

PUTTING THE LEARNING BACK INTO LEARNING TECHNOLOGY

Barry McMullin
Dublin City University
E-mail: barry.mcmullin@dcu.ie

Abstract

The story of technology and teaching in higher education has generally been one of successive false dawns. Each major technological advance has been ritually hailed as heralding a revolution in either the quality or cost of education (or both). Large sums of money have been expended on foot of such predictions - but, in each case, the long term impact has been found to be, at best, modest (at worst, actually negative). The application of Internet technologies in education has followed this pattern quite consistently - from hyperbolic claim, through commitment of sometimes extraordinary amounts of resource (admittedly, in this case, at the irrational height of "dot.com" fever), to both public and not-so-public failure to deliver any recognisable revolution ("no significant difference" - again). So what might we learn from this? A common factor, already recognised in earlier iterations, seems to be preoccupation with technology per se, and neglect of pedagogical theory. Indeed, many recent innovations, though technologically dazzling, seem to have been premised on the most naive and primitive theories of knowledge and learning. Yet beneath the technological hype and dazzle, the Internet may yet have something genuinely profound to bring to education. From a social constructionist view of learning (and teaching) there are signs of a slower, quieter - and much cheaper - Internet revolution, under such unlikely rallying cries as "open content", "wikiwiki", "blogging" and "moodling". In this paper we will review these developments, relate them to each other and to theoretical foundations, and finally risk some continuing optimism about the ultimate role of the Internet in enhancing higher education.

Introduction

Over the past half century or more, there have been repeated claims that a new technological innovation will dramatically alter and enhance the learning process. By turns, radio, television, video tape, interactive video disk, computer based training, and no doubt many others, have all been ritually hailed as revolutionary contributions which will radically transform the practice and *effectiveness* of teaching and learning. By 1992, Ramsden was ready to summarise the resultant experiences, briefly but accurately:

Computers and video in higher education have so far rarely lived up to the promises made for them ... No medium, however useful, can solve fundamental educational problems. (Ramsden 1992:159-161)

Then came the Internet and World Wide Web. "eLearning" became the next great thing, and technology was poised, again, to radically change the way people learn. Governments, companies, educational institutions (both ancient and modern) were all equally dazzled by the promise

of vast new revenues - and the threat that somebody else might get them first! Partnerships formed, projects were launched, veritable armies of programmers, "content designers", "subject experts" were all put to work.

Of course, it couldn't last. The Internet "boom" turned out to be an Internet "bubble" - and duly burst.

Though eLearning was not, after all, a panacea, it has nonetheless shaken things up. Ramsden was right in observing that technology in itself is unlikely to solve "fundamental educational problems", but it might still allow us to see them in a new light.

My fundamental premise is that there has been at least one consistent and repeated motif in the (so far) failed promises of successive waves of learning technologies: namely that they have been driven by technology rather than by learning. I start with a general statement of pedagogical commitment: to the view that learning, especially "higher order" learning, is at once personal, social and constructivist. Knowledge cannot be "transmitted" (electronically or otherwise!), but must be constructed anew. Yet this constructive process can be greatly facilitated, especially by social interaction - with teachers and with other learners. This is the pedagogy of *social constructivism*. I will not elaborate the theory itself here - it is treated extensively elsewhere in this collection, and especially in Carlile and Jordan (2005) and Higgs and McCarthy (2005). My task here assumes this theory as a starting point, and uses it as a "searchlight" on the technological landscape.

My contribution will then be the modest one of presenting a selection of just four recent technological innovations which, it seems to me, have significant potential to support and enhance social constructivist learning. The first three are generic, and not specifically designed for educational use, but I suggest that they can nonetheless be effectively co-opted for this purpose. The last (moodle) serves, in part, to do just that - to package and tailor generic innovations and place them easily in the hands of teachers and learners; but it also goes further in its own right, as we shall see.

In conclusion, I will take the risk of once again being optimistic about the potential of technology to enhance learning: not in itself, but as an instrument of pedagogical change.

Open Content/Free Culture?

What is it?

