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Technological literacy: from function to meaning

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Abstract

Technological literacy has been given increasing attention in recent literature on the technology curriculum. This paper focuses firstly on some discussion of one of the most commonly accepted definitions, which seeks to explicate technological literacy in functionalist terms. It then goes on to consider some of the metaphysical assumptions underpinning the techno-scientific framework which, it is argued, threaten to impoverish our understanding of that framework and consequently any view of technological literacy developed within it. A view of technological literacy is then developed which presents it as the resultant of an active engagement in the construction of meanings. It is argued that this is a form of technological literacy which aims to inculcate the creative skills essential to the forming of a constructively critical perspective on the techno-scientific framework.

Problems of Definition

'Technology' as a concept appears to suffer from a lack of clarity in terms of both breadth and depth; the 'breadth problem' arises partly out of the fact that technology is, as some commentators have suggested¹, a 'vaguely articulated construct' that tends to be resistant to attempts to sharpen it up. This may be because it is an inherently vague notion, or it may be just 'blurred' at the edges in that there are many things quite properly referred to as 'technological', but that, in a society which has come very largely to define itself in terms of techno-scientific activity, the boundaries of the 'technological' are not easy to draw. Alongside the problem of 'breadth' is one of 'depth': this arises out of the sheer range of skills and knowledge coming under the umbrella heading of 'technology'. Should we construct a 'hierarchy' with the more 'important' technologies higher on the curriculum agenda? If so, which comes higher? Should we adopt the catch-all approach so that 'literacy' entails at least some understanding of all or most 'technology'? What kinds of knowledge? What kinds of understanding? Should 'depth' entail a 'mix' of major and minor? What kind of balance in this case? To answer some of the latter questions presupposes we have managed to find some satisfactory solution to the issue of breadth.

One route out of these difficulties is to suggest that 'technology', [like, for instance, the notion of 'game'] has a 'family resemblance' character²; there is no one essential set of defining characteristics, and the boundaries are continually being redrawn anyway. On this view, 'technology' is not so much lacking in clarity as a construct, but, rather, an inherently heterogeneous mix of skills, traditions and activities permeating, and interacting with society and culture in indefinitely many ways. I do not mean to imply an arbitrariness in this; indeed, the varieties of technological expertise interlock in many subtle

ways, and the history of their development is itself a vital aspect of the history of our culture which needs to be incorporated into any programme of technological literacy.

Technological Literacy

Nevertheless, the term 'technological literacy' is generally taken to imply an understanding commensurate with the application, function and role of technology in contemporary society. The analogy is with functional competence in the domain of literary activity, and is useful in drawing our attention to those aspects of technological understanding having a specifically functional significance; just as some, at least, of the criteria of literacy require the individual to have some competence with [say] grammar and syntax, so the technologically literate will possess certain functional competences.

Likewise, just as we can consider varieties and degrees of functional literacy, so we can also apply such notions to the domain of technology. Functional technological literacy can thus take a variety of forms: for example, a minimum know-how in terms of operational familiarity with the everyday paraphernalia of life [washing machines, video recorders, word processors etc.]; or some capability, or knowledge considered essential in some way for an individual to function in some specific techno-environment; again, an awareness or appreciation of the development of some kind of overview of technology in context; finally, a high-level understanding and skill with the technical working vocabulary and principles of a specific technology or range of technologies [eg information technology]. This list isn't intended to be exhaustive; but the 'grammar' and 'syntax' of these varieties and levels of functional competence may range from the basic to the highly sophisticated.

This indicates that functional technological literacy may be characterised in various more or less distinct ways, eg:

- Technology-as-doing
- Technology-as-knowing-about
- Technology-as-awareness

And, just as literacy itself is a vital functional prerequisite for the individual in society, so various forms of technological literacy may be also, eg:

- As a condition of participation in contemporary society
- As empowering the individual
- As an essential adjunct to economic survival [both personal and societal]
- As a condition-of-being-in the techno-scientific framework

So much for functionalist interpretations of technological literacy; functional technological literacy could be seen as 'liberating' for the individual in various ways. But on the other hand, it might equally be seen as providing mechanisms of social control³. There is a possibility that this kind of 'functional' competence, far from empowering or freeing people, might serve merely to bring them more conveniently under the control of the contemporary state, since technology may also be conceived as a means of both defining and controlling the status, capability, actions and even the social space allowed or appropriated to the individual. Worse still, we also have to reflect on the gloomy possibility that the postmodernist postfordist dream⁴ of a liberated high-skill and technologically literate workforce may well be at odds with the reality of a high-tech environment in which more sophisticated technology actually tends to 'de-skill', thus reducing the level even of functional literacy⁵.

