

YSIMSTE

**York - Seneca Institute for Mathematics, Science and Technology
Education**

COLLEGE MATHEMATICS PROJECT 2011

FINAL REPORT

Executive Summary

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Preface

Once again, we are pleased to present the annual report of the College Mathematics Project (CMP). In doing so, the CMP team acknowledges the critical work of many individuals and groups whose contributions have enabled the project to operate throughout the year. These include:

- the Ministry of Education and the Ministry of Training, Colleges and Universities for their ongoing support, both financial and professional;
- the CMP Steering Committee, the college Vice-Presidents, Academic and the CMP College Leads, who have ensured that CMP had the data with which to conduct its research;
- the School/College/Work Initiative (SCWI), whose Regional Planning Teams have organised forums at which CMP research has been shared with school and college educators;
- Seneca College's Information Technology Services (ITS) department, especially John Meskes, Mehrdad Ziaei and Mohsen Rezayatmand, who have enabled the CMP data to be assembled, analysed and displayed.

Thank you to all of these individuals and groups and also to the many others who have made contributions to the CMP this year.

Margaret Sinclair

As this report was going to press, our dear friend and colleague, Margaret Sinclair, passed away. Margaret was an Associate Professor of Mathematics Education at York University and co-Director of the York/Seneca Institute for Mathematics, Science and Technology Education (YSIMSTE). She was a key member of the CMP team in its early years and her critical but constructive contributions will be missed. This 2011 final report of the College Mathematics Project is dedicated to her memory.

Le présent document est également disponible en français au site
<http://collegemathproject.senecac.on.ca>

Executive Summary

The College Mathematics Project (CMP) is a collaborative program of research and deliberation concerning mathematics achievement of first-year college students in Ontario. Its goals are:

- To analyse the mathematics achievement of first-semester college students, particularly in relation to their secondary school mathematics backgrounds;
- To deliberate with members of both college and school communities about ways to increase student success in college mathematics.

CMP 2011 included all 24 colleges and 72 district school boards in all regions of the province. It was funded by the Ministry of Education and the Ministry of Training, Colleges and Universities, and led by a team of researchers from the York-Seneca Institute for Mathematics, Science and Technology Education (YSIMSTE) based at Seneca College.

The CMP employs the overall methodology of deliberative inquiry, in which research into the current situation is linked to deliberations among stakeholders over appropriate courses of future action. The CMP 2011 research analysed the secondary school and college records of almost 95,000 students who enrolled in all college program areas in fall 2010. Of these, over 35,000 took a first-semester mathematics course and the research focused on their achievement in these courses, relating this to a variety of factors, including the choice of mathematics courses taken at secondary school. Because this was the third year in which all 24 colleges participated, we have been able to identify preliminary trends emerging in our data,

Highlights of the CMP 2011 research include the following:

- 67.6% of students achieved good grades (A, B or C) in first-semester college mathematics, while 32.4% were considered to be “at risk” (having received a D or F or having withdrawn from the course). This percentage (of good grades) represents very little change from the previous two years.
- Of the Very Recent Ontario Graduates – those who have taken the most recently revised mathematics curriculum in secondary school – 61.6% of the males and 68.7% of the females achieved good grades.
- Second Career students achieved better than other students: 80.0% of males and 84.5% of females achieved good grades.
- Graduates of French-language school boards attend English- and French-language colleges in approximately equal numbers; the mathematics achievement of students attending French-language colleges has increased since last year while that of students attending English-language colleges has shown very little change.
- Older students, particularly females, achieve significantly better than younger students: for example, 77.6% of males and 85.5% of females aged 30-39 obtained good grades.
- Patterns of achievement analysed according to secondary school mathematics pathways follow similar patterns to those found in the past:

- Many more students came to college with MAP4C than MCT4C in Grade 12 but their achievement was lower overall. The same applies to MBF3C and MCF3M in Grade 11.
- However students with high marks in MAP4C do well in college mathematics; 76.8% of those with 80% and over in MAP4C obtained good grades in college.
- Over 3,000 students in our sample took no mathematics after Grade 11; only 50.2% of those who took MBF3C as a terminal mathematics course achieved good grades in college mathematics.
- The numbers of students transferring from Grade 10 Applied Mathematics to MCF3M is increasing each year from 0 (in 2007) to 381 (in 2008) to 806 (in 2009) to 1,213 (in 2010). 63.9% of the 2010 students go on to obtain good grades in college mathematics.
- Systematic qualitative research was undertaken this year into the content of first semester mathematics courses, particularly those of a foundational or preparatory nature. This was set in the context of curriculum case studies corresponding to the complete mathematical experience of students taking selected programs in Business and Technology.
 - The case studies illustrated how mathematics is taught both as standalone courses and as embedded into specialist courses within each program (such as accounting or electrical theory).
 - They also demonstrated how, at different colleges, the curriculum of programs focused on the same occupation may differ, while still being based on the same provincial program standard and aimed at the achievement of the same learning outcomes.
 - CMP analysis of a systematic selection of foundation program mathematics courses from across the province showed that they share a common emphasis on the numeracy skills required for college diploma programs and the occupations for which these programs prepare students.
 - Analysis of diploma level mathematics courses showed a greater proportion of program-specific mathematics topics but also a strong continued emphasis on numeracy skills.
 - The numeracy skills most frequently encountered in first-semester college mathematics courses were also mapped onto the provincial curriculum for Grades 1-8 and 9-12 mathematics. This analysis showed that the grades at which these key numeracy skills were most frequently taught were Grades 6, 7 and 8.