One of earliest Internet facilities was the development of so-called "anonymous ftp servers" - the precursors of modern Web sites - where electronic documents could be made available for download to any computer with an Internet connection. These were quickly adopted as a mechanism for academics (then the primary users of the Internet) to share their scholarly work. In some ways, this was merely a new form of a long-standing academic tradition - namely, the free exchange of "preprints" and "offprints". Yet it also marked a radical change, in that access was now much faster (reduced from weeks to minutes), and a much wider diversity of materials became readily available to anyone with an interest.

The World Wide Web was originally born as an enhanced version of this facility (Berners-Lee 1996)¹, and was still largely directed at the same specific purpose of facilitating exchange of scholarly work. It introduced several new features, but, perhaps most critically, the idea of "hypertext" linkage - direct electronic links between networked documents. At one level this was merely a more efficient version of the traditional academic devices of cross-referencing and citation. But, at another level, it permitted the spontaneous, bottom-up, emergence of a global network of densely interconnected digital resources, which was easily and freely browsable, indexable and searchable.

Of course, the Web rapidly transcended these beginnings in academic practice. It is now a primary medium for public discourse, for trading of goods and services, for government and political activism, and for a myriad of other new forms of human communication and interaction.

¹ <http://www.w3.org/People/Berners-Lee/1996/ppf.html>

But it is worth emphasizing here that this dramatic innovation, which appears overtly *technological*, has been parasitic upon a much older *cultural* innovation, namely the tradition of “open” content and the “free” exchange of human ideas. The Web, as we now know it, simply could not have arisen in what Lawrence Lessig has called a “permission culture”²: a culture in which, before accessing any particular knowledge or idea, one would have to somehow negotiate, individually and repeatedly, specific terms - rights, permissions, charges - to enable that access.

What has this got to do with *learning*?

At a basic level, it is clear that learning - in the sense of academic, reflective, “higher order” learning - absolutely requires access to learning “resources”, such as books, journals, abstracts, commentaries, annotations etc. Indeed, a traditional mark of the quality or stature of a university institution was precisely the size and scope of its “learning object repository” - that is to say, its *library*. The web has radically altered this by making it possible, in principle at least, for students anywhere to access a shared global repository of learning resources - a repository which *could* far exceed the holdings of any traditional library. But the realization of this potential depends, in turn, on:

- the original *creation* of such content;
- its (open) *publication* on the web;
- and its *location* or *identification* by relevant learners.

I have already noted that the very origin of the Web was as a device for the sharing of original scholarly content. Even as the Web has exploded and diversified into popular or mainstream culture, this original usage has still been steadily, if more quietly, thriving. Many academics continue to use personal web sites to informally publish preprints (or, indeed, much larger bodies of work)³, but there has also been a sustained growth in more systematic and larger scale initiatives. This includes the now global network of scholarly “eprint archives” which are indexed and searchable through the Open Archives initiative⁴, and the emergence of peer-reviewed, but open access, online electronic journals, such as First Monday⁵, BioMed Central⁶ and others. Moreover, a large number of “classic” texts (where copyright has expired) have been republished on the Web (e.g. Project Gutenberg⁷); and it is progressively becoming normal practice for all “public sector” documents, reports and resources to be freely published through the web (e.g., all new, and much historical, Irish legislation is now available online⁸).

These resources are certainly of some educational value, but they are generally what would be traditionally described as “primary sources”—which are not regarded as most suitable or effective for the purposes of *learners*. Rather, at least for “established” domains of knowledge, one generally expects learners to engage first with “secondary” treatments, which have been specifically organized, designed and distilled to facilitate learning. It is useful here to distinguish at least two categories of such overtly “educational” resource:

- lecture notes/commentary/critique;
- textbooks (and/or its digital equivalent, known as “courseware”).

Roughly speaking, “lecture notes” and similar materials, are relatively informal resources, specifically tailored to suit some local need - one specific course or class - and usually authored

² <http://free-culture.org/>

³ <http://www.williamcalvin.com/>

⁴ <http://www.openarchives.org/>

⁵ <http://www.firstmonday.org/>

⁶ <http://www.biomedcentral.com/>

⁷ <http://www.gutenberg.org/>

⁸ <http://www.irishstatutebook.ie/>

by the individual academic/teacher responsible for that class. They might typically select, summarize, and critique a range of more comprehensive or generic resources - primary sources, textbooks, etc. The provision of such resources is a long standing academic practice; but the Web has also brought significant changes and new opportunities:

