I begin with a note of personal bias: I believe that the mathematics goals of the American Association for the Advancement of Science (AAAS) are closer to the quantitative literacy (QL) goals discussed in *Mathematics and Democracy: The Case for Quantitative Literacy* (Steen 2001) than either the goals of the new National Council of Teachers of Mathematics (NCTM) standards or current school science or mathematics curricula. Indeed, *Benchmarks for Science Literacy*, published by AAAS, has many of the same QL goals—they are just not called by that name (Project 2061 1993). In one respect, therefore, QL is very much part of what we think good science teaching should be about.

On the other hand, *Principles and Standards for School Mathematics* (NCTM 2000) abandoned, for many reasons, the vision of the original standards (NCTM 1989) that described both the mathematics important for all students to learn and the mathematics that goes beyond basic literacy important for those students going on to higher education or technical careers. *Principles and Standards for School Mathematics* is a notable and useful description of the goals of school mathematics, but it goes well beyond the goals of QL (QL may be an undefined subset) and may be an unrealistic vision of the mathematics that all children can learn in 13 years. (I am willing to make the same statement about the amount of science content in the AAAS *Benchmarks* and the *National Science Education Standards* (NRC 1995).)

I also must point out that *Mathematics and Democracy* is very mathematics-centric, even as it makes the case for the interdisciplinary nature of quantitative literacy. The references are almost all from the field of mathematics and mathematics education, not from the places where QL really lives—the natural and social sciences. QL is not something new, nor is it something that exists in isolation. It exists in many places but always in specific contexts. Yet for lack of appropriate contexts, QL rarely is seen in school classes.

For example, mathematics in science classes is typically independent of mathematics in mathematics classes. In school science, there is almost no consideration of mathematics “scope and sequence,” nor is much effort made to use consistent terminology and symbols. Typical science classes make little effort to reinforce mathematical concepts or to demonstrate their application in scientific inquiry. Mathematics classes, in turn, may employ a science setting (e.g., counting whales or planets) but not science content appropriate to the local scope and sequence. Current mathematics classes abound in inappropriate, inconsistent, or unrealistic situations and data. Units, when necessary, are often absent or incorrect. QL-type applications are rare. On an optimistic note, some of the new “reform” or “standards-based” K–8 curriculum materials in mathematics do a much better job of offering realistic and appropriate examples and contexts.

The knowledge and skills that make up quantitative literacy can be defined through careful sets of learning goals, specific concepts and skills that together paint a coherent and complete picture. There are two types of goals: targets for adult knowledge and skills such as those in *Science for All Americans*.
(AAAS 1989) (targets), and benchmarks to monitor progress toward the adult goals (NCTM 1989, AAAS 1993) (steps along the way, or standards). We need both. Benchmarks are especially important as a strategy to reach our targets because they define the content around which curricula can be designed and built. So far, most of what we have in QL are targets without standards. And those targets span the disciplines.

Where does QL live, or where might it thrive? School mathematics is typically formal and theoretical, thus not yet a welcoming environment for QL. In comparison with the NCTM standards, QL involves the sophisticated use of elementary mathematics more often than elementary applications of advanced mathematics. Although science can be data-rich, natural science often is taught more like what Arnold Packer and others call "x, y math." Because the contexts of QL are most commonly personal or social, the social sciences may offer the most natural home. Of course, this assumes that curriculum developers, teachers, and teacher educators in the social science disciplines are willing to take on the responsibility for helping students build on the prerequisite mathematics to learn QL skills and concepts and that the sum of any student’s experience totals a coherent vision of QL.

Recommendations:

- QL has a strong partner and advocate in the science community. Read and criticize the mathematics in Science for All Americans (Project 2061 1989), Benchmarks for Science Literacy (Project 2061 1993), and the Atlas of Science Literacy (Project 2061 2001).

- Consider engaging the social sciences (let them lead or share the lead) in the quest for QL.

- Adopt detailed and specific goals with benchmarks for progress.

- Coordinate QL across disciplines by making QL part of faculty development.

- Promote the pedagogical advances that the K–12 mathematics community has made through its curriculum development work.

- Develop reliable and valid assessments of experiments in curriculum and instruction that target QL (i.e., do science). And publish the results.

References


