

## A teenager's perspective on the usual mathematics preparation

Cognitive Instruction in Mathematical Modeling (CIMM) gives this teenager a platform on which to view the usual school math preparation. He finished writing this in October 2010.

My name is Asa. I am homeschooled, now in my sophomore year, and I've been doing CIMM with my instructor Chris Horton for almost a year. When I began work with Dr. Horton last year, I had just finished an algebra text on my own, and was looking for something new that would challenge me. I certainly found that. The math I've done this past year has been the most unconventional work I have ever done; it has also been the most thought provoking. My whole perception of mathematics is shifting, and I'd like to share that experience with you.

I have always liked mathematics. I went to a public elementary school, yet I never dreaded math class the way the other students did. A lot of that, I suppose, was that I was good at it. I was good at manipulating numbers to get the answers that the teachers wanted to see. On another level, however, it was the concepts behind the answers that interested me. When I left school I did algebra, but once again it was all number manipulation. It was often challenging, and sometimes fun, but there seemed to be something missing. I would not understand what it was for a long time.

I can understand why a newcomer might be bemused with the simplicity of the early stages of CIMM. Playing with dots and circles may seem like childish games compared to the serious business of factoring quadratic equations. However, I realized that this way of thinking about math was far more to the point. CIMM deals with underlying concepts about the way math interacts with the real world that many students, whether they do well in math classes or not, do not grasp. Although at first it seemed unconnected and far behind conventional math, the more I did it, the more it linked up with, clarified, and surpassed the math I had been doing.

There are many things I love about this program. One is its emphasis on critical thinking. It makes you reexamine your preconceived ideas about the rules that surround numbers and what they mean. What does it really mean to say  $1=1$ ? Why are certain operations acceptable, but not others? Testing yourself along the way lets you build an understanding of math that isn't faith based, but one that you feel is really true.

Mathematics is a language, and CIMM is an incredibly helpful way to understand the way information is translated in and out of that language. Too often, once we begin working with numbers, they take on their own meaning until we have forgotten their original significance. CIMM forces you to state clearly what you mean, to make distinctions, and avoid vague statements, which ultimately leads to better understanding of the concepts at hand. By highlighting the connection between mathematical symbols and their real life counterparts, math becomes more accessible and applicable.

Relationships are a key concept in math, and CIMM places emphasis on this idea, which is at the heart of many problems. It teaches the way in which different aspects of a mathematical model are connected, the links between the parts and the whole, and the way they operate in changing conditions. Most importantly, it shows how to express what you see: to communicate the relationships that you can observe for yourself and then use them to solve problems.

CIMM also has the advantage of being a very visual program. Understanding scratches of graphite on paper is easier for many people if they can connect them with a more direct visual representation of what they are working with. CIMM encourages drawing for better comprehension, which literally helps to “connect the dots”, by drawing dot diagrams to express concepts. Also, this provides a smooth transition into geometry, where lack of prior experience with math in a diagram can be a major setback. Although a lack of visual tendencies is not a handicap for understanding CIMM, those people who feel more comfortable when they can see what they are dealing with are sure to enjoy this way of doing math.

CIMM also makes using math to solve physics and science problems a lot easier. It teaches linking math symbols with elements of a model, carefully labeling your intentions, so that the math you do can stay grounded in reality as much as possible. For students who have trouble with word problems this clarifies everything.

I believe that schools across the country would benefit vastly from introducing, or at least experimenting with, this program. I have very intelligent friends in high school who despise math, yet I think it would be more bearable and perhaps (who knows?), maybe even enjoyable if they used a program like this one. Math was fun for me, but fun in the way Sudoku is. Building understanding that reaches beyond the next test and giving students ownership over what they are trying to learn should be the goal. Too often, students only learn how to solve the problems on the test sheet and don't go beyond that. Yet, even if raising your scores is all you care about, CIMM is a wonderful and effective way to bring new confidence into math.

I feel that CIMM has helped me immeasurably in my grasp of the entire subject of math. So versatile is it in its application, and so basic to math is the problems it addresses, that every math concept was clarified by the ideas I learned in CIMM, from arithmetic to algebra to trigonometry to physics. In school, I was always the kid who asked “why” to everything the teacher said, and nowhere except math did I meet so many dead ends. CIMM has helped me clear out the store cupboard of my mathematics skills, and organize it in a more orderly fashion. It is an ongoing challenge to clarify and expand my knowledge, but the tools I have learned in this program will stay with me for the rest of my life.