Numeracy

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Abstract

This essay describes the development of the word numeracy as it evolved from its initial use in 1959 to its current meaning today. Initially appearing in a British report to address mathematics education of teenage boys and girls, it was first used in relation to the word literate and defined as the ability with or knowledge of numbers. By the mid-1960s, the meaning shifted from computation of numbers to the ability to interpret data and make sense of the world through business, science, and technology. In the 1970s, numeracy was seen as a skill that was essential in life and by the turn of the twenty-first century, numeracy came to include the ability to reason. Numeracy was no longer seen simply in the area of mathematics but continued to permeate through all areas of study and furthermore, into daily life.

Keywords: mathematics, numeracy, education

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Because the ability to function in a technology-driven world is now a basic requirement, numeracy is as essential as literacy for high school graduates. But numeracy is not simply the ability to do calculations. It is about the interpretation of those calculations, the understanding of the relationship between numbers and manipulation of material components of the world. The difference between calculation and numeracy is made manifest in the 2016 movie *Hidden Figures*, about Katherine Johnson, a brilliant woman --otherwise known as the "computer" in a pre-computer filled era--working for NASA in the 1960s. She was one of the unacknowledged brains behind one of the greatest technological achievements in history, space flight. Fifty years after the events of the movie, machines now process data more quickly than any human, but it is the analysis of that data that distinguishes mathematical computation from numeracy. People, not computers, have to figure out the meaning and purpose of the numbers.

The word "numeracy"—which only came into use around the time of the mid-twentieth-century events of *Hidden Figures*—is awkwardly defined. The *Oxford English Dictionary* (OED, 2011) defines numeracy as "the quality or state of being numerate; ability with or knowledge of numbers." Although numeracy is a term used in many English-speaking countries, such as South Africa, Australia, and New Zealand, it is more common to speak of quantitative literacy or mathematical literacy (Goos, Dole, & Geiger, 2012).

According to the OED, the word numeracy first appeared in the Crowther Report, written to address the mathematics education of British boys and girls between the ages of 15 to 18 (Crowther, 1959). It was in the Crowther Report that the word numeracy was used to mirror the word literacy in educational discourse:

> When we say that a scientist is "illiterate," we mean that he is not well enough read to be able to communicate effectively with those who have had a literary education. When we say that a historian or a linguist is "innumerate" we mean that he cannot even begin to understand what scientists and mathematicians are talking about. The aim of a good Sixth Form should be to send out into the world men and women who are both literate and numerate. (Crowther, 1959, p. 270)

By the mid-1960s, numeracy began to shift from the simple computation of numbers and their function in other areas of life to the interpretation of data and the connections that allow us to understand the worlds of business, science and technology. One of the early uses for "numeracy" is from an article in a 1966 issue of the *Economist*, stating that: "The need for numeracy today is enormous. Business requires people who have grasped the principles of reducing chaos of information to some kind of order" (OED). A 1972 use in the *Daily Telegraph* states that "the plan must be welcomed for introducing pre-school children to reading, writing and numeracy" (OED). The use of the word numeracy needed to change from reactive with adults in the business sector to proactive in the education sector.

The 1970s saw increasing public attention to the centrality of numeracy as an essential life skill. In 1978, Sir Wilfred Cockcroft, a mathematics educator from the University of Hull, was commissioned by the British government to lead an inquiry about the teaching of mathematics in schools in England and Wales (Cockcroft, 1982). *Mathematics Counts*, more commonly known as the Cockcroft Report (1982), described being numerate as "possessing an at-homeness with numbers and an ability to use mathematical skills to cope confidently with the practical demands of everyday life" (p. 11). His report pointed to the fact that many adults in Britain had great difficulty with

everyday situations involving mathematics such as making change at the store or determining the cost of gas for their car (Cockcroft, 1982). His argument for the urgent need to improve the teaching of numeracy skills was supported by a Yorkshire Television series, *Make it Count* (1978), which revealed that 'functional innumeracy' was far more prevalent than society cared to believe. The numeracy movement continued to gain strength with the 1989 publication of *Everybody Counts* as it provided a revitalization effort based on the recommendation of seventy leading Americans in the fields of education, mathematics, sciences and government (National Research Council). The report not only outlined the problem in mathematics education but it also provided a national strategy to improve curricula, teaching, and assessment. At this point, the focus was simply on creating graduates with 'sufficient mathematical literacy.'