- From the early days of the Web, individual teachers have used personal web sites (and, latterly, “virtual learning environments”) as a convenient mechanism for disseminating these resources. This has rather modest (if any) pedagogical significance in itself; but to the extent that it streamlines or reduces the administrative burden on teachers, it correspondingly increases their ability to invest more effort in teaching.
- Much more significantly, the growing availability of pedagogically useful and relevant resources on the Web, means that “lecture notes” can increasingly be structured in the form of *hypertext commentary* or annotation. This can be particularly efficient to create, and allows for highly selective and targeted linkage to primary sources, with immediate and seamless access by learners. This was much more difficult, in not impossible, in traditional media. A local library was unlikely to stock the necessary range or quantity of holdings. This was commonly compensated for by the practice of aggregating selected extracts in “reading packs” for students; but the burden of evaluating and/or clearing copyright for such packs has become progressively much more onerous. Of course, the Web based alternative therefore *relies* on referencing Web content which is either public domain or explicitly licenced for open use (e.g., via Creative Commons⁹ or Free for Education¹⁰ licences); but, as already described, there is a growing body of at least *primary* resources, in many domains, which are indeed free to use in this way.

Of course, if lecture notes are structured as hypertext overlay on primary sources, they must themselves be authored and disseminated in a suitable online format; this is potentially a significant technological barrier, to which I will return in subsequent sections.

In any case, between primary sources on the one hand, and lecture notes on the other, fall the traditional educational resources of textbooks and courseware. These still exist, of course; but have not generally migrated into online, *open access*, forms. Traditional publishers are still experimenting with effective “business models” for online publishing. The Internet has raised difficult and complex issues here, which extend far beyond textbook publishing, raising fundamental questions about the nature of “intellectual property” in the digital age. Exploring these further is beyond my scope here, but I shall suggest avenues for further exploration in the conclusion.

wikiwiki, wikipedia

What is it?

“Wiki” (from the Hawawian “wikiwiki” meaning “quickly”) is a generic name for a family of Web based collaborative authoring systems. Wiki based web pages are usually immediately recognizable by the appearance of a button or link labelled “edit this page”. For many users, when they first encounter it, this seems disconcerting, if not unbelievable, as it is so different from the typical “read only” or “consumption” model of using the web. Nonetheless, it is a serious and meaningful invitation for readers to immediately and freely modify the content - deleting, revising, annotating or augmenting, as they see fit.

Of course, some controls are necessary. The details vary between implementations. While some wiki systems are completely public, even permitting page editing by unidentified or “anonymous” users, others require at least some form of user registration before editing, and others again may be limited to closed groups of pre-authorized users. Perhaps more importantly, wikis now

⁹ <http://creativecommons.org/>

¹⁰ <http://www.aesharenet.com.au/FfE/>

generally have facilities to record and track modifications and - if necessary - allow them to be easily reversed. If appropriate, specific modifications can also be associated with the particular person who carries them out; this can be useful *even* in systems allowing anonymous editing, where those users who *want* to be identified (or credited!) with a particular contribution can still do so. Mechanisms are also necessary for reconciling or resolving conflicting "concurrent" modifications of the same page by different users. A final, and critical, feature is that wikis incorporate "notification" or "alert" facilities, whereby users can elect to receive (by email or otherwise) automatic reports when certain kinds of change are made (e.g., when certain articles are modified, or when new articles are created in certain topic areas etc.). This allows users to very efficiently monitor, and respond to, each other's interventions - which is of the essence of effective collaboration.

At face value, it may seem like a wiki is simply a form of Web-based "Content Management System" (CMS). Yet, although there is much conceptual overlap, wikis are quite distinctive, both technologically and culturally (and the two are intertwined).

Technologically, wikis are much more lightweight compared to typical CMS systems. Firstly, they make absolutely minimal demands on the user or "client side" computer system. The user is not required to install any special software or plugin: a quite basic Web browser (which, virtually by definition, any prospective user already has available) is all that is required. Secondly, all users of a given wiki are *required* to rely on "plain text" editing, within simple browser forms; but where this "plain text" is enriched with a very simple and intuitive "mark up" to indicate common textual structures such as emphasis, headings, lists, and most importantly, hypertext links. This is in contrast to systems which either require all users to install (and master) some more or less complex new authoring tools; or permit users to rely on their own idiosyncratic tools, but then somehow have to reconcile the resulting zoo of incompatible and conflicting document formats. Finally - and implicit in the above - wikis are specifically tailored and optimized for authoring *Web-based* materials, where the primary usage mode is reading from screen; whereas CMS systems are still typically oriented to authoring "typeset" materials whose primary usage mode is reading from paper. The two are subtly, but significantly, different.

