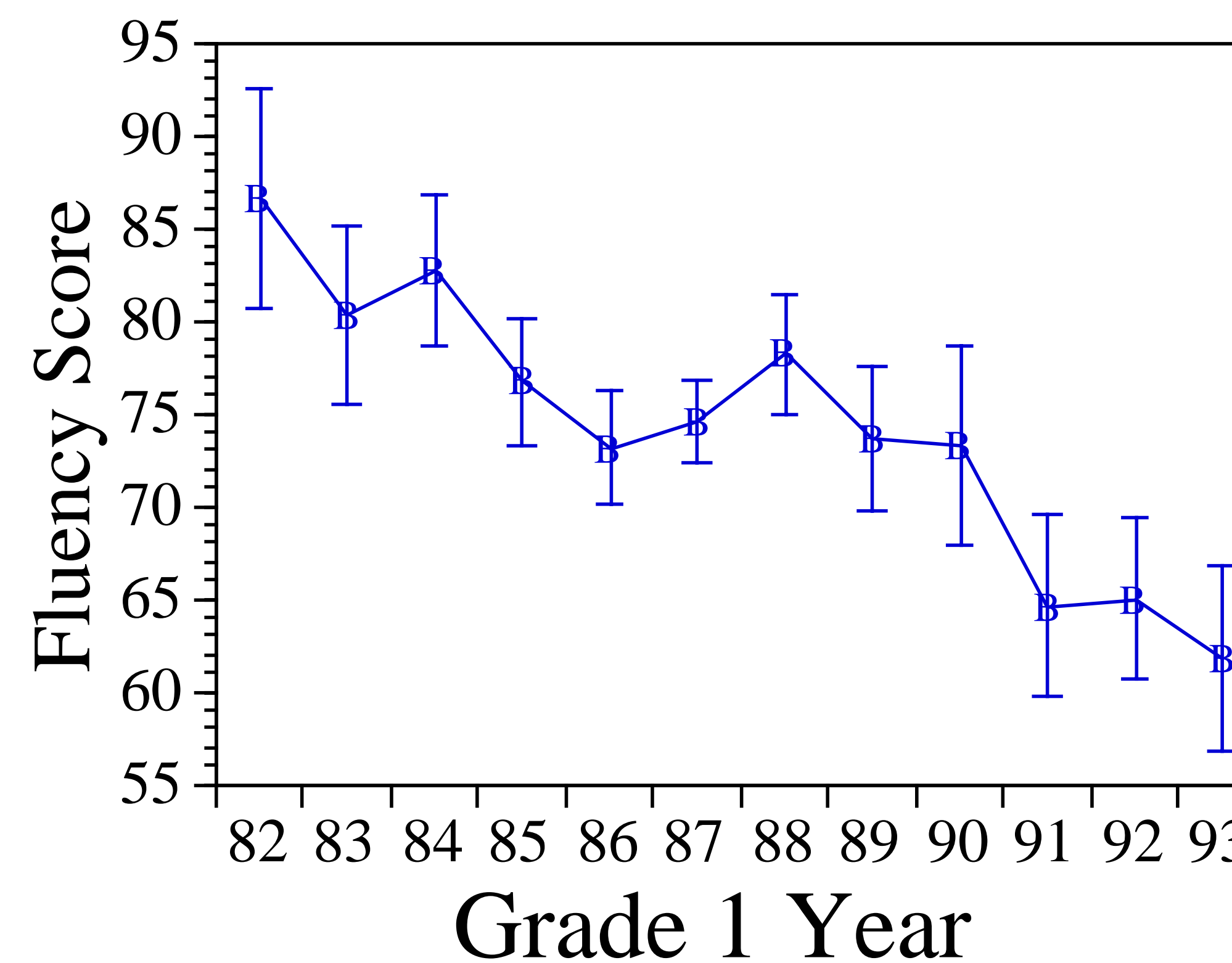
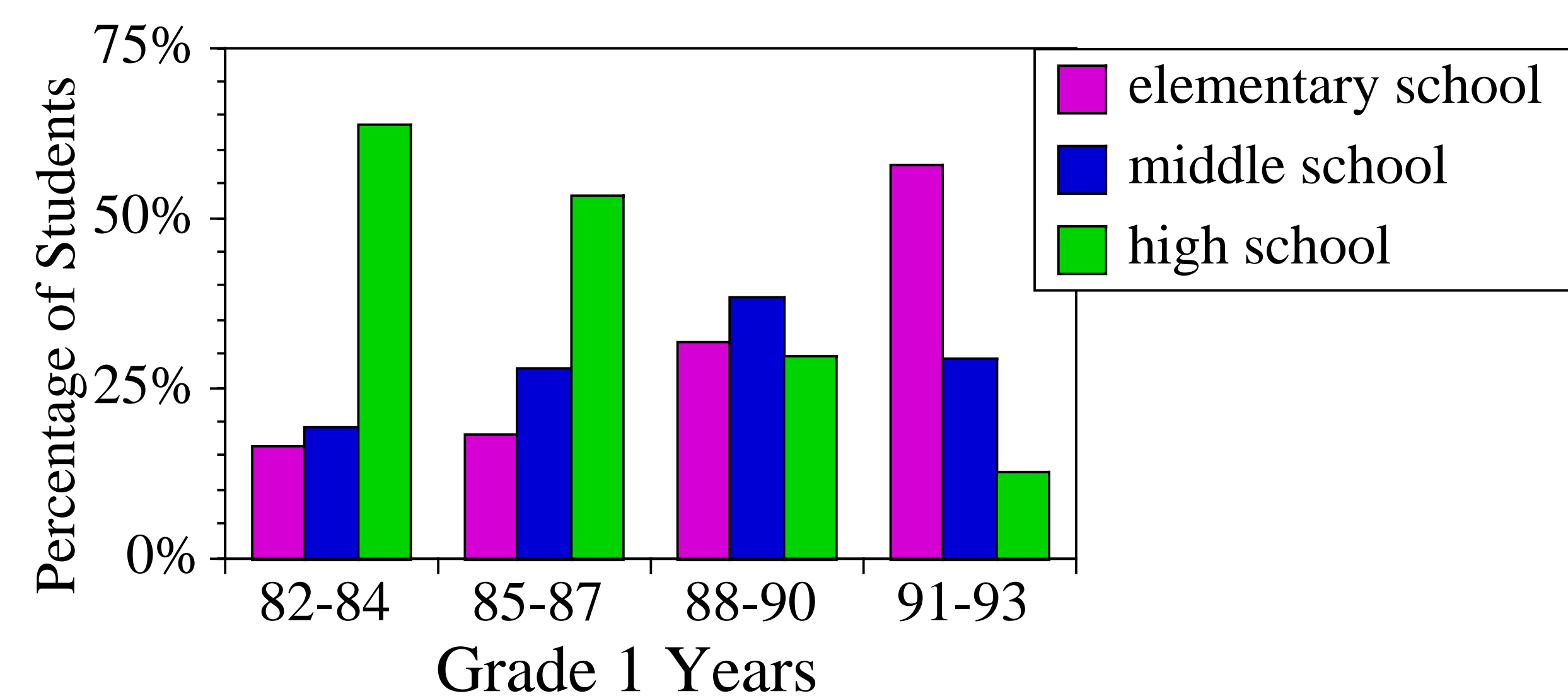


Figure 2. When did you start using a calculator?



Why are scores declining?

We can't address this question directly. However, some of the participants also filled out a questionnaire about aspects of their mathematics experience. One question of interest was "When did you start using a calculator?" As shown in Figure 2, students educated more recently were also more likely to report using a calculator from earlier grades. Thus, memory retrieval of basic facts is practiced less now than in the recent past.

Conclusions

These data supported our intuition that the calculation skills of undergraduates have declined over the last decade (see Mulhern & Wiley, 2004, for similar findings with Irish students).

Does it matter that students are less fluent with basic arithmetic facts and procedures? We expect university students to automatically access words; should they also be able to retrieve facts such as 7×8 ? Or has the ubiquity of calculators and computers made fluent arithmetic skills obsolete?

Our results have implications for educators and policy makers, and for researchers who study mathematical cognition.