Leading MATH Success

TIPS4RM Targeted Implementation and Planning Supports for Revised Mathematics

OAME/OMCA GRADE 12 PROJECT

MCT 4C

Ontario Association for Mathematics Education

OMCA Ontario Mathematics Coordinators Association

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Funding provided by the Ministry of Education.

Grade 12 Mathematics for College Technology (MCT4C)

Introduction

This package of materials has been created in response to the revised grade 12 mathematics curriculum to be implemented in September, 2007. The prepared lessons are not exhaustive, but rather were developed to give a flavour of the intended approach for this course. Attention was given to areas where there was a lack of resources, as well as to modelling how to bridge the understanding for students between the abstract and application. Teachers are encouraged to work together in school and board teams to develop lessons not included to extend their own learning as the writers in this project have done.

The following supports are included in this package.

- Lessons and BLMs for approximately 1/3 of the course
- One Summative performance task
- Electronic Resources (GSP sketches and Data files)

These resources are also posted on the OAME website: http://www.oame.on.ca:

Guiding Principles:

Writers and reviewers completed this resource package in order to:

- improve student success (model teaching considerations which support the profile of the learner)
- interweave and revisit the big idea of the course –properties and representations of functions as well as applications of algebra, trigonometry and geometry.
- emphasize problem solving and inquiry
- make the mathematical processes and literacy strategies explicit
- continue the use of TIPS4RM

Lesson Planning (Match Template)

The lessons and assessments have been created using the MATCH template from the TIPS4RM resource. The acronym MATCH is organized around a three part lesson, paying attention to:

Minds on getting students mentally engaged in the first few minutes of class
Action! the main portion of the lesson where students investigate new concepts
Consolidate/Debrief ideas for 'pulling out the math', and checking for understanding

Meaningful and appropriate follow-up to the lesson is provided in the Home Activity section.

The time allocation in the upper left corner suggests how much time should be devoted to each of the three parts of the lesson.

The materials section in the upper right corner identifies resources needed for the class.

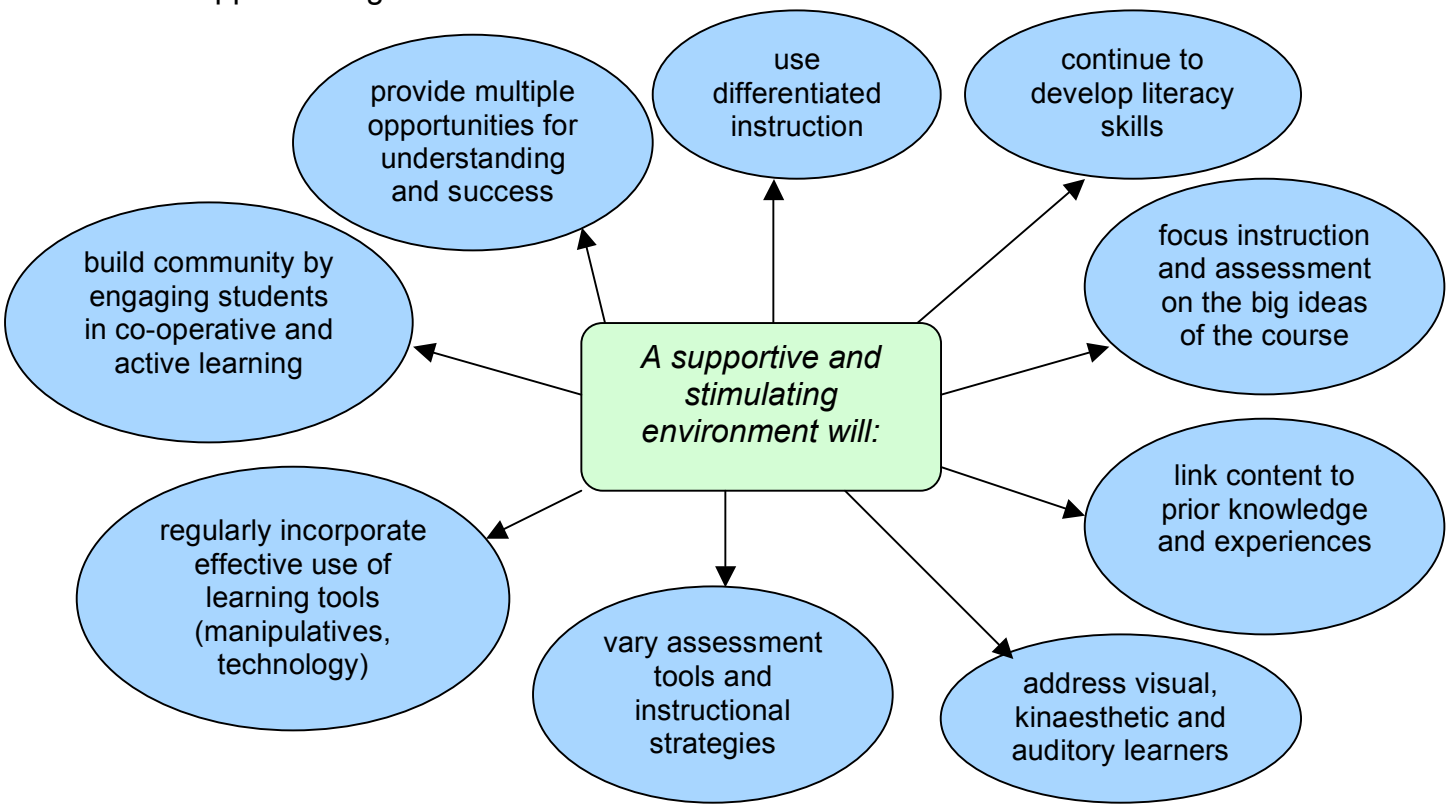
The right hand column offers Tips for teachers such as instructional strategies, references to resources, literacy strategies used, and explanations.