Finally, aside from the possibility of state intervention, benign or otherwise, functional literacy is also at the mercy of other groups within society, each with particular ideological axes to grind⁶, and which might threaten the impoverishment of any notion of technological literacy. In short, if we constrain ourselves to functionalist interpretations of technological literacy, we may find ourselves beset with a number of intractable problems.

The Metaphysics of the Techno-Scientific Framework.

Apart from worries about state control or ideologies, certain kinds of metaphysical assumption also threaten to impoverish our conception of the techno-scientific framework, and this in turn threatens to constrain and impoverish notions of technological literacy. These assumptions can be

classed under deterministic, constructivist, and deconstructionist headings. Each can be damaging in different ways. Determinism in one form or another tends to pervade popular views of science and technology. Science is seen as progressing in more or less linear fashion towards ultimate truths about the natural world; and technology is perceived as a juggernaut unleashed by science in the pursuit of an ultimate utopia [or nightmare]. These are not easy assumptions to dislodge, as I have argued⁷ but they need to be challenged; techno-scientific determinism relies mainly on meta-inductive and reductive arguments. I do not have space to deal with reductionism here, but this has been very ably criticised elsewhere⁸. However, meta-inductivism holds that the only satisfactory explication for the success of the natural sciences at least, is that the causal mechanisms and entities postulated by them are at least approximately true. This entails a realist view of scientific theories; even if our current theories are not strictly true, science is at least progressing towards ultimate truth about the natural world.

The trouble with this, is that whatever 'ultimately' exists may do so regardless of our capacity to construct explicatory theories; this meta-inductive hypothesis cannot be open to refutation in any ordinary sense since even if all our theories were to be refuted, it could still be consistently maintained that science might eventually succeed in generating true theories. As an hypothesis it does no work; meta-inductivism is vacuous, and as a critique of progress in science, it has come under sustained attack from various quarters^{9,10}. More generally, convergentist critiques of scientific progress do not stand up either to philosophical analysis, or the evidence that comes from a study of the actual history of science¹¹. The universe, for the disciple of determinism, is a closed one; the technological corollary of this is the 'megamachine'¹² with everything [and everyone] locked finally into place; literacy in such a domain would suffer the same deterministic fate. But techno-scientific activity, although continually opening up new domains that are conceptually richer, and thus in this sense progressing, need concede nothing as to the 'ultimate truth'. We don't have to accept the metaphysics of determinism in order to make sense of the techno-scientific framework.

Against this we might consider the social constructivist¹³ approach to the notion of a technological literacy which seeks to explain the products of science and technology as resultants of social processes. The purposes, meaning and nature of those products is, according to social constructivism, decided through a consensus which

emerges among the differing social groups involved. However, the language within which talk of various possible interpretations of techno-scientific activity goes on must itself provide a relatively fixed and stable framework in order to make such talk a possibility in the first place, and it is far from evident that this stability is arrived at merely through 'social consensus'. Truth is not fixed by conventionalism any more than it is fixed by determinist metaphysics.

The social constructivist approach to explicating techno-scientific development is threatened with a slide into the anarchy of a total relativism, and this can open up the prospect of a deconstructionist¹⁴ attack on the very idea of a stable language wherein any intelligible critique of the techno-scientific framework might be developed. The case for deconstructionism is that the meanings of all terms within a language are indefinitely defeasible. One 'interpretation' can always be substituted for another and so on indefinitely. The result according to deconstructionism is an endlessly shifting morass of 'meanings' from which it is impossible to command a clear view. Language is a labyrinth from which there is no escape. However, deconstructionists cannot in consistency even formulate their case, since any such attempt undermines the very view they wish to put forward. To present an argument for deconstructionism is to invoke the very criteria of language-stability they claim to reject. There is thus literally no reason why we should accept the deconstructionist position.

The Construction of Meaning

If we are to command a clear view of the potential power of a true technological literacy, we need to avoid the pitfalls of determinist, constructivist, and deconstructionist metaphysics; each threatens impoverishment in one way or another because each impoverishes our conception of the nature and working of language, including the techno-scientific vocabulary. Wittgenstein offers a conception of the countless different 'games' played with natural language which both undermines these metaphysical traps, and also captures the actual characteristics of living, growing languages. I cannot do justice to the subtlety and complexity of his account here, but there are some features which I believe serve as useful signposts.

