

When an inclusive math competition opens the door to STEM

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Goal of the communication and connection to one of the MACAS topics

For years now, there has been interest in how to integrate STEM in schools and how mathematics fits into STEM. While this was not the original goal, the annual GAMA Contest, focusing first and foremost on mathematics, has led students to tell us about mathematics by making connections with different subjects and contexts. The purpose of this paper is to share information about this contest, as well as examples of student submissions that we feel are rich from a STEM perspective.

Proposal

For historical reasons, there is little mathematical tradition in the francophone schools of New Brunswick (Canada). This observation led us to try to develop the mathematical culture in these schools. It all started in 2009 with a "Math Day", which was held once a year and allowed people from the Ministry of education and the school districts, teachers from the Community College and schools, as well as professors from the Université de Moncton to meet for a day to discuss mathematics. While these days were very interesting, it remains that the people who attended were already convinced of the beauty and usefulness of mathematics. The impact of these meetings beyond the room where they took place was not significant (if not non-existent). The number of participants greatly decreased over the years, which made us rethink our strategy. That's when, in 2012, GAMA (*Groupe d'action pour les mathématiques en Acadie*) was born. Essentially, this group aims to help people develop a more positive attitude towards mathematics and develop or improve mathematical culture at the school level.

One of the activities the group organizes annually is the GAMA Contest. This contest is a friendly competition for all students (K-12). Over the years, through various contests, students have had to create a logo for GAMA, take photographs of the mathematics around them, explain the mathematics in different jobs, etc. The purpose of this contest is not to assess students' procedural or problem-solving skills, but rather to get them to see and talk about math in a different way. Here is an overview of the contests that have taken place over the past few years and the type of entries we received from students.

In 2016, we asked students to show us where mathematics is around them, and to surprise us with their original photographs. The settings depicted in the photographs, while varied and rich in STEM potential (e.g., nature, music, architecture, sports, etc.), did not bring out connections to mathematics as deep as we might have wished. When asked what mathematics they saw, most referred to the geometric shapes found in their photographs (and some of these examples were not quite on point, as the identified geometrical shapes did not really appear in the photograph if one insists on their properties). Seeing this, the GAMA team decided to create teaching handouts featuring both the mathematics seen by the students and the mathematics seen by our team (which went beyond geometry). To provide better guidance to the students, without restricting their creativity, we decided to

improve the document presenting the annual GAMA Contest. We added some questions or (rather general) suggestions to guide students' thinking when creating their final product. It seems that a combination of clearer instructions and interesting themes led students to make connections between math and other STEM subjects where mathematics was seen as more than simple calculations or geometrical shapes.

In 2017, we invited students to create a T-shirt merging Canadian history and mathematics to highlight the 150th anniversary of the Canadian Confederation. This theme, by its very nature, led the students to explore the humanities in their design. For example, the beaver (the official emblem of Canada), the British crown (Canada being part of the Commonwealth) and information on natural treasures of different Canadian provinces (e.g., national parks, waterfalls, mountains) were found on various students' submissions.

In 2019, we wanted to draw students' attention on the mathematics in trades and professions, so we asked them to tell us about the mathematics found in their parents' occupations, in the occupation they wish to pursue in the future, or in an occupation they discovered. The students surprised us with their diverse ideas. From geologist, to microbiologist, anesthesiologist, air traffic controller, meteorologist, nurse, perfume chemist, and mountain engineer, the students were able to make connections between mathematics and other subjects, by way of the careers they were talking about.

Finally, in 2021, we asked students to tell a story about mathematics. They could make up a story about mathematics or in which we see mathematics, tell a personal mathematical story (a discovery they made, a mathematical challenge they overcame) or a real mathematical story from their personal explorations or reading. In their stories, they could feature a mathematical concept or curiosity, or show us the importance of mathematics. We heard about Katherine Johnson and NASA from a third-grade student. We learned about a 12-year-old student with type 1 diabetes. Finally, the second-grade class that won our hearts told us the story of 34 who is looking for his place in the world and struggling to find it: the letters reject him, the geometrical shapes shun him, and the calendar doesn't have numbers big enough for him to fit in. The creativity they showed, both in the story and in the drawings that accompanied it, was amazing.

The GAMA contest has shown us, over the years, great potential for the emergence of connections between STEM subjects in student-made creations. It is precisely for this reason that we advocate for the development of more math contests that are not intended for the elite, as they seem to provide a door to STEM that can be opened by all students.