As the turn of the twenty-first century approached, and as computers, calculators and, eventually mobile phones increasingly took over computational skills, the focus of numeracy education shifted. There was something of a crisis of definition. The National Council on Education and the Disciplines in the United States, for instance, refer to numeracy as "quantitative literacy" and questions that "although almost everyone believes quantitative literacy to be important, there is little agreement on just what it is" (Nygaard & Hughes-Hallett, 2001, p. 4). They seek to clarify by concluding, "quantitatively literate citizens need to know more than formulas and equations. They need a predisposition to look at the world through mathematical eyes . . . and to approach complex problems with confidence in the value of careful reasoning" (Nygaard & Hughes-Hallett, 2001, p. 2). Steen (2001) defines quantitative literacy as the capacity to:

> Deal with quantitative aspects of life, and proposed that its elements included: confidence with mathematics; appreciation of the nature and history of mathematics and its significance for understanding issues in the public realm; logical thinking and decision-making; use of mathematics to solve practical everyday problems in different contexts; number sense and symbol sense; reasoning with data; and the ability to draw on a range of pre requisite mathematical knowledge and tools. (as cited in Goos et al., 2012, p. 3)

The Department of Education and Early Childhood Development in Victoria, Australia (2009) interprets numeracy in practice as the teaching, learning and using of mathematics:

> Numeracy is not the same as mathematics, nor is it an alternative to mathematics. Rather, it is an equal and supporting partner in helping students learn to cope with the quantitative demands of modern society. Whereas mathematics is a well-established discipline, numeracy is necessarily interdisciplinary. Like writing, numeracy must permeate the curriculum. When it does, also like writing, it will enhance students' understanding of all subjects and their capacity to lead informed lives. (p. 8)

The definition of being numerate was shifting and was no longer believed to be the "extension of mathematics into other subjects" but rather the "key to understanding our data-drenched society" (Nygaard & Hughes-Hallett, 2001, p. 2). Students were encouraged to learn mathematics within the context of practical application; they were better able build on the interconnectedness of the different types of knowledge they encounter in their daily lives.

Educators attempting to fulfil their mandate to teach mathematics are currently being faced with their inability to teach it in a way that makes interdisciplinary connections — they are omitting the real-world elements that would yield the desired result of being numerate. For example, the Ontario mathematics curriculum documents specify the teaching in elementary schools of five strands of study ranging from Number Sense and Numeration to Patterning and Algebra all described in isolation, all reported on separately on report cards, then equally assessed on standardized tests ordered by the province. As a result, students are unable to readily make connections with real-world knowledge because the mandated curriculum only produces data, not potential for growth or interpretation.

In Ontario, as elsewhere in North America, news reports on a crisis in mathematics education continue to appear in the headlines. Part of the problem is that the state-mandated objectives still flounder in soggy, essentially meaningless prose. The Ontario Ministry of Education (2013) documents, for example, declare that "numeracy is about doing the math – about recognizing and using mathematics – in a variety of contexts that range from the everyday to the unusual; it's about being able to use mathematics as a tool to explore problems and situations." This is exactly the kind of empty mandate that leaves educators trying to figure out what is meant when we say that students lack numeracy skills. At this stage, sixty years after the word numeracy came into use as a economic/educational term, perhaps the problem of effective implementation lies in its many competing definitions: the range of meanings destabilizing the object of inquiry. Mathematicians, after all, do not do numeracy.

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