

MATHEMATICAL SKILLS NEEDED FOR LIFE

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What lifelong mathematical skills do you want your students to take with them when they leave your mathematics program? When I answer this question, I think of the mathematical skills my father, Joe Conklin, has used to run his farm for the past 45 years. Every day of his career, he utilizes a wide range of mathematics.

Joe Conklin needs excellent estimation and mental arithmetic skills to make day-to-day decisions. He judges the reasonableness of quotations given him by salesmen, grain handlers, cattle buyers, and shed sellers. He holds his own with any younger, quicker mind when it comes to doing calculations in his head. Certainly, he has always bested his five children.

A good feel for measurement allows Joe Conklin to find the area of almost any shape field – by some method or other – whether school mathematics or a more sophisticated everyday mathematics. He can convert area given in square yards to acreage by estimating or by computing an exact answer (to a given precision). He knows conversion factors and their use for the various grains from pounds (the harvest unit) to bushels (the pricing unit). Figuring the volume of liquid (fertilizer, water, etc.) flowing from any pipe or hose on his machinery is an everyday exercise.

My father has a wonderful number sense and feel for numbers. Others cannot trick him with "number lore" or logic moves. Neither very big nor very small numbers are beyond his comprehension – except, perhaps, the size of the national debt. He is fond of numbers and the relationships among them.

Joe Conklin has excellent higher-order thinking skills and problem-solving abilities. I have observed his use of many different heuristics when working on a problem. He may try to find a previous problem he has done that is similar, to reduce it to an easier problem (a favorite trick), to draw pictures of the problem (another favorite, when appropriate), or to work on subgoals of the problem (Schoenfeld, 1980; Polya, 1985). I have never heard Dad mention Polya but he follows his advice whenever he is in a problem solving situation. Dad makes sure he understands the problem, the information needed, and the information given. Then he devises a plan that will connect the data he has with the solution he desires. He

carries out the calculations, using whatever tools are needed. My father always reviews his work for reasonableness. He makes a decision as to the appropriateness of the answer and completeness of the solution.

Dad has an algebraic sense about working with numbers and finding solutions to problems. He may not use elegant syntax, but the solution of the problem and the concepts used in the solution are understandable. In a complicated problem he always has work for others to follow, whether to pursue other options or to learn a new solution. Whether one is "schooled" in mathematics or not, Dad can explain the work he has done in a way that the listener understands. Dad must have read the *Standards* to know that communication is very important in mathematics.

If it has not been obvious from his other talents, then I should point out that Dad has very acute reasoning skills. He understands the rules of logic from the practice he has made of them. He can reason from given data to draw conclusions about financial matters for both the farm and community organizations to which he gives advice. From weighing the market influences on grain prices to selecting concentrations of fertilizer, Dad makes sound judgments based on his knowledge, the facts, and his reasoning skills. These skills have been honed over years of working on the farm and they contribute to this man's success in the farming business. Farmers who make poor judgments based on false logic do not survive for long.

As an outgrowth of his reasoning skills and number sense, Dad has developed good proportional and probability sense. He thoroughly understands "1.5 pounds per acre" and how to translate that to his situation. He knows what 14% moisture means and not just that the crop is too wet for market. He understands 10% chance of rain and how that will affect his work for the day.

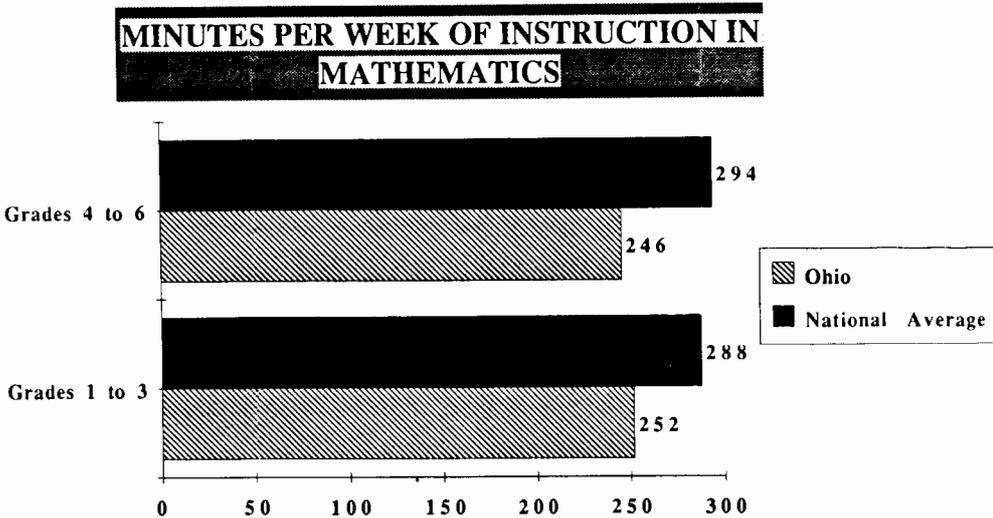
If Dad is lacking any skill that, as a mathematics teacher, I believe is important, it is the ability to use technologies to model his problems in a sophisticated manner. I think the addition of a computer with the graphing software and a spreadsheet would be a big boost to his business. As we all know, when the graph appears, sometimes there are surprises we had not anticipated. Access to technology would add to Dad's predictive and reasoning powers as he makes decisions about his business. From the list of 10 basic skills described by Ellis (1988), Joe Conklin is lacking only one – computer literacy. Just give him time and that may be one more problem he will solve.

References

- Ellis, A.K. "Planning for Mathematics Instruction." In T. R. Post (Ed.), *Teaching Mathematics in Grades K-8*. Boston: Allyn and Bacon, 1988, pp. 20-39.
- Polya, G. *How to Solve it*. Princeton, NJ: Princeton University, 1985.
- Schoenfeld, A. H. "Heuristics in the Classroom." In S. Krulik & R. E. Reys (Eds.), *Problem Solving in School Mathematics: 1980 Yearbook*. Reston, VA: National Council of Teachers of Mathematics, 1980, pp. 9-22.

From Alan Osborne, Ohio State University:

I ran into interesting statistics concerning instruction in mathematics at the elementary school level in Ohio in contrast to the rest of the country:



State Indicators of Science and Mathematics Education
R.K. Blank and M. Dalkilic
Washington, D.C.: Council of Chief State School Officers, 1990, p. 18

It is worth noting that Ohio time per week in mathematics in grades one to three is the lowest of any state and only one state, Montana, reports less time for the grade levels four through six.

Would this help account for the poor showing on the Ninth Grade Proficiency Test?