To solve a situational problem – Elementary Cycle One

Improving comprehension and implementation in class

In the *Québec Education Program: Preschool Education, Elementary Education*, the following passage appears on page 142: "During Cycle One, the students learn how to identify the relevant information in a situational problem. They see how the information given in the situational problem relates to the assigned task. They also learn how to model a situational problem, apply different strategies and rectify their solution in light of their results and discussions with their classmates."

Introduction to situational problems

First, it should be remembered that a situational problem is not an ordinary problem-solving exercise. It is a task involving a set of related problems that have no solution and that require students to discover or invent ways of arriving at a possible solution. In this context, the teacher acts as a guide rather than as a "conveyor of knowledge."

The different branches of mathematics (i.e. arithmetic, geometry, measurement, statistics and probability) can be used in situational problems. It can be even more interesting to combine different subjects to make situations both meaningful and more realistic for the students.

KEY FEATURES OF THE COMPETENCY	POSSIBLE ACTIONS ON THE PART OF THE STUDENT
TO DECODE THE ELEMENTS OF THE SITUATIONAL PROBLEM	Defines the task to be performed and the type of result expected; Derives information from various types of representation (words, symbols, objects, drawings, tables, graphs, etc.); Selects the relevant information; Derives implicit information or identifies any information that is missing
TO MODEL THE SITUATIONAL PROBLEM	Recognizes similarities between the situation and his/her own experience; Draws on networks of mathematical concepts and processes; Organizes the elements of the situation, using various types of representation; Defines a work plan and its steps; Selects one or more problem-solving strategies; Finds the missing information, if necessary
TO APPLY DIFFERENT STRATEGIES TO WORK OUT A SOLUTION	Uses mathematical concepts and processes related to the task; With or without the help of technology, uses one or more problem-solving strategies (e.g. makes a drawing, does a calculation, carries out tests and verifications or a manipulation, refers to previously solved problems, makes a table or draws a graph, makes a list or a flow chart, looks for a pattern or an analogy, works backwards, simplifies the problem, constructs a model, checks all the possibilities); Always evaluates his/her work against the facts of the situation and in light of the task to be performed
TO VALIDATE THE SOLUTION	Assesses the appropriateness of the result obtained; Evaluates the resulting solution (procedure and final answer) against the facts of the situation and in light of the task to be performed; If necessary, rectifies the solution (procedure and final answer); Compares his/her solution (procedure and final answer) with those of his/her classmates or solutions from other sources; Assesses the efficiency and appropriateness of the strategy or strategies used
TO SHARE INFORMATION RELATED TO THE SOLUTION	Provides a comprehensible and structured solution; Uses one or more appropriate types of representation (words, symbols, objects, drawings, tables, graphs, etc.); Explains the main steps of his/her solution orally or in writing; Describes orally or in writing how he/she validated his/her solution (procedure and final answer)

Some relevant sources

Banque de situations-problèmes mathématiques, 1er cycle du primaire

http://www.cslaval.qc.ca/apo/pdf/Banque-Math.pdf

This document provides a summary of the situational problems tested at the beginning of the project, instructional comments by Richard Pallascio, a list of the characteristics of a situational problem according to Astolfi (1993: 319), the key features of the competency presented as a set of steps[1] and a framework for organizing different situational problems according to the philosophy of the Québec Education Program. This framework specifies the subject-specific and cross-curricular competencies as well as the broad areas of learning involved in each situational problem.

Référentiel des stratégies d'enseignement et d'apprentissage de résolution d'une situation-problème au 1er cycle

http://differenciationpedagogique.com/data/exemple2/referentiel_des_strategies_au_1er_cycle.doc

This source will provide ideas on teaching and learning strategies for at-risk students and students experiencing difficulty with regard to the key features of Competency 1.

MELS, *Programme de formation de l'école québécoise, Progression des apprentissages au primaire, Mathématique*, Gouvernement du Québec, 2009, p. 12.

MELS, *Programme de formation de l'école québécoise - éducation primaire - enseignement préscolaire*, Gouvernement du Québec, 2001, p. 142.

www.mels.gouv.qc.ca/progression/mathematique
www1.education.gouv.qc.ca/sections/programmeFormation/primaire/

Teach students how to use a calculator not only to check their work, but above all to enable them to exercise critical judgment, compare different answers and apply different problem-solving strategies.

[1] "When solving situational problems in mathematics, the students must also perform a series of operations in order to decode, model, verify, explain and validate. This is a dynamic process that involves anticipating results, redoing certain steps in the problem-solving procedure and exercising critical judgment." Taken from *Québec Education Program: Preschool Education, Elementary Education; Mathematics*, 142.

