# A Radical Experiment in Mathematics Teaching

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ABSTRACT. The usual ways of teaching mathematics merely 'chloroform the child's reasoning faculties.' So, over seventy years ago, Louis P. Benezet, an imaginative school superintendent, abolished all *formal* arithmetic teaching until grade 6. Instead, students spent years reading, writing, and speaking, all the while learning mathematics in context. Today mathematics teaching is also a powerful anaesthetic: Students solve problems by rote, a skill that improves with every year in school, and have no time to develop understanding. Benezet's approach, a lost episode in the history of education, eliminates rote learning and has great possibilities for incorporating historical materials.

We want history of science (or mathematics) to be part of teaching but are told that history is wonderful, a beautiful subject, but a luxury for which our nation has no time if it is to compete in the ever-changing global economy. I want to revive[1] a radical and inspiring experiment in mathematics teaching, one with plenty of possibility for history.

## Serious Problems Require Strong but Tasty Medicine

Louis P. Benezet, superintendent of the Manchester, New Hampshire school district, thought that standard mathematics teaching was 'dull[ing] and almost chloroform[ing]' children's reasoning abilities (1935a). So he abolished *formal* arithmetic teaching until grade 6 (roughly age 11). Instead:

> The children in these rooms were encouraged to do a great deal of oral composition. They reported on books that they had read, on incidents which they had seen, on visits that they had made. They told the stories of movies that they had attended and they made up romances on the spur of the moment. (Benezet 1935a)

The results contrast with most classrooms I know:

> In the traditional fourth grades when I asked children to tell me what they had been reading, they were hesitant, embarrassed, and diffident. In one fourth grade I could not find a single child who would admit that he had committed the sin of reading. I did not have a single volunteer, and when I tried to draft them, the children stood up, shook their heads, and sat down again. In the four experimental fourth grades the children fairly fought for a chance to tell me what they had been reading. The hour closed, in each case, with a dozen hands waving in the air and little faces crestfallen, because we had not gotten around to hear what they had to tell. (Benezet 1935a)

Snippets from the syllabus show how mathematical ideas are introduced:

> [In the first grade,] this instruction...comes in incidentally in connection with assignments of the reading lesson or with reference to certain pages of the text.
>
> [Second grade] The recognition of page numbers is continued. The children are taught to recognise any numbers that they naturally encounter in the books used in the second grade. If any book used in this grade contains an index, the children are taught what it means and how to find the pages referred to. (Benezet 1935b)

Students learnt mathematical ideas as needed, in an environment designed to include numbers and mathematical ideas of increasing complexity. The approach is Deweyian, although Benezet nowhere mentions Dewey. Etta Berman (1935) concluded that, in formal arithmetic, the experimental students caught up to the regular ones in only 4 months during the sixth grade. In reading, writing, and thinking, the experimental students got many more years of practice than the regular students.

## Mathematics Teaching is Still an Anaesthetic

In 1936 the conservative faction on the school board finally managed – the vote was 7 to 5 – to sabotage the program by adopting a standard arithmetic text (Manchester School Board 1936). In 1938, Benezet decided to withdraw his candidacy for superintendent (Manchester School Board 1938). This experiment in progressive education lasted roughly from 1925 to 1936 and is now almost forgotten: 'The problem with education is that the problems don't stay solved' (attributed to Melba Phillips). The problem that Benezet tried to solve – rote learning – is still with us. Benezet asked students:

> The distance from Boston to Portland [Maine] by water is 120 miles. Three steamers leave Boston, simultaneously, for Portland. One makes the trip in 10 hours, one in 12, and one in 15. How long will it be before all 3 reach Portland? (Benezet, 1936)

The second grade taught under the new method had a nearly perfect score. In the ninth grade, taught under the standard system, 6 students out of 29 got the correct answer. Benezet does not say what answers they gave, but the results of the following modern experiment indicates the most likely guess. Reusser (1988) asked 97 first and second grade students: *There are 26 sheep and 10 goats on a ship. How old is the captain?* Seventy-six of the 97 students 'solved' the problem by adding 26 and 10. Mathematics, in short, means little to students (Schoenfeld 1992). Most disturbingly, Radatz found that the fraction of students answering nonsense questions *increased* with every year of schooling (Schoenfeld 1989, p. 100).

The results of the National Assessment of Educational Progress are no more encouraging (Carpenter 1983). Students were effectively guessing on this question:

> Estimate $5.3 \times 3.04$: (a) 1.6 (b) 16 (c) 160 (d) 1600 (e) Don't know

The fraction correct was 20.7 percent among 13-year-olds and 36.6 percent among 17-year-olds. However, '57 percent of the 13-year-olds and 72 percent of the 17-year-olds calculated the answer to a similar exercise' (Carpenter 1983). Students learn rote procedures but not a sense for numbers:[2] 'Men are born ignorant, not stupid; they are made stupid by schooling' (Bertrand Russell).

## A Chance for History of Science

In the usual curriculum, students learn little mathematics. In Benezet's approach, students skipped formal arithmetic for several years, and instead read stories and gave talks. They developed a deep mathematical understanding by learning the ideas in context. In short, Benezet solved the problem of rote learning.

Benezet's design has great possibilities for us: The readers could be based on examples from the history of science, which provides contexts for fascinating mathematical patterns. One story, for example, could describe how Galileo analysed motion down an inclined plane: how he had no stopwatch, yet he managed to determine how far a ball rolls in equal successive time intervals (Polya 1977, pp. 84–90). Older students could investigate the resulting pattern

$$1 + 3 + 5 + \cdots + (2n - 1) = n^2.$$

'Only' political barriers exist to implementing this combination of Benezet and science history. But there is a political solution. Benezet's approach is congenial to almost every mathematics teacher that I know. We could make common cause with those teachers trying to improve mathematics education, show how a lost episode from the history of education solves fundamental problems in education, and how episodes from the history of science would provide rich contexts for Benezet's method.

## ENDNOTES

1. See Whitney (1986) for a previous attempt.
2. See Sowder (1992) for a discussion of number sense.

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