

# ***Learning with technology as coordinated sociomaterial practice: digital literacies as a site of praxiological study***

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## **Abstract**

While considerable attention has been given to the concept of learning – what it is, how we might know it when we see it, and how to intervene in it – by contrast, technology remains under-theorised. While theoretical approaches that have developed accounts of the relationship between technology and human action, few of these are well represented within educational technology or networked learning. This paucity of theorisation has resulted in simplistic accounts of the role of technology in various kinds of learning, usually involving some kind of causal or determining mechanism. Such accounts are vulnerable to critique (e.g. Friesen, 2009), but nonetheless remain prevalent.

In this paper, I will recap some of the problems with this position, and then consider alternatives that address issues around agency and the role of the social. Specifically, drawing on Mol's concept of praxiology, developed in the context of work on the constitution of diseases in medical practice, I will explore alternative ways in which educational uses of technology can be understood. This value of this will be illustrated through the design of a study of digital literacies. Some implications of this include for researchers – including concerns about reflexivity – will then be drawn out.

## **Keywords**

Technology, science and technology studies, praxiology, digital literacy

## **Introduction**

This paper explores the feasibility of using theories of technology and practice developed within Science and Technology Studies to design in the context of studies of educational technology and networked learning. First, concepts of 'technology' are reviewed, highlighting this as a theoretical blind spot for the field, and identifying traditions in other areas of work that could contribute to our understanding of technology. Next, one conceptualisation – Mol's praxeology – is explored in more detail. Finally, this is applied to educational research with a focus on technology, specifically, in the context of a project on digital literacy. Having demonstrated the relevance and viability of such designs, the paper concludes with a call for further research along these lines to be undertaken within the field.

## **Theorising technology**

The idea of 'learning' has been widely theorised in research in this field; 'technology', however, remains relatively neglected. This was not always the case; for example, Saettler's account of the field (1990) attempts to define educational technology, drawing on the Greek concept of "techné" as a point of reference. Techné can be understood as the rational, craft-based approach to producing or achieving something; it is often discussed in terms of the application of science (or scientific knowledge) to nature (Pinch & Bijker, 1978). However, in spite of these historical precedents, there is little evidence that technology is currently understood in anything other than a common sense way.

This is somewhat ironic, in a field that is, ostensibly, concerned with technology as an object of study. By contrast, other fields can demonstrate lively debates about this issue. For example, in the philosophy of technology, Feenberg (2002) has developed a position that relates the design of technology to political and social concerns, using the notion of technical codes to explore how hierarchy and capitalist values are reproduced through the design of technical systems. In Science and Technology Studies, early work by Pinch & Bijker (1978) showed how the process of designing technologies reflects social interests, being shaped by competing groups over time. Building on this tradition, Grint & Woolgar (1997) likewise explored the ways in which our design and understanding of technology is shaped by social concerns, and further, how technologies

can be understood as a site of social struggle, where designers work to ‘configure the users’ to ensure that they engage with their machines in appropriate ways.

Within educational technology research, however, our understanding of technology is less well developed, and in an era when learner-centred accounts are valorised (Thorpe, 2002), the concept is hardly deemed worthy of attention. A review of ten years’ worth of research in six educational technology journals found only 10 articles where the focus could be interpreted as being on technology (Oliver, forthcoming); five of these relied on conceptions of affordance, three on technology as part of a system, one on the social shaping of technology and one on design-based research. Of the rest, the majority can be characterised as adopting a ‘common sense’ view of technology, in which its introduction is understood as a causal factor in some subsequent change (e.g. in attitude, learning outcomes, *etc*).

Friesen (2009) has argued that we have a particularly instrumental view of technology, one that is oriented almost exclusively to the notion of developing a ‘technical fix’ to educational problems. In part, he argues, this is the consequence of the origins of this work in military technologies, concerned with the idea of closed ‘command and control’ systems. Friesen, drawing on Habermas, argues that there are alternative ways in which technology could be conceived – in practical or emancipatory terms. On this account, a practical orientation to technology would be concerned with its meaning, and with users’ experiences. Such an orientation could be seen as relating to the emerging body of work on learners’ experience of e-learning (Sharpe *et al*, 2009), or to phenomenographic accounts of technology use. Emancipatory work would focus on questions of equity and justice, and could be related to value-led action research with a democratic orientation, for example.

