

Digital Keywords: a Vocabulary of Technology and Education

David Pimm¹

Published online: 9 July 2015
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The complexity, that is to say, is not finally in the word but in the problems which its variations of use significantly indicate. (Williams 1976, p. 81)

It is a fairly common experience in English (as with other languages) to have two or more conflicting or even contradictory senses figured upon the same word. A canonical example (in relation to educational assessment) comes with the word *standard*: *standard* in the sense of a flag hoisted when going into battle, around which soldiers rally, and *standard* in the sense of a unit of comparison or measure (such as the standard metre that used to be housed in Sèvres near Paris). With the former sense, raising standards is a good thing; with the latter, it is their maintenance and constancy that is of value. Given Lakoff and Johnson's (1980) identification of the metaphor 'up is good', then 'higher is better' for the flag standard, as for many other things. For a standard that is not supposed to vary, overshooting is at least as bad as the opposite.

The motivation for this column arises from a two-pronged query: why has there been a relatively rapid shift in terminology around technology and education? And why the shift in meaning of the same words (e.g., *computer*: a person or a non-human device) and what are some of their origins (e.g., *computus*: the mathematical art of calculating the date of Easter)? But some of the very core words currently in use: 'digital', 'virtual', 'technology' itself, are either new or mutating beneath us. But how many of us now think of 'analogue' as the oppositional term to 'digital', a word that gave the latter term its meaning? How many of us still hear 'almost' when the word 'virtual' is used? And does it matter?

This column is not so much interested in such changes within computer science itself, say, as it is concerned with those occurring within a (practical or research)

✉ David Pimm
djp3@sfu.ca

¹ Simon Fraser University, Burnaby, BC, Canada

educational setting. For a canonical instance of such a study, albeit one with different foci, I turn to the work of the UK literary critic Raymond Williams. In 1976, he published *Keywords: A vocabulary of culture and society*, a collection of entries (which he referred to as ‘notes and short essays’) on a set of words central to this area of interest, a work he had originally conceived as an appendix to an earlier book (entitled, unsurprisingly, *Culture and society*). His post-war concern here was with a certain terminological instability and confusion he had noted in discussions, as well as with a breadth and range of meaning, of subsequent variation, where different senses of key words were conflicting:

It [*Keywords*] is not a dictionary or glossary of a particular academic subject. It is not a series of footnotes to dictionary histories or definitions of a number of words. It is, rather, the record of an inquiry into a *vocabulary*: [...] Every word which I have included has at some time, in the course of some argument, virtually forced itself on my attention because the problems of its meanings seemed to me inextricably bound up with the problems it was being used to discuss. [...] I began to see this experience as a problem of *vocabulary*, in two senses: the available and developing meanings of known words, which needed to be set down; and the explicit but as often implicit connections which people were making, in what seemed to me, again and again, particular formations of meaning – ways not only of discussing but of seeing many of our central experiences. (p. 13; *italics in original*)

The field of technology and (mathematics) education, at least of *electronic* technology and mathematics education, is less than sixty years old. It has occurred entirely within my lifetime (just). Yet I am not aware of much attention being paid at all to the ways in which we speak and write in this field, in the ways we argue, and how such complex forms of linguistic framing interact with the arguments themselves, as Williams points out. There is a tendency to take words for granted. Yet as with anything or anyone else who finds themselves in this position, our words may soon wriggle beneath us and start to protest and rebel.

The focus of this DEME column, then, is to attempt to mirror Williams’ vocabulary-examination project in the area of technology and education. And to echo the initial attempt by Love and Tahta (1991) to engage in such an activity for the whole of mathematics education. According to them, this would be “a major enterprise that would need the cooperative effort of large numbers of people” (p. 253). So the openness of this column to contributions arises from an invitation for submissions in the form of notes, entire digital keyword entries, observations or interactions with previous remarks or claims.

In the remainder of this initial column, then, I offer a few notes about the originary terms computer-assisted learning (CAL) and computer-aided instruction (CAI), as well as the shift to the notion of *mediation* and its complex of related terms: *medium* (media) and *mediate*. Interestingly, both *media* and *mediation* have entries in Williams’ book, as does *standard*, the source of the confusion (static vs changing) I discussed in my opening paragraph here.

Aid/Assist

The nineteen-seventies and -eighties saw much written about computer-aided instruction (CAI) and computer-assisted learning (CAL), though these terms are still in use today. CAI sounds like it is to *aid* the teacher, CAL to *assist* the learner. Is there a significant difference between these two verbs and what they signify about the nature of the relationship? Certainly, both have to do with ‘helping’. There is a longer tradition of ‘teacher aids’ for mathematics (the original 1950 name in the UK of the Association for Teachers of Mathematics was the Association for Teaching Aids in Mathematics) that the word might connect to.

Back in the eighteenth century, there was a textbook entitled *The Schoolmaster’s Assistant* (see Fauvel 1991), itself a text modelled explicitly on the Catholic catechism. To assist, to be an assistant, is to be framed in a subordinate position to someone (or, later, something) else. To aid is to be in a stronger position, more knowledgeable perhaps or better resourced. In this issue, in the article by Jupri et al., the authors write: “technology acts as an assistant to carry out algebraic routine procedures”. Artigue (2002) has written on the distinction between the nature of the help provided, between pragmatic (aid/assist) and epistemic (mediate) uses of a tool.