The narrow column to the left of this suggests opportunities for assessment.

For further details about this organizer go to http://www.curriculcum.org/lms/

Teaching Considerations

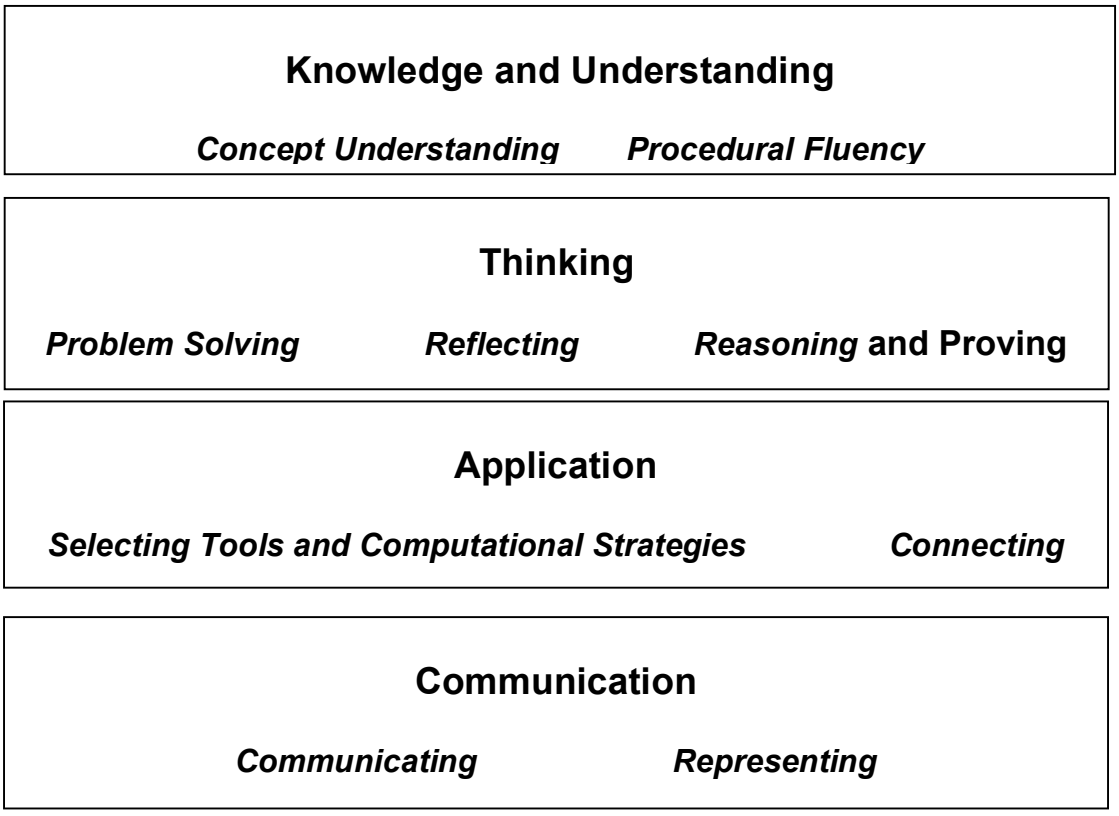
There are many considerations in the development of a positive learning environment which supports the grade 12 learner.



Processes

The seven mathematical processes can be referred to as the '***actions of math***.' In the revised curriculum, these process expectations have been highlighted in their importance since they support the acquisition and use of mathematical knowledge and skills. They can be mapped to three categories of the Achievement Chart – Thinking, Communication and Application. The fourth category, Knowledge and Understanding, connects to the overall and specific expectations of the course, which can be referred to as the '***mathematical concepts'***. Students apply the mathematical processes as they learn the content for the program.

The **combination** of the mathematical **processes** and **expectations** are **embedded** in the **achievement chart** as the following:



Students need multiple opportunities to engage in the processes. Lessons included in this project highlight these processes to be developed. The included performance task provides criteria for assessment on all the processes.

