

Is Mathematics Necessary?

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Florida Department of Transportation. The department needs to calculate many things, including areas, and its method of finding the area of irregular shapes was surprising to me. When I asked the speaker how the department copes with new workers with varying degrees of mathematical training, the answer was that it doesn't: it had found that the only safe assumption is that new workers know nothing about mathematics, so they are taught what they need as it is needed. This is satisfactory to everyone. It does not imply that the time that new employees had spent in school trying to do problems in arithmetic, algebra, and geometry was wasted, but it had nothing to do with their jobs. Boston, 1789, Florida, 1993: some things do not change.

A way of thought.

Despite the initial opposition and continued irrelevance to jobs, mathematics instruction spread in the United States in the nineteenth and twentieth centuries. As the *History of Mathematics Education* [3] tells us, Harvard in 1816 required "the whole of arithmetic" for entrance. Until then addition, subtraction, multiplication, division, and the Rule of Three had been enough. After 1865, geometry was required as well. As the country was settled, secondary education expanded, and arithmetic moved from the academies and high schools to become an elementary school subject by the end of the nineteenth century [3, p. 27]. Algebra was an optional subject in some high schools, and it became possible to study calculus in the upper reaches of some colleges. Today years and years of mathematics is compulsory for all and calculus has become a high school subject.

How come? Because parents, school boards, society as a whole think that mathematics instruction is worth doing. On account of applications and jobs? Certainly not. The reason, I think, is that one of the tasks of schools is to do their best to teach students to think, and of all subjects none is better suited to this than mathematics. In no other subject is it so clear that reasoning can get results that are right, verifiably right. When you solve

$x^2 + x = 132$ and get $x = 11$, you can then calculate $11^2 + 11$ and know that you are correct. No other subject has this capacity at the elementary levels. Mathematics increases the ability to reason and shows its power, all at the same time.

It is not fashionable these days to assert that mathematical training strengthens the mind, perhaps because that proposition is as impossible to prove as the proposition that music and art broaden and enrich the soul. But it is still believed by many people, including me. Some of our forebears had more confidence, as did John Arbuthnot (1667–1735) whose *On the Usefulness of Mathematical Learning* (c. 1700) proclaimed: "The mathematics are the friends of religion, inasmuch as they charm the passions, restrain the impetuosity of the imagination, and purge the mind of error and prejudice" [4, p. 70]. Even better, "[M]athematical knowledge adds vigour to the mind, frees it from prejudice, credulity, and superstition" [4, p. 67]. Though we no longer say such things out loud, the belief that they hold quite a bit of truth goes a long way toward explaining why people have supported and continue to support the mass teaching of mathematics, though many of them did not enjoy the experience when they underwent it.

Once a graduate of my school, a mathematics major, came back to campus to visit. I said to him, after finding out that his job was running a television station in Knoxville, Tennessee, "Well, I guess all that mathematics you learned hasn't been very useful." "Oh no," he replied, "I use it every day." I found this claim incredible (soap operas have no partial derivatives), so I pressed him. It turned out that he meant that he believed he used *the mathematical way of thinking* every day.

That is impossible to quantify and impossible to prove, but we cannot tell him that he is wrong. Nor should we.

It is time to stop claiming that mathematics is necessary for jobs. It is time to stop asserting that students must master algebra to be able to solve problems that arise every day, at home or at work. It is time to stop telling students that the main reason they should learn mathematics is that it has applications.

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We should not tell our students lies. They will find us out, sooner or later.

Besides, it demeans mathematics to justify it by appeals to work, to getting and spending. Mathematics is above that—far, far above. Can you recall why you fell in love with mathematics? It was not, I think, because of its usefulness in controlling inventories. Was it not instead because of the delight, the feelings of power and satisfaction it gave; the theorems that inspired awe, or jubilation, or amazement; the wonder and glory of what I think is the human race's supreme intellectual achievement? Mathematics is more important than jobs. It transcends them, it does not need them.

Is mathematics necessary? No. But it is sufficient.

References

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