

ED 4161 The Teaching of Mathematics in the Intermediate and Secondary School.

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Curricular Models.

1. General theories of education give comprehensive principles, recommending the production of a particular type of person as a member of a particular type of society. A major shift from an industrial age to an **informational age** implies a new demand for the workers' skills. This means not only being mathematically literate, but having **significant mathematical background** is now a standard requirement. (Principles and standards for school mathematics, NTCM 2000). The four primary reasons for that are:
 - Basic math skills are useful for everyday life;
 - Mathematics is our cultural heritage;
 - Many workplaces require basic math skills;
 - Scientific and technological jobs require fundamental knowledge in math.(Note that the notion of *basic skills* includes counting and logical ability, along with algebraic, geometric and statistical understanding and is far from being primitive or elementary.) Students are also expected to develop **critical thinking, understanding of technology, ability to adapt to changes, and make sound decisions.**
2. The **Core Curriculum** includes common objectives and outcomes for **all** students. Its implementation is differentiated by the depth and breadth of treatment and by the nature of applications. There are three major different **curriculum models**:
 - **Crossover** model has two parallel tracks, college bound and non-college bound, with basically identical content objectives but significantly different level of depth and abstraction. The model allows a student to switch to the other sequence if such a decision is made by the student. (In practice may require a significant cognitive effort from a student switching to the college bound sequence).
 - **Enrichment** model allows heterogeneous classes in which the students who complete the core content study ahead of others are assigned some enrichment topics to explore.

- **Differentiated model** organizes classes in a heterogeneous manner. Within the same classroom different learning teams may address the same topic at a variety of levels.

Note that along with traditional (sequential) approach when different **strands** (algebra, geometry, etc) are studied in different years, there exists an **integrated curriculum** approach when students are exposed to a mixture of topics during each year.

3. Development of current **NL curriculum** is associated with establishing in 1994 the *Atlantic Provinces Education Foundation* (APEF) and new programs in Math, Language Arts, Science and Social Studies. *Foundations for the Atlantic Canada Math Curriculum* was distributed in 1996. In 2004 *Council of Atlantic Ministers of Education and Training* replaced APEF. This provided a framework for basic decisions on instructional techniques and assessment strategies, which led to development of *Essential Graduation Learnings* (EGLs). EGLs are statements of expectations about knowledge, skills, and attitudes of all students who graduate high school. They provide a consistent vision for the development of the core curriculum and are supported by curriculum outcomes. Core EGLs are:

- Aesthetic expression;
- Citizenship;
- Communication;
- Personal development;
- Problem solving;
- Technological competence;
- Spiritual and moral development.

NCTM (USA and Canada) **content** curriculum standards are: **number and operations, algebra, geometry, measurement, data analysis (statistics) and probability**. The **process** standards are **problem solving, proofs and reasoning, connections, communications, representations**.

4. Curriculum outcomes illustrate what students are expected to know and do at various stages of schooling. Assessment standards are directly linked to Curriculum Outcome Statements.

4. NL Program Design (Senior High).

Program level	Course 1	Course 2	Course 3	Course 4
Advanced	Math 1204	2205	3205	3207
Academic	Math 1204	2204	3204	3103(optional)
Practical	Math 1206	2206	3206	

Implementing a course of study.

1. Educational philosophy (system of beliefs) defines educational goals and objectives, also known as curriculum outcomes. Curriculum outcomes illustrate what students are expected to know and do at various stages of schooling.
2. Assessment and Achievement Standards are directly linked to Curriculum Outcome Statements.
3. Curriculum outcomes have different types.
 - GSO – **General** Curriculum Outcomes – define what students are expected to know upon completion of study in a curriculum area (e.g. Math).
 - KSCO – **Key Stage** Curriculum Outcomes – define what students are expected to know by the end of grade 3, 6, 9 ,12 as a result of their cumulative learning experience in the curriculum area. They form a basis for *Criterion Reference Tests*.
 - SCO – **Specific** Curriculum Outcomes – define what students are expected to know upon completion a specific course in a curriculum area.
4. Curriculum Guides
 - elaborate on curriculum outcomes at specific grades;
 - provide information on program design and nature of learning;

- give examples of instructional practice and assessment strategies;
- suggest useful resources for teaching.

5. Implementing a course of study, a teacher must be informed about
- What is to be learned (content and processes).
 - How it is suggested to teach.

Bases on this information and own teaching/learning practice the **teacher sets up particular goals and objectives for the course.**

6. **Educational objectives** have different types:

- **affective** (appreciation, fascination, interest, recognition);
- **cognitive** (knowledge and skills, conceptual understanding, application in complex or non-obvious situations);
- **psychomotor** (graphing functions and geometrical drawing).

7. Different **types of questions** promote different objectives.

- What do you remember about X? (*knowledge retention*)
- Given X, what would you predict? (*comprehension*)
- How could you use X? (*application*)
- What are the characteristics of X? (*analysis*)
- How would you create X? (*synthesis*)
- Do you agree with this statement about X? (*evaluation*)
- X is wonderful, is not it? (*affect*)
- Build X from cardboard paper. (*psychomotor development*)

8. Implementing a course of study, a teacher needs to be very organized and selective about **teaching resources.**

- Be consistent with your teaching goals and students' learning objectives in the course.
- Review your university math notes and books which are relevant to the course content, and could assist you in identifying the most important mathematical ideas along with their connections and multiple representations.
- Consider taking an advice from other teachers, who taught the course previously and are willing to share extra teaching materials.
- Create and use a good teaching portfolio (*see instructions for your portfolio project*).