As a consequence of this pragmatic, instrumental orientation, there has been little drive towards re-thinking technology. This has left us with a tradition of research dominated by deterministic models of how technology works. Under this conception, technology operates like a simple, causal black box, and about which the only questions that can be asked are ones of efficiency and control (Oliver, 2011). Research work then concentrates on the construction of these black boxes; where we try to understand them, it is in functional terms, and this is usually a means to the end of making them more effective and efficient. As a consequence, the only recent theorisations of technology are concerned purely with its functional composition. Theories of affordance provide clear examples of this: technology is understood in terms of what it can do (to us), and the conclusions to be drawn primarily concern further technical design (e.g. Conole & Dyke, 2004). Educational technology is not the only field where this happens – comparable theories have been created in engineering, for example, such as Arthur’s attempts (2009) to provide an account of technology’s ‘evolution’, in such a way that it need not account for the agency of people.

Design is clearly important, and should certainly form part of the body of work undertaken in this field – but it seems strange that work related to education, psychology and social science – fields oriented to *people* as the object of study – should pursue this line, particularly where the dominant values espoused in research are learner-centric (Thorpe, 2002). In this respect, recent work focused on learner experience marks an important complement to design-oriented research. It is also worth noting that there is work that draws on quite different conceptions of technology. Wenger’s work on Communities of Practice (1998), for example, in which technology would count as a reification of practice, adopts a very different orientation to technology than the dominant, black box, deterministic accounts. Here, technology (as a reification) only makes sense when considered in relation to practices; it is in the interplay between practice and its reification that individuals produce meaningful action. Under such a framework, the meaning of technology becomes situated; it relates to historical contexts of use by specific groups. Comparable arguments can also be made for work building on activity theory (Derry, 2007).

Whilst rarer, there are also studies in e-learning that draw on traditions such as actor-network theory; these can provide a very different account of technology, one that emphasises its socially constructed character. These studies fit far better with the theoretical foundations being developed in Networked Learning, which emphasise “*a relational view* in which learning takes place in relation to others and also in relation to an array of learning resources” (Jones, Ferreday & Hodgson, 2008). Enriquez (2009), for example, explored how the virtual learning environment (VLE) Blackboard was taken up and used in different departments. Rather than drawing monolithic, general conclusions about its value, her analysis shows how use of the VLE allowed students to bring together their experiences of study in different contexts – or, in some cases, failed to do this. Her analysis explicitly rejects questions about what Blackboard’s ‘impact’ might be – because this assumes Blackboard is a constant, unitary thing, and that its effects operate in some causal manner – in favour of an analysis that shows a

repertoire of ways in which it can be used, and which thus contributes to a better understanding of its ‘artful integrations’.

If technology is understood in this relational way – as something in flux, its meaning determined in important ways by the contexts and manner of its use – then this requires us to approach its study in different ways. Such relational approaches are, arguably, more consistent with the idea of networked learning than deterministic, decontextualised accounts of technology. However, such approaches are also less well established, and it is not obvious how some of the research concerns that characterise the field (see, e.g., Conole & Oliver, 2006) might be taken up within such a tradition. This is the problem that will be taken up here, using the area of digital literacy as an illustration. First, however, a relational, situated perspective on technology use will be developed, drawing on Mol’s work on praxiology.

## Atherosclerosis, and Mol’s production of praxiology

Studies in clinical contexts have raised fundamental questions about the ways in which we understand technology. How, for example, can a gynaecological simulation that was shown to have validity in US research studies be seen as lacking in validity when used in Sweden (Johnson, 2008)? If a simulator’s fidelity is understood in terms of its relationship to physical bodies, then this only makes sense if Swedish and American bodies differ in radical ways. However, Johnson argues, the problem makes much more sense if simulators are understood not in terms of a relationship with physical reality in some simple, positivistic way, but instead in terms of a relationship to *ways of knowing* reality. In other words, the problem of validity in this case arose because what were being simulated were not bodies *per se*, but the clinical practices through which bodies come to be known, classified and operated upon. For example, the apparatus that was used represented a disembodied torso; this is an issue for practitioners who expect to make eye contact with their patients. Technology can no longer be understood simply in terms of its functions, but has to be reconceived in relation to people, practices and purposes.