Firstly, many 'language-games' interlock to yield pictures of varying degrees of richness. At the basic functional level, learning, for example, to make observation reports precedes other more sophisticated 'games' with language such as 'imagine that...' and likewise the effective use of, for example, metaphor or simile presupposes a grasp of these yet more complex and sophisticated language-

games. There is an ordering in the acquisition of such skills; they are not all on the same level and their mastery is a very gradual process. We would not normally regard the learner who had so far only acquired skill in the observation-report language-game as 'literate', because we recognise that literacy is also concerned with a grasp of the complex and multi-levelled interplay of different language-games. Although there are 'rules' for the uses of our language-games, and for the varieties of 'constructions' therewith, such rules are neither fixed nor all encompassing, as Wittgenstein² stresses.

Secondly - and this is what, I think, rescues us from the earlier mentioned metaphysical traps, and enables us to push notions of technological literacy beyond the merely functional - literacy is not merely concerned with functionality as such but also with the construction of meanings. Literature is itself a paradigm of this latter kind of activity, and it has frequently been employed to construct critiques of the techno-scientific framework.

I will use Charles Dickens as an example to illustrate this. Dickens was concerned, in *Hard Times*¹⁵ and other novels with what he saw as the dehumanising effects of industrialisation, and a society apparently obsessed with laissez faire economics and mechanistic utilitarianism. He uses irony, parody, and caricature [among other language-games] to systematise and order a complex and disparate set of circumstances, events and artefacts, thereby offering a particular interpretation. Now, it might be said that Dickens' interpretation of some of the effects of nineteenth century technology is just one more interpretation amongst a potentially indefinite number of such interpretations. Does this mean that, after all, anything goes and that deconstructionism is right? Not at all; to begin with, Dickens draws upon many of our shared language-games; these interlock and fit together in particular kinds of way, and Dickens makes superlative use of this fact. His critique not only engages with the situation he describes, but also yields a rich and compelling picture which provokes the reader into further reflection precisely because the reader shares this framework of language.

Secondly, although we can of course reject Dickens' reading, any such rejection, if it is to mean anything, must be based on some kind of assessment and this itself presupposes a shared form of communication. Agreements, as well as disagreements, acceptance, rejection and so on, perforce take place against the shared background of a relatively stable framework of language. But there is a more centrally important point in relation to this, a point which not only undermines the impoverishing metaphysics of

determinism, but helps clear away the muddles of the social constructivists. In offering this 'picture' of nineteenth century technology and industrialised society, Dickens is not merely mirroring a pre-existent reality; his picture is a creative construction with a constitutive relation to what is pictured. The picture he offers us not only draws upon what is pictured, but in the process transforms it. What is pictured here is never the same again after it has been touched by Dickens' vision. This is not a picture determined in advance, nor is it arrived at through a consensus; but when we properly take in this picture, we ourselves see with 'new eyes' as it were. What this indicates, is that our language-games are not merely static; they actually have great transforming power, to renew and regenerate themselves; and literacy is the key to the unlocking of this power. But we need to understand better the nature of this power and free it from the clutches of an impoverishing metaphysics.

Now, we may nevertheless be tempted into thinking that, although Dickens is indeed commenting on the society of his day and offering new insights into the condition of that society through creative constructions with language-games, this does not really apply to language-games in the techno-scientific framework. Well, to begin with, I hope that it is plain from this discussion, that the critique of a writer such as Dickens is indeed an essential dimension in any programme dealing with technological literacy. But the points I have tried to make about the nature of the language-games employed by Dickens apply equally to those specialist languages within the techno-scientific framework itself. The language-games we play with calculation, mathematics, empirical observation, testing, prediction, simplicity, symmetry, and so on, form stable, pre-existing elements alright; but from which, nevertheless, new 'pictures' can grow. And new pictures in this sense, open up entirely new domains, as any careful research into the history and growth of the techno-scientific framework will show. The construction of meaning entails an active striving towards new perspectives. This is no mere tracing around the framework of a fixed and immutable language. Language must continue to grow in order to live, and this is as true in the techno-scientific framework as in any other. This, I think, points to the need to incorporate into the curriculum a notion of technology literacy that aims not merely to produce 'functionally' literate technologists versed in various skills and disciplines, but also one which aims to get the active engagement of the learner in the creative processes essential to the forming of constructively critical perspectives through which meaning can be infused into the techno-scientific framework itself.

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