

Speaker:

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Position: Retired, Teacher

Title: Unlocking Mathematics: New Technology for Deep and Early Understanding

Intended Audience: Elementary or High School

Type of Presentation

Preferred: Long Presentation (60 minutes)

Language(s) of

Presentation: English

Foundation, a two dimensional computer language, is visually identical to mathematical notation. It uses technology to break new ground and has application throughout the whole school Mathematics curriculum from Grade 1 addition and subtraction to Grade 12 Calculus. It has been tested for a period of 18 months at Grade 1 and 2 levels with remarkable anecdotal results that were presented at the October 2013 NCTM and TEAMS conferences. These results suggest that mathematical concepts might be made understandable both earlier and more deeply.

The system is not difficult to learn. Teachers could learn it easily through following on-line documentation. The tool is intended to supplement other approaches, not to replace them, in the support of any lesson plan in any grade from 1 to 12. The pilot project used the existing Ontario Mathematics curriculum. It is suggested that it become a component of any strategy to improve national student performance.

The original goal for this project was to make mathematical expressions their own algorithms, so that calculations could be performed without translating expressions into a computer language. This alone has many benefits for Mathematics teaching in all grades. The goal was achieved by basing Arithmetic on functions rather than on operators. It was simple enough that grade 1 and 2 students had no difficulty understanding the basic concept of a function.

However, once this was implemented, other major benefits were observed. The software tool was named "Foundation" because it is a common foundation for arithmetic expressions and algebraic expressions. Each could be built identically through simple composition - removing the conceptual barriers between them. It is an easy way to link Mathematics with a computer. New concepts could be introduced concretely with moving processes, rather than abstractly by replacing symbols with other symbols on paper or a board. It could be a teaching tool for the language of Mathematics (*its notation*) which unifies the whole subject. The system includes special features and virtual manipulatives for use in younger grades. Additional features are being added grade by grade to maximize the potential benefits.

Effort has been devoted to keeping Foundation simple, consistent and mathematically intuitive. Foundation offers as much freedom as a blackboard or whiteboard. The teacher can place anything (*number, variable, function, expression, manipulative or text*) anywhere on the electronic white board and use it for any Mathematics lesson in any grade. Foundation is interactive technology in which a three way interaction takes place between the teacher, the students and the computer. In every moment of the lesson, everything that happens is under the control of the teacher or student, not the computer. It places no limitation on curriculum – nor does it influence curriculum – it supports the whole curriculum and any lesson plans, both commercial and teacher-generated, in any grade.