Although such problems have been identified and explored in medical contexts, they remain relatively unfamiliar in educational ones. Consequently, it is useful to take a closer look at approaches developed to study medical practice as a point of departure for work concerning technology and education.

Mol (2002) uses an ethnographic study of atherosclerosis in a Dutch hospital to develop her account of praxiology – the study of practices. This focus on practice as the unit of analysis has a number of implications, not least of which are ontological. In a manner similar to activity theory (Kuutti, 1997), claims can no longer be made about technology *per se*, nor learners *per se*, but have to be made in relation to purposeful and situated action involving material artefacts. Thus, rather than conceiving of technologies as objects that should be understood in their own right, technology becomes one part of a more complex process involving people, places, actions and claims.

In the traditional ordering of disciplines, an ethnographer talking about disease transgresses the thresholds separating the layers of reality in the pyramid of objects. But the move made here is different. It is not a matter of turning the arrow round so that instead of the natural sciences explaining social phenomena a social explanation of molecules, cells, or bodies is being presented. Instead, another praxis has been introduced, another approach taken: that of practice. The latter encompasses molecules and money, cells and worries, bodies, knives, and smiles, and talks about all of these in a single breath. [...] If practice becomes our entrance into the world, ontology is no longer a monist whole. Ontology-in-practice is multiple. (Mol, 2002: 157)

In this, Mol’s work builds explicitly on actor-network theoretic studies, and also on social scientific studies of clinical practice, such work by Latour (Latour, 1987; Latour & Woolgar, 1979). This provides a view of the world as interconnected, constituted by heterogeneous networks – but in Mol’s case, it is the networked *enactment* of things that is studied, rather than the mapping of networks *per se* or the analysis of historical snapshots, as was the case with some earlier actor-network theoretic work. This expectation of heterogeneity results in an inclusive kind of account, and requires openness in the way in which problems are framed.

Returning to the main concern of this paper, it is worth highlighting the ways in which technologies are important in this account. In line with Latour and Woolgar’s earlier work (1979), technologies are used to produce the medical reality that is then coordinated (or not) with the patient’s account of their actions and

experiences. For example, in the case Mol describes, demonstrating the thickening of the intima under a microscope shows what atherosclerosis ‘really’ is; however, this is only possible once tissues have been removed, treated and coloured, and then placed between glass slides. Importantly, the ‘reality’ that is constituted by the practice of analysing tissue samples is just not the same as the ‘reality’ that is construed by (say) taking a patient history in an examination room, which might involve two people, chairs, and dialogue about matters such as shortness of breath, pain and walking a dog (p23). The two are not equivalent, not interchangeable, not even synchronously possible, and yet both allow clinical experts to say something about atherosclerosis – even if what they can say might be tentative or even inconsistent.

What this highlights is that we should not expect the ontologies produced by different practices to ‘collapse’ to a single, foundational ‘truth’; indeed, in some cases, resolution of any kind may be impossible.

The practices of enacting clinical atherosclerosis and pathological atherosclerosis *exclude* one another. The first requires a patient who complains about a pain in his legs. And the second requires a cross section of an artery visible under the microscope. The exigencies are incompatible, at least: they cannot be realized simultaneously. [...] The incompatibility is a practical matter. It is a matter of patients who speak as against body parts that are sectioned. [...] In the outpatients clinic and in the department of pathology, atherosclerosis is *done* differently. (Mol, 2002: 35-6)

Mol’s account therefore expects multiple ‘realities’ to be created by our practices, and also expects these to be brought together in more or less successful ways. Where enacted realities coordinate, Mol describes how the differences between them can be *bracketed*, so that they can be treated as if they are equivalent (if necessary, through some process of translation) – at least until some inconsistency arises, at which point it becomes necessary to unbracket them again to try and explain what has happened (p64).