The CMP 2011 project included a Provincial Forum, hosted by Seneca College in October 2011, where themes of a provincial policy nature were discussed. Half of the day comprised the discussion of two major themes of the CMP: Mathematics Education for the 21st Century Economy and Student Success in Secondary-Postsecondary Transition. Also included in the forum was an outline of CMP 2011 research results and a presentation from the Conseil supérieur de l'Éducation du Québec on their research in this area. Finally, forum participants had the opportunity to deliberate over three sets of questions arising from the research. The forum is described in more detail in the report and individual presentations are available on the CMP web site.

The CMP report concludes with a discussion of two themes that emerged from the research and deliberation this year. The first of these is Numeracy and in support of this theme, we suggest that a provincial **numeracy strategy** is required. Such a strategy would aim to increase levels of numeracy among Ontario secondary school graduates through a multi-faceted program of action, which could include some or all of the following ideas:

- *The implementation of a Grade 10 numeracy test having the same status as the existing Ontario Secondary School Literacy Test (OSSLT) in lieu of the present Grade 9 assessment of mathematics.*
- *Involving employers, college faculty, and parents in identifying the numeracy skills in greatest need of support.*
- *Increased efforts, through both pre-service and in-service teacher education, to support teachers' mathematical skills and understanding and to eradicate negative stereotypes associated with mathematics.*
- *Considering the use of a numeracy test for teacher candidates, such as has recently been introduced (along with tests in literacy and information and communication technology-ICT) in England & Wales, starting in 2012.*
- *Research into ways in which Junior/Intermediate teachers with a mathematics teaching qualification are currently being deployed by school boards, and the impact of such deployment on achievement.*
- *Development of sample instructional materials to support the teaching of numeracy across the curriculum (for example in social studies as well as in science and mathematics).*

Colleges and universities have a role to play here also. Until innumeracy among incoming students is eradicated, there will be a continuing need for developmental courses of the variety that have grown up over the past few years. Colleges can support schools' efforts at developing higher levels of numeracy if they could work together in a number of related areas:

- *To develop a common numeracy assessment tool to be used by all colleges as part of their admission and placement process for all incoming college students – perhaps with a technology version and a business version – based on a numeracy framework approved by both the college system and the Ministry of Education. This assessment would be consistent with, but not the same as, the Grade 10 numeracy test since it would be designed specifically for students applying to college programs in technology and business.*
- *To reframe program admission and placement requirements to take into account students achievement on the common numeracy assessment.*
- *To develop a system-wide college numeracy course (again, perhaps in a technology version and a business version) for students whose scores on the numeracy assessment show that they need such a developmental course.*
- *To share both the assessment framework and course information with elementary and secondary schools so that teachers at earlier levels understand better the expectations of the college system of students entering into vocational diploma and certificate programs.*
- *To use the CMP data collection system to collect students' numeracy assessment scores and to provide feedback to school boards and schools on the (aggregate) achievement of their graduates.*

The second theme of this year's final report is called **College Knowledge** and is focused on the varieties of knowledge and skill that students require to be successful at the postsecondary level of education.

While the CMP has neither the resources nor the research evidence on which to support specific recommendations, we believe that our evidence supports the need for further work in this area. We therefore invite the education community – both at governmental and local levels – to discuss possible solutions and, specifically, that:

- *The Ministry of Education and the Ministry of Training, Colleges and Universities set up an expert panel to study the assessment of students at the interface of secondary and postsecondary education and to recommend possible policies and practices that could ensure that students are adequately prepared for postsecondary education.*
- *The School/College/Work Initiative be asked (and resourced) to expand the range of mechanisms for facilitating students' successful transitions from school to college as well as maintaining its ongoing support for dual credits and forums.*
- *Colleges, Universities and School Boards work together at the local level to develop joint programs aimed at providing all students who intend to go on to postsecondary education sufficient college knowledge to maximise their chances of success.*