Building a Virtual Community of Problem Solvers: The CASMI project (Workshop)

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Abstract
During our workshop, we are going to present the Internet based learning community CASMI (Communauté d'Apprentissages Scientifiques et Mathématiques Interactifs, www.umoncton.ca/casmi. The aim of the project is to develop a genuine problem solving community that unifies schoolchildren (K-12), teachers and university students attending prospective teacher programs. Most of our problems are open ended and challenging. These types of problems are often connected to real life situations familiar to the schoolchildren, in which certain mathematical concepts are needed to find a solution. Members can submit their solutions using an electronic form integrated with standard word processing tools. Once submitted, each solution is analyzed by university students enrolled in didactic courses. Using an electronic response form which assesses both problem solving strategies and communication skills, the university student assesses the solution and gives personalized formative feedback that can viewed in the member's e-portfolio. During our workshop, we are going to present the CASMI site and let participants explore its different features as well as our formative assessment tool. We will conclude with a discussion on different opportunities that gives this resource for classroom teaching and research.

Workshop summary
The CASMI (Communauté d'Apprentissages Scientifiques et Mathématiques Interactifs, www.umoncton.ca/casmi) project was launched in October 2006 (Fig. 1). It is grounded on six years of success of the CAMI site (Freiman and al., 2005[1]) and is based on the *problem of the week* idea (mathforum.org). The aim of the project is to develop a genuine problem solving community that unifies French speaking schoolchildren (K-12), teachers and university students attending prospective teacher programs.

To become a member of the community, you need to register and create your e-portfolio by choosing a username and a password. This provides you with free access to all activities on the website and allows you to save all your work (problems solved, work done on the problem

Fig 1: Main page of the CASMI
Website: http://www.umoncton.ca/casmi

of the week and proposed problems) (fig 4)). The major activity in CASMI is *problem solving* with the choice of 12 ongoing problems in three subjects areas: math, science and chess. Each of these subjects is divided into four levels of difficulty: manchot (penguin), girafe (giraffe), dauphin (dolphin) and hibou (owl), manchot being the easiest and hibou the hardest. The CASMI Team creates interesting and challenging problems for schoolchildren of all ages and levels of difficulty. The Fig. 2 shows the screen with an example of such a problem.

Fig 2: Example of a penguin level mathematic problem on the website. By clicking on the left button under the problem, schoolchildren have access to a space where they can answer the problem.

Most of our problems are open ended and challenging. These types of problems are often connected to real life situations familiar to the schoolchildren, in which certain mathematical concepts are needed to find a solution. Some problems can be ill structured: bits of information can be missing from the text but are to be defined in order to solve the problem. With such kind of problems, schoolchildren are asked to transform the real life situation into mathematical models and work with them to get to an answer. This allows different interpretations and strategies that can be shared and discussed further in the classroom community and on the CASMI forum.

CASMI members can submit their solutions using an electronic form integrated with standard word processing tools. Usually two weeks are given to solve a problem. Before submitting the final solution, all the work done in the form is saved in the database so the solution can be edited, modified or revised up until final submission (Fig. 3).

Once submitted, each solution is analyzed by university students enrolled in didactic courses. Using an electronic response form which assesses both problem solving strategies and communication skills, the university student assesses the solution and gives a personalized formative feedback. This formative evaluation can be viewed by the member using his personal electronic portfolio that is integrated within the CASMI Web site (Fig. 4).

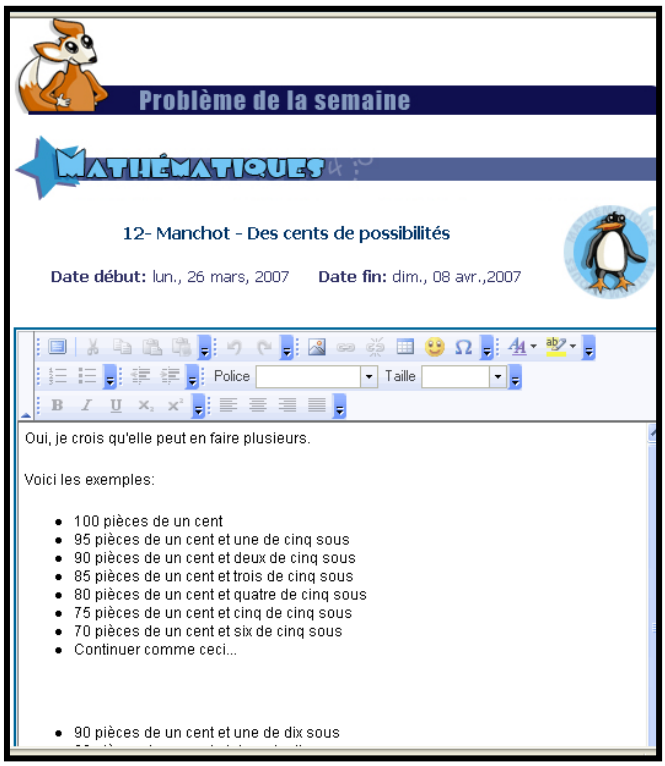


Fig 3: View of the form which members use to solve the posted problems.