This is the plot of my philosophical tale: that *ontology* is not given in the order of things, but that, instead, *ontologies* are brought into being, sustained, or allowed to wither away in common, day-to-day, sociomaterial practices. (Mol, 2002: 6)

This work of coordinating differently enacted realities then raises a cluster of questions: about who can produce accounts, where, and with what; about which are privileged when there are inconsistencies; about which can be translated, which interfere and which are simply incompatible. It raises political questions about who should be expected to make decisions, but also, about what is worth doing and why, and how we should think about the differences, tensions and conflicts that will inevitably arise (p166-181). This orientation to practice therefore demands some kind of political stance to be taken – although it does not specify what this should be.

## Praxiology, technology and learning

Mol’s account provides an orientation to research, but does not specify the methods through which such research should be undertaken. From the preceding account, however, some characteristics of Mol’s praxiological study can be identified.

Broadly, this approach explores how people undertake and coordinate sociomaterial practices. Who is included within the scope of this is a political question, one that is to be determined by the researcher, rather than the method. The exploration is undertaken ethnographically; like actor-network theoretic studies (e.g. Latour & Woolgar, 1979) it involves following the actors, and uses observations, field notes and interviews to generate data. These sources are used to produce accounts of peoples’ practices, and thus the ways in which they enact reality. The expectation is that the different realities they enact will need to be coordinated, but that this coordination work will not always be successful. Further analysis can then be undertaken to describe the ways in which coordination happens, whether this be through translation, bracketing, dismissal or tolerance of ambiguity. This can then be interrogated in terms of a ‘politics of what’, as to whether the coordination that is achieved contributes to the good of those involved. Again, the specification of ‘good’ is seen as a political necessity rather than a matter of method.

While this approach was developed in order to study clinical practices, it seems equally well suited to educational practices, including those involving technology. To illustrate this, here, I will explore what a praxiological approach would look like in the context of work on digital literacies.

In the UK, the Joint Information Systems Committee (JISC) recently commissioned ten projects on the topic of digital literacy. As even a cursory review of the literature will reveal, however, there is no unifying conception of what 'digital literacy' is. For Lankshear and Knobel (2008), for example, digital literacies are socially situated practices, through which people make meaning using digital media. For learndirect – a national training organisation – digital literacy is a set of skills that cover the operation of computers, productivity software and the internet, and which can be taught through self-study online resources supported by multiple-choice testing. Beetham *et al* (2009) have provided an overview of some of these differences, and have related them to groups with particular concerns. For example, they identify information literacies as being defined by library staff, addressed to learners and researchers, oriented towards information discovery and asserting cultural values of evaluation, reflection and critical judgement. Media literacies, meanwhile, they characterise as being less clearly 'owned' by a single group, as addressing users as consumers and producers of media, as being oriented towards critique, creativity and audience, and as valuing things such as democratisation of production.

This review thus foregrounds the social enactment of practices relating to digital literacy, and the need for coordination. However, this coordination has not yet been achieved; the JISC call for projects referred to above builds on Beetham *et al*'s broad definition ("*digital literacy defines those capabilities which fit an individual for living, learning and working in a digital society*"), and reflects, rather than reconciles, their inclusive bringing together of potentially related practices, such as ICT/computer literacy; information literacy; media literacy; communication and collaboration; digital scholarship; learning skills; and life-planning.

Framing digital literacies as practices in this way places them well within the scope of Networked Learning. Literacy provides a classic example of networked activity:

Look at the material world in this way. It isn't simply that we eat, find shelter in our houses, and produce objects with machines. It is also that almost all of our interactions with other people are *mediated through* objects of one kind or another. For instance, I speak to you through a text, even though we will probably never meet. And to do that, I am tapping away at a computer keyboard. At any rate, our communication with one another is mediated by a network of objects – the computer, the paper, the printing press. And it is also mediated by networks of objects-and-people, such as the postal system. The argument is that these various networks *participate* in the social. They *shape* it. In some measure they help to overcome your reluctance to read my text. And (most crucially) they are *necessary* to the social relationship between author and reader. (Law, 1992: 381-2)

Law's example already implicates technologies in literacy practices; the digital literacy practices specified in relation to the JISC project imply heavily technologically-mediated relationships. This implies that digital literacies can be understood appropriately as a subset of Networked Learning, as defined by Goodyear *et al* (2004: 1), in which "information and communication technology...is used to promote connections: between one learner and other learners, between learners and tutors; between a learning community and its learning resources".

