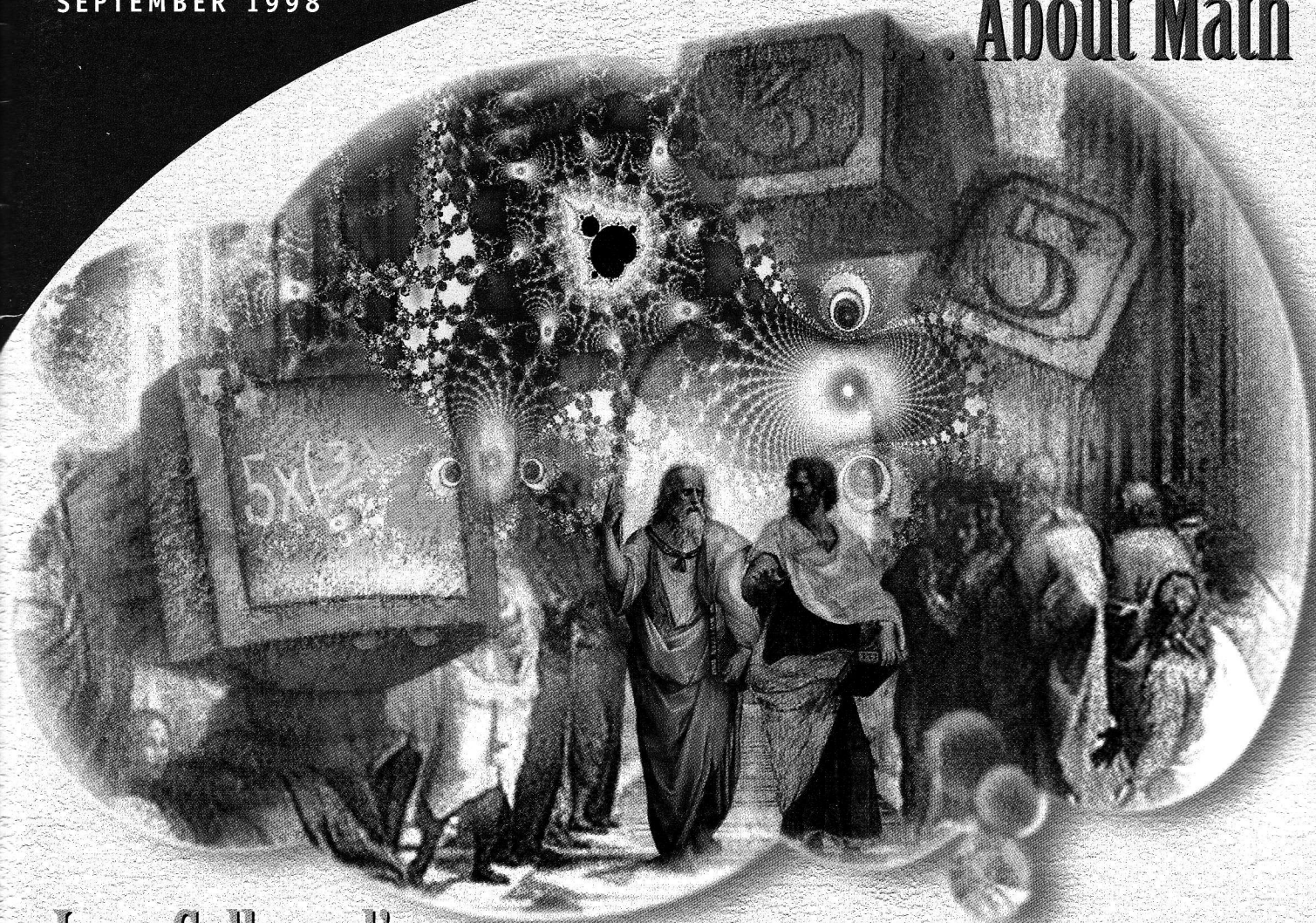


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Professionally Speaking

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The Pleasure of Thinking About Math



June Callwood's Remarkable Teachers

Programs That Help Violent Kids

The Pleasure of Thinking

Mathematics is much more than a set of tricks for coming up with the right answer. It can also be a source of intellectual growth. But teachers who hate math are more likely to transmit their fear or disinterest to their students than an interest in mathematical reasoning.

By Luis Radford

A good teacher is often seen as someone who has a solid knowledge of the subjects to be taught and the appropriate teaching skills. Ontario's pre-service teacher education system is based implicitly on the theory that a university graduate already has a knowledge of the subjects to be taught and can therefore register for a program that will provide the necessary teacher education in the space of one year.

Unfortunately – at least for mathematics – experience has proven this theory wrong. With a few exceptions, students who register in an education program to learn how to teach elementary school have very little knowledge of mathematics. Many who intend to teach in the Primary, Junior and even Senior Divisions have not taken a

single mathematics course since Grade 10.

It is also a mistake to think that pre-service teacher education students have no ideas about teaching. In fact, they can draw on a long past of school and university experiences for ideas on how to teach.