Medium (pl. Media)

For [Things Mathematicall], being in a manner middle, between things supernaturall and natural: are not so absolute and excellent as things supernaturall; Nor yet so base and grosse, as things natural: But are things immateriall, and neverthelesse, by material things able somewhat to be signified. (Dee, 1570; cited in Rudd 1651, p. 4)

The Latin meaning of *medium* is “middle” and also carries in English the sense of an intervening agency or substance. Isaac Newton wrote extensively about both medium (e.g., the aether) and mediation (e.g., water dissolving copper when the latter has been melted with sulphur, the mediating third), and these two terms interacted (see Dobbs 1975, p. 207). A spiritual medium, such as Madame Arcati in Noel Coward’s play *Blithe Spirit*, acts *between* the two things deemed in need of connection (such as a person and mathematics), a medium of exchange likewise. And inside Roman Catholicism, for instance, the priest takes on such a position.

But is there the same sense of middle active in the term “expressive media”? And what is signaled with the newly ubiquitous adjective ‘digital’ in digital media? (For more on the noun-perturbing effects of metaphoric adjectival use in English, see Pimm 1988). Having identified three senses (of which the intervening one is the first), Williams writes:

It is interesting that sense (i) depended on particular physical or philosophical ideas, where there had to be a substance intermediate between a sense or a thought and its operation or expression. In most modern science and philosophy,

and especially in thinking about language, this idea of a medium has been dispensed with; thus language is not a medium but a primary practice. (p. 169)

Mediate/Mediation

According to Williams (pp. 170–173), *mediation* has three separate meanings: to divide in half, to occupy a middle position, and to act as an intermediary. The third sense often involved ‘interceding between adversaries’ with an intent of reconciliation (mediation in a legal setting still carries that connotation), while the second relates to “a means of transmission, or agency as a medium – ‘By mediacion of this litel tretis, I purpose to teche ...’ (Chaucer, *Astrolabe*, 1391)” (p. 170). Williams continues, “The political sense of mediation as reconciliation has remained strong, but most modern philosophical uses depend on the idea of a substantial rather than a merely neutral or instrumental mediator” (p. 171). In some settings, there is a negative connotation to mediation, in a similar sense to assisted (e.g., wind-assisted speed records), as being contrasted with ‘real’.

As mentioned above, ‘mediation’ seems to have taken over from ‘assistance’, in terms of being a general term for the ‘role’ that the computer/software/microworld/environment/applet/App is supposed to play in the learning of mathematics. And unlike ‘assistance’, linguistically and otherwise, mediation places itself *in medias res* (“in the middle of things”). Post-Vygotsky, the word has donned theoretical garb, especially with ‘semiotic mediation’, though there is also computer mediation (e.g., CMC). In the article by Andrà et al., in this issue, various forms of mediation are discussed, including semiotic mediation, but also physical and mental mediation. And the term ‘immediate’ is itself a negation, i.e., meaning “unmediated”. How do these various uses of ‘mediation’ solve problems of talking about the effects (if not the efficacy) of digital experiences and how do some of these senses and uses, historic and contemporary, interfere?

Some Closing Words About ‘Technology’ Itself

My starting premise is that words matter. Rotman (2008), in his engaging and challenging book *Becoming beside ourselves*, reminds us that it is not even mathematics that will likely change most from digital pressures so much as the mathematician. Now we have ‘digital’ as the widespread preferred adjective, including ‘digital technology’, superseding ‘new technology’ or ‘information technology’ (to me one of the least informative terms) or ‘information and communication technology’. To return to the initial query, what is being signalled by this plurality of and rapid drift in naming – for change of terminology is seldom either neutral or innocent? In particular, is it drawing attention to the most educationally salient aspect of these devices?

And in the same way that in the nineteenth century ‘geometry’ and then ‘algebra’ morphed into ‘a geometry’ (which also permits ‘geometries’) and ‘an algebra’ (hence ‘algebras’), so ‘technology’ has, arguably faced with proliferation and fragmentation, shattered into ‘a technology’ (and ‘technologies’). One thing this pluralisation both

reflects and perhaps achieves is a destruction of a sense of naïve uniformity, that there is a monolithic thing called ‘technology’ that has constant and predictable effects and that internal differences are minor or insignificant. Perhaps this has never been the case and ‘technology’ itself might have been used early on to provide an umbrella term for ‘calculators and computers’. These are words and expressions whose history could be explored to document an alleatory and forgetful field (see Love and Tahta 1991; I believe ‘technology’ would be a significant word to add to their closing list).

As Robert Bringhurst (2004, p. 9) observes, in *The solid form of language*, “Drop a word in the ocean of meaning and concentric ripples form. To define a single word means to try to catch those ripples. No one’s hands are fast enough.” Though the above discussion I hope suggests at least that ‘concentric’, although accurate in the sense of perturbations arising from the single surface source, fails to capture the immense interactions and turbulence among certain meanings of a single word (Bringhurst does go on to talk of interference patterns created by dropping “two or three words in at once”).

And, lastly, given the title of this journal, it may also be important to remember, along with T. S. Eliot, that it is possible to have the experience yet still miss the meaning.

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