Les situations-problèmes : au cœur de la réforme en mathématiques

Instantanés mathématiques, APAME, volume 37, numéro 3, printemps 2001, p.14-27.

To help teachers become familiar with the meaning of this competency, a group of teachers took part in an action research project that involved developing and testing out situational problems in mathematics. Richard Pallascio acted as a resource person for this group.

MELS, *Programme de formation de l'école québécoise, Progression des apprentissages au primaire, Mathématique*, Gouvernement du Québec, 2009, p. 23-24

www.mels.gouv.qc.ca/progression/mathematique

The *Progression of Learning* provides examples of cognitive and metacognitive strategies for the different key features of Competency 1. For example, the teacher could assist students in determining the prior learning they should draw upon, using a counterexample to prove that a statement is false, observing a pattern or adapting their approach to the task at hand.

Improving Learning in Mathematics: Challenges and Strategies

Swan, Malcolm. 2005. *Improving Learning in Mathematics: Challenges and Strategies*, Great Britain: Department for Education and Skills, Standards Unit.

www.ncetm.org.uk/files/224/improving_learning_in_mathematicsi.pdf

Malcolm Swan suggests a number of strategies (pp. 11-15 and pp. 30-44):

- Arrange the room to facilitate discussion, question with mini-whiteboards, use posters to stimulate thinking (not only to display the finished work), use card matching activities to focus on interpretation.
- Encourage discussion among students and set the ground rules: talk one at a time; share ideas and listen to each other; make sure that people understand what you are saying; try to say something that follows on from what the last person said; if you disagree with what people are saying, challenge them to explain their ideas; respect each other's opinions; don't worry about making mistakes, since we all learn from our own or other people's mistakes; share responsibility for reporting on what was learned and try to agree in the end.
- Ask questions that make students think; ask open questions; give students enough time to come up with their answers; give examples of mistakes, and ask students to explain these mistakes; ask students to give examples; conduct small group and whole group discussions, use different strategies to meet the needs of different types of learners.

Avez-vous des problèmes avec la résolution de problèmes?

Instantanés mathématiques, APAME, volume XXXIV, numéro 3, février-mars-avril 1998, p. 7-11.

This outlines the basic principles and beliefs underlying the experimentation, followed by a procedure for conducting activities and a table summarizing the teacher's role in each of the three phases of the learning process.

Comment accompagner son enfant dans l'apprentissage des mathématiques, SMAC

Devoirs et leçons, j'accompagne mon enfant, MELS

http://www.smac.ulaval.ca/fileadmin/smac/documents/Conference_de_quartier/Guide_17-10-13.pdf
http://www.education.gouv.qc.ca/references/publications/resultats-de-la-recherche/detail/article/devoirs-et-lecons-jaccompagne-mon-enfant/

Parents are of great help during their children's education, and these two documents can provide them with a number of suggestions.

Enseigner les mathématiques, des intentions à préciser

DeBlois, Lucie. 2011. *Enseigner les mathématiques, des intentions à préciser*, Canada, Les Presses de l'Université Laval, p. 16.

The following passage appears on page 16: The CESAME team experimented with forming groups consisting of students who differ in terms of the procedures or solutions adopted by each group member. The advantage of this type of team is that it makes it easier to change the makeup of the groups and prevents the stigmatization of students according to their gender, their difficulties or their strengths. . . . Cooperative learning is another approach that encourages interaction among students. This approach is distinguished from teamwork in that each individual makes an organized contribution to the final product. Cooperative learning requires an approach to learning that should initially involve short tasks. [*Translation*]

Conditions gagnantes et leur contexte d'utilisation

www.intranet.fse.ulaval.ca/dl.php?rep_pub=prof&fich=pub_6007_Conditions_gagnantes_ressorties_lors_des_formations_automne_2011_ld.pdf

This outlines teaching practices developed by teachers from the Commission scolaire du-Fleuve-et-des-Lacs and Lucie DeBlois in 2011.

Other points to consider…

- In mathematics, students do not always know how to go about performing a task or do not immediately find what they need. They must therefore be strategic, persevering, patient and hardworking. Many use mathematics class to develop these attitudes and skills.
- In mathematics, when students face problems and the teacher suggests that they work in teams, the context created and the ensuing discussions give students the opportunity to acquire social skills.
- A good first step in improving students' ability to critically assess what they are doing is to ask the following question on a regular basis: "How do you know this?" *L'art de questionner en numératie*: http://apprendreenseignerinnover.ca/projects/lart-de-questionner-en-numeratie/