These candidates have to be convinced to discard their old ideas, which takes quite some time.

For example, in order to teach arithmetical concepts like borrowing and carrying over, students must first be encouraged to recognize the advantages of working with tactile materials.

“ If I had known the program included a math course, I wouldn't have signed up. ”

LACK BASIC KNOWLEDGE

A lack of basic knowledge and the need to discard old ideas on teaching to arrive at a new perception of pedagogy that reflects modern concepts of teaching and learning are not the only problems teacher

educators encounter. Closer examination reveals that the act of teaching is also linked both to our perception of mathematics and to our emotional relationship with mathematics.

For many of them, good teaching still consists of behaviourist lecture methods. Often, these ideas about teaching, derived from school and university experiences, become barriers to learning new teaching methods.



Like our ideas about teaching, our perceptions and emotional responses are based on our past experience. For many education students, mathematics is a set of tricks they must learn to come up with the right answer, so they tend to limit themselves to a model based on teaching little tricks and procedures that have nothing to do with understanding the process.

The fact that our students generally have a very limited perception of math and a negative response to it leads to two other major difficulties.

A few years ago, on the first day of class, I overheard two students saying to one another, "If I had known the program included a math course, I wouldn't have

signed up." A few minutes later, I encountered these two students in my Educational Psychology of Mathematics course.

That year, I began the course by asking two questions: "Do you like math?" and "Will you enjoy teaching math?"

Once two or three students had spoken up about their fear of math or lack of interest in it, almost all the students indicated that they had had bad experiences at school or were unable to derive any enjoyment from studying math.

"Mathematics is about memorizing all kinds of tricks – what's the point?"

Of course, these students' reactions were not new for me. They have emerged over the past few years in many studies on



emotional responses to mathematics and perceptions of mathematics. What was new was that the students realized it themselves, and were even surprised by it.

CHANGE PERCEPTIONS

What can we do to change education students' perception of mathematics? This question is especially important, because if we cannot help them to change their perception, they will inevitably transmit it to their students and perpetuate the problem.

Laurentian University's École des sciences de l'éducation is starting a new pre-service teacher education program in 1998-1999. It includes a new course, *Introduction to Mathematical Thought*, which is sub-titled "The Pleasure of Thinking."

The goal of the course is not to compensate for deficiencies in students' basic mathematical knowledge or to deal with problems associated with the teaching and learning of mathematics.

In this one-year program, we would rather give them an opportunity to build a good emotional relationship with mathematics and help them broaden the often very limited perception

they have of this discipline. The goal is to give students an opportunity to enjoy some experiences with mathematical thought and to encourage them to discover a source of intellectual satisfaction similar to the satisfaction we experience in other areas like painting, music, literature or poetry.

REDISCOVER PLEASURE

The objective is to discover or rediscover the pleasure of thinking and to become aware of the special nature of mathematical rationality.

“The course will demonstrate that mathematical truths vary with the culture and are not cast in stone.”

Using in-class learning situations and episodes from the history of mathematics, the course will show how certain responses – techniques of perspective-based representation, methods of solving word problems, for example – are considered better than others. In short, the course will demonstrate that mathematical truths vary with the culture and are not cast in stone.

The course goes beyond the utilitarian aspect of mathematics and is based on activities in which the students handle objects and use symbolic systems of representation – tables, drawings, letters and other symbols. The methodology has been designed to provide students with an opportunity to use mathematical research to enjoy an aesthetic experience similar to the experience of playing games of strategy.

These activities will make students aware that, in mathematical research and problem-solving, the idea of a

problem-solving process includes this aesthetic dimension combined with the pleasure of seeing an idea take shape. If they are to enjoy this experience, they cannot simply seize on the problem. They must first learn to savour it and take pleasure in the problem-solving process.

Introduction to Mathematical Thought includes one unit on the relationships between painting, mathematics and music at different points in history. Another unit covers the representation of space and the invention of perspective in the Renaissance. We look at how perspective was examined scientifically, using the only mathematical theory that could express the concept of beauty at that time in the Western world – the theory of proportion. We compare the Renaissance concept of beauty to ideas about beauty in contemporary art and the beauty of fractal expressions in dynamic recurrent process.

Our goal is the satisfaction derived from the research process and the sense of wonder at the result. In Francis Bacon's words, "For all knowledge and wonder – which is the seed of knowledge – is an

impression of pleasure in itself." ■

Laurentian University professor Luis Radford obtained his PhD from Université Louis Pasteur in France. He conducts research on the teaching, history and semantics of mathematics in partnership with the Sudbury school boards. A number of his research findings have been published in the *Revue des sciences de l'éducation*, *For the Learning of Mathematics*, *the Gazette*, *Mathesis* and *Educación Matemática*. He is currently studying the learning of algebra with the aid of grant from the Social Sciences and Humanities Research Council. He can be reached at lradford@NICKEL.LAURENTIAN.CA