These technological characteristics of wikis then give rise to a distinctive culture of usage. The "barriers" to entry are extremely low. Almost any web browser will work. One needs to familiarize oneself with the wiki "mark up" (which may vary somewhat from one wiki to another), but because this is kept simple and intuitive, most users can begin editing wiki pages within 5-10 minutes of first being introduced to them. The consequence is that a user's focus and effort is quickly applied to the editing or authoring task, rather than to overcoming technological obstacles or learning complex new tools.

An example: the strange case of the *wikipedia* . . .

Perhaps the best known example of a public wiki is the wikipedia¹¹. This is, in effect, a collaboratively authored, Web-based, encyclopedia. By definition, it is dynamic, and continuously changing; but in the space of only four years since its inception, and relying entirely on voluntary effort in contributing (and, of course, revising) its content, it has already grown to have over 470,000 articles, covering a very wide variety of subject areas. In contrast to a conventional, centrally edited and directed, encyclopedia, the development of wikipedia is organic and driven by the diverse interests and skills of whoever happens to contribute to it. This means that both breadth and depth of coverage is highly variable; but that is not *necessarily* a disadvantage, as it allows a very flexible and adaptive development process.

For example, the original, English language, version of wikipedia has already diversified to support translations into a wide, and growing, variety of other languages. Uniquely, these include minority languages, such as Irish. It would be almost unthinkable that a "mainstream" encyclopedia would be translated into Irish, as it would imply an impractical commitment both to be complete and to be maintained up-to-date. By contrast, the wikipedia - because of its dynamic

¹¹ <http://www.wikipedia.org/>

and flexible (or chaotic?) development model, implies no automatic commitments either to completeness or currency; which therefore permits incremental and continuous improvement. No doubt, the Irish version of wikipedia will never be as complete or current as the English version; but for those users who need it, it will be much better than having no Irish language encyclopedia at all! Moreover, the Irish wikipedia will probably evolve to contain the primary or definitive versions of articles in certain specific topic areas. Of course, *mutatis mutandis*, similar comments could be made for other language versions of wikipedia.

A common reaction of many people, on first encountering wikipedia, is to respond that surely, if there is an editing "free for all", the *quality* of the articles must therefore be completely unreliable; whereas the very notion of a traditional "encyclopedia" is that it should be *authoritative*. This is a very interesting critique, and probably deserves an entire article in its own right.¹² In brief, however, there are both theoretical reasons, and sound empirical evidence, that the wikipedia model can and does yield very high quality materials - no matter how counter-intuitive this may seem. The theoretical basis is essentially the core academic premise of *peer review*; wiki technology, combined with potentially global communities of peers, allows the most extreme and immediate form of such review. The empirical evidence is an experiment in which a number of wikipedia articles were deliberately corrupted, introducing a variety of errors, ranging from gross to subtle¹³. In all cases these were corrected "... within a couple of hours", revealing an extraordinary capacity for self-repair - which no conventional, centrally controlled, encyclopedia can possibly deliver.

What has this got to do with *learning*?

The emergence of wiki technology has one obvious potential for use in education. Collaboratively authored, open access, projects such as wikipedia clearly give rise to materials that teachers may exploit. This can be at the immediate and simple level of including links to such materials in tailored, hypertext linked, course notes. Of course, in this simple respect, wiki materials are no different from any other public web resource. But wikis also introduce a quite new and distinctive additional possibility. Suppose a teacher locates a wiki-based page (say in the wikipedia) that is very relevant to a course, but yet is not quite exactly what is wanted. This is a very common scenario. A traditional response might be to provide a separate annotation, or clarification. But in the wikipedia the teacher can literally reach in and edit the original. Of course, this would still need to be done with an eye to the generic audience (otherwise the change will probably be quickly revoked!), but this is often still perfectly compatible with better meeting the needs of one's own particular class; and can be a good deal simpler and faster, both for a teacher to write and a learner to