Fig 4: By clicking on the link next to the arrow, all members of the CASMI community have access to their portfolio, which you can see in this capture. Each member can check the problems he or she solved, problems he or she proposed, share his portfolio with other members and change his personal information.

T l are published as part of our general analysis of each p s are accessible from the archive by means of the search e

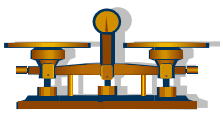
Besides the problem of the week, other CASMI activities allow our members to propose new problems for future problems of the week or participate in our discussion forum. Finally, we offer some surprise activities throughout the school year.

Example of a CASMI problem and possible solutions

Here is an example of a math problem that was recently posted on the site in the Manchot (penguin) level.

Samantha went to the store and bought 9 marbles. These marbles were particular because all of them except one had the same mass. The mass of one marble was 6 grams (g), the mass of the others was 5g. Using a 2 plated scale no more than a total of 3 times, how could she find out which one of the marbles has a different mass?

Question for the Aces: How could Samantha figure out which marble has a different mass by using the 2 plated scale less than 3 times?

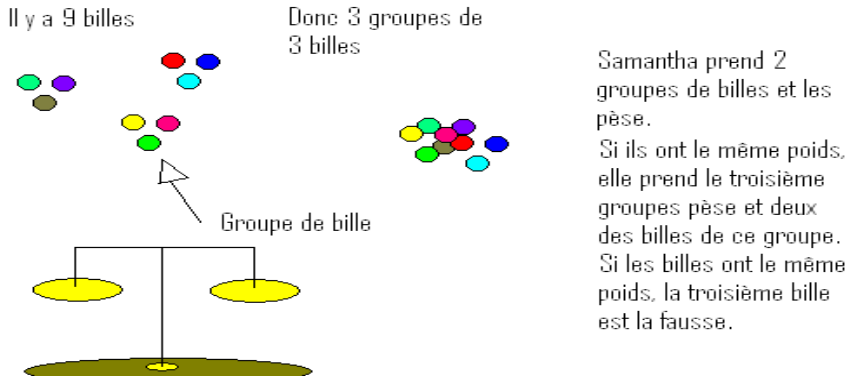


Because there are several ways to interpret and solve this problem, it can bring a lot of richness in discussions between students and teacher and between students themselves.
There were many varieties of representations and reasoning styles as well as different strategies used by schoolchildren as shown in the following examples.

Solution 1

We put 4 marbles on each side after if it's = it is clear that it is the marble which we haven't put, but if one side is inclined, we will take marbles from it and we will make 2 against 2 and we will see again which one is the heaviest. (The original text is in French)

Solution 2



Here is the translation of the text: Left corner: *There are 9 marbles* Middle on the top: *So, 3 groups of 3 marbles.* Middle on the bottom: *Group of marbles*. Right: *Samantha takes two groups of marbles and weight them. If they have the same weight, she takes the third group and weight two marbles from this group. If their weight is the same, the third is fake.*

Solution 3

Samantha went to the store and bought 9 marbles. These marbles were particular because all of them except one had the same mass. The mass of one marble was 6 grams (g), the mass of the others was 5g. Using a 2 plated scale no more than a total of 3 times, how could she find out which one of the marbles has a different mass?

I make 3 groups of 3 marbles et I weight 2 groups at the time to pour put on the scale, and after I eliminate 2 groups and I'm left with 3 marbles I put them of the scale in take those which make the scale move.

side 1	side 2
Group 1	Group 2
Group 2	Group 3
group 1	Group 3
Marble 1	Marble 2
Marble 2	Marble 3
Marble 3	Marble 1

The examples chosen are just a few of many interesting ones that were submitted. In our assessment approach, we value different types of strategies and interpretations that represent different modes of thinking and different ways to express this thinking.

During the first year of CASMI community, more then 5000 members from different countries have been registered, and over 4000 of them are schoolchildren. These schoolchildren sent us more then 10000 solutions. Our archive of problems already contains 880 (including 700 problems and solutions from the old CAMI website).

The CASMI community and dynamic database management system have been developed using multiple funding sources such as Inukshuk Foundation, Natural Sciences and Engineering Research Council of Canada (CRYSTAL Atlantique Center), New Brunswick Innovation Foundation, and others.

During our workshop, we are going to present the CASMI site and let participants explore its different features as well as our formative assessment tool. We will conclude the workshop with a discussion on different ways this resource can enrich classroom teaching and learning and also discuss future development.

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[1] Freiman, V., Vézina, N., Gandaho, I. (2005). *New Brunswick pre-service teachers communicate with schoolchildren about mathematical problems: CAMI project*. Zentralblatt fuer Didaktik der Mathematik, Vol. 37, No.3, pp.178-190.