To assist students' development of these processes (instructional strategies, questions and feedback) see TIPS4RM Processes Package on the Leading Math Success website http://www.curriculum.org/lms/

Literacy Strategies

> Mathematics is the most difficult content area material to read because there are more concepts per word, per sentence, and per paragraph than in any other subject; the mixture of words, numerals, letters, symbols, and graphics requires the reader to shift from one type of vocabulary to another.
>
> Leading Math Success, Report of the Expert Panel for Mathematical Literacy Gr. 7 – 12

Improve student achievement demands an emphasis on developing literacy competencies linked to mathematics learning. To consolidate understanding, learners need opportunities to share their understanding both in oral as well as written form. Weakness in reading or writing skills provides barriers to success in problem solving. This resource explicitly embeds literacy strategies in the lessons.

Starting points for teachers:

- Use strategies to develop vocabulary and comprehension skills, including
  - word walls
  - Frayer model
  - concept circles
- Use strategies relating to the organization of information
  - "inking your thinking" – having students write down their thoughts
  - concept maps
  - anticipation guides
- Use strategies to help students understand features of textbooks and graphics
  - read problems aloud
  - highlight key words
  - think aloud

More details and strategies can be found in Think Literacy: Cross-Curricular Approaches, Mathematics, Grades 10-12, 2005, http://www.curriculum.org/thinkliteracy/library.html

Assessment

The primary purpose of assessment and evaluation is to improve student learning. Information gathered through assessment helps to provide feedback to students as well as guiding teachers' instruction.

Assessment must based on the four categories of the achievement chart and include the mathematical processes.

Assessment should be varied in nature. The chart below provides suggestions for a variety of assessment tools and the categories that they could be connected to.

Category	Assessment Tools
Knowledge and Understanding	Quiz, Test, Exam, Checkbric, Demonstration, Short Answer , True/False , Multiple Choice, Observation
Thinking	Editorials, Observations, Portfolio/Digital Portfolio, Essays, Articles, Debates, Report, Investigations, Graphic Organizers, Open-ended Questions, Performance Assessment Tasks, Video Tapes, Plays, Student /Teacher Conferences
Communication	Concept Map, Journals, Plays , Multi media presentations , Oral presentations , Drawings , Discussions, Explanations , Performance Task Assessment, Student/Teacher Conferences, Portfolio
Application	Concept Map, Debates, Editorials, Portfolio, Observation, Tests, Quizzes, Open-ended Questions, Design of Products, Models/Concrete Representations, Discussion

Note : This is by no means an exclusive or exhaustive list. It is only a guide.

Summative Tasks

One summative performance task is included in this resource. It provide opportunities to assess the important concepts in the course through the mathematical processes. It is important for teachers to be aware of the skills and knowledge expected of the students on those assessments at the beginning of the course, so that students are appropriately prepared for them by having similar opportunities during the course. A paper and pencil test at midterm and final exam can assess the Knowledge and Understanding category.

Manipulatives and Technology

Many expectations in the revised curriculum make reference to using a variety of tools, including manipulatives, calculators and computer software. All new learning should begin with exploration and use learning tools whenever possible to provide students with representations of abstract mathematical ideas in varied, concrete, tactile, and visually rich ways.

> Information and communication technologies provide a range of tools that can significantly extend and enrich teachers' instructional strategies and support students' learning. Technology can reduce the time spent on routine mathematical tasks thus allowing students to devote more of their efforts to thinking and concept development.
>
> *The Ontario Curriculum, Grade 12 Mathematics, Revised, 2007*

The lessons and assessment written for this support document identify these learning tools. Teachers need to make arrangements to have these materials available and for computer lab booking at the beginning of the course. The use of these learning tools should not be considered an extra to the instructional component of the course, nor should they be considered as only beneficial to a select few.

Online Resources

Ontario Resources

TIPS4RM, Leading Math Success and TIPS resources	http://www.edu.gov.on.ca/eng/studentsuccess/
Think Literacy Mathematics Grades 7 – 10	www.oame.on.ca/main/index1.php?lang=en&code=ThinkLit
Ontario Association for Mathematics Education	www.oame.on.ca
Statistics Canada	http://estat.statcan.ca/
Ontario Mathematics Coordinators Association	www.omca.ca

Learning Resources

Learning Math Series	www.learner.org
Math Forum	www.mathforum.org
NCTM	www.nctm.org
PBS	www.pbs.org/teacherssource
Regina University - Rich Math Tasks	http://mathcentral.uregina.ca
Rich Math Tasks - UK	www.nrich.maths.org.uk/
TI Education	http://education.ti.com/educationportal/sites/US/homePage/index.html

Virtual Manipulatives

National Library of Virtual Manipulatives	http://nlvm.usu.edu/en/nav/vlibrary.html