This situation seems ideally suited to a praxiological study. The emphasis on digital literacy as a practice, or at least as a set of related practices, clearly fits with a praxiological orientation. Moreover, an educational context shares many similarities with the kinds of clinical work that Mol studied. There are, for example, close parallels between the kinds of diagnosis and intervention that formed the focus of Mol's examples, and the ways in which educational institutions are required to assess, develop and credential learners.

Such an approach would also have value in addressing the kinds of orientations to research that Friesen (2009) identified as being hitherto neglected. A study that explored how these different enactments of digital literacy might be coordinated would serve practical ends (in Friesen's sense) by documenting and sharing the perspectives of various actors involved in this work. It could also be emancipatory, in that it requires an explicit political commitment, which in this case would value the practices of learners, teachers, and possibly employers of the learners or the researchers involved in these projects. Specifically, it might provide insight into the ways in which practices that are important to particular groups or individuals might be recognised and valued by others – or at the least, provide a better explanation of why they are not. Instrumentally, such a study would also allow new educational practices to be developed that enable learners to practice the kinds of digital literacies they need in order to undertake digital scholarship or other forms of professional practice subsequently.

This way in which such a study could be undertaken can be illustrated by reference to one of the projects funded within JISC's programme. The project is based at the Institute of Education, University of London – a primarily postgraduate institution, whose portfolio of taught courses can be characterised as being oriented to mature learners and relating to various areas of professional practice. The project involves 'baselining' current practice, intervening through four pilot projects (implementing innovations in areas of teaching or academic service) and achieving organisational change to establish these new practices as part of normal, mainstream work. The project's aims include supporting the development of digital literacy as an 'attribute' that graduates will be able to use in the context of subsequent professional practice. The 'baselining' phase, in particular, represents an important opportunity for praxiological work: its purpose is to document current practices, providing a point of reference for the design of subsequent interventions, and also allowing claims to be made about the eventual achievements of the project.

Undertaking a praxiological study as part of this 'baselining' work would involve, as a first step, identifying who would be included within the scope of the study. The body of students at any institution is likely to be diverse, but for the purposes of this work, important differences might be expected between students on postgraduate certificates in Education (providing a licence to teach, and so oriented to preparation for practice), Masters programmes (aimed at mid-career professionals, who could be expected to have developed forms of literacy within their professional context, but who may be out of practice with forms of academic work) and Doctoral students (oriented towards the development of academic literacies). Other groups that would need consideration, given the context and aspirations of the project, would include the teachers and support staff who train these students, and the practice-based professional staff who will work with them (or may employ them) during work placements and after graduation. Politically, since the aim of the project is to change practice within the educational institution, the focus for this work would be on educational interactions between students and teachers (or support staff), with employers/professional colleagues involved primarily in relation to their judgement of students' digital literacy.

These actors would then, as far as is possible, be followed to develop an understanding of the ways in which digital literacy is enacted in different contexts. While ethnography usually involves sustained immersion in the field, contemporary ethnography recognises that – particularly where networked technology use is concerned – such access is problematic, and in some cases may be better achieved through mediated engagement (Hine, 2000). Consequently, following Mol, direct observation would be achieved where possible, with priority placed on moments of 'diagnosis', where judgements are made about whether particular students 'have' digital literacy. Such moments would include training sessions, assessment, discussions between a student and tutor about their development, and reflective reports by professional colleagues following work placements. Where access is practical, other lower-priority enactments of digital literacy will also be pursued – such as writing sessions using digital applications, the use of information resources in the library, teaching using technology in classrooms, and so on. There will also be times when access is simply not practical – for example, in relation to mobile uses of technology, or even for home use (because such observation would be intrusive, and being widely dispersed, would also be beyond the resources of the project). In such situations, where access is not practical, mediated forms of engagement will be used. For example, students will be asked to generate evidence of their digital literacy – or the lack of it, in cases where they consider their literacy practices to have failed in some way. This mediated engagement would include requests for screenshots, produced digital artefacts and notes about the experience of enacting digitally literate practices, together with follow-on discussions that allow elaboration. This mediated kind of engagement remains consistent with Mol's own approach: just as Mol reports on discussions around the process of taking medical case histories, so it would be possible in this context to interview students to ascertain their educational case histories.

While Mol is not specific within her book about the way in which her fieldwork was structured or how opportunities were sampled, following the actors implies that continuity is an important principle. As with other forms of ethnography, the quality of the study would rely on the ability of the researcher to engage with the field site, and to convey a credible and persuasive account of their experiences (Hine, 2000).

Similarly, given praxiology's interest in the enactment of multiple realities, contrasts are fundamentally important to Mol's analysis. Sampling in this project therefore involves following specific actors – in this case, students – over a period of time, in order to understand the diverse digital literacies that they enact, and then seeking to generate evidence about the diversity of enacted realities by involving other actors whose practices overlap with the students'. Specifically, this involvement would require observation of interactions, and

interviewing teachers and/or professional colleagues about the priority moments of ‘diagnosis’ of digital literacy, mentioned above. This structure would provide analytic depth through longitudinal contrasts, as well as breadth through the contrasts generated in relation to key moments.

However, these principles will pose further challenges to researchers. Firstly, following actors for a longitudinal study is time consuming and can be invasive, disrupting the practices that are being studied. (See, e.g., the reactions of scientists described by Latour & Woolgar, 1979.) The continuity of access required is also demanding, and may limit participation. Moreover, moments of diagnosis may well be sensitive: there are ethical issues to be considered around being present when the competence (or otherwise) of students is being judged. Finally, as with any ethnographic work, this would not guarantee representativeness or generalisability; however, it would allow the kind of insight and credibility that ethnographers aspire to (Hine, 2000: 142-146).

The process of data generation described above would thus create a body of evidence about the enactment of digital literacies. The next step is to create a structured description of these data. The variety of such enactments will be reviewed, to identify continuities and differences. This would allow an exploration of the ways in which different enactments of digital literacy have been coordinated. It would also allow examples to be identified where enactments of digital literacy conflicted, and how such conflicts might be managed. Potential examples of this can already be identified in the existing literature on digital literacies – for example, in relation to cases of academic misconduct, where a student considers themselves to be digitally literate for finding and ‘remixing’ a digital source, whereas the teacher marking their work considers them to be illiterate in important ways because they have plagiarised a source (see, e.g., Beetham & Oliver, 2009).

This analysis would document ways in which enactments of digital literacy can be coordinated successfully – where there is accord, or at least comprehensible translation, between the practices a learner might undertake at home, in their studies and in professional practice. It would also identify areas where such coordination has not been achieved. In these cases, the ‘politics of what’ comes to the fore: decisions would need to be made about what kinds of changes in practice represent the best outcome for those involved – and, given the political priorities identified earlier – particularly for the students. Given the role of this work in providing a project baseline and informing further work, this prioritisation would help specify and prioritise interventions to be undertaken in the next phase of the project. Its outputs could be expressed both as an overall report, but also as structured cases of students (subject to anonymisation and informed consent) that build on existing ‘learner journey’ reports of digital literacy (Bradley, Greaves and Holley, 2011).

## Conclusions

This paper addresses the lack of debate about the concept of technology in studies of educational technology and networked learning. While such debate is largely absent in this context, other research areas have developed active programmes of work that address this. Some examples of this have been identified here – such as technical codes in the philosophy of technology, or social and relational conceptions of technology in Science and Technology Studies. The relevance of these to work in this field has been demonstrated, using praxiology to specify the design of a study of digital literacies that recognises our complex and contested understandings of this concept.

Adopting a praxiological approach offers several benefits. As argued, it addresses the kinds of practical and emancipatory concerns that Freisen (2009) argues are missing from work in this field, which remains dominated by instrumental concerns. It would also demand reflexivity of researchers in a way that functionally-oriented theories of technology do not. By giving up correspondence accounts of truth, and allowing a practice lens to be turned back on the process of research, praxiology draws attention to the way in which research too is an enactment of particular realities. In doing so, it highlights the limits of our accounts. It requires a tolerance of doubt, rather than offering certainty, but in doing so it foregrounds the moral and political values of research (Mol, 2002: 160-166).

The current neglect of such approaches is a missed opportunity. Arguably, the field would be enriched by greater attention to one of its fundamental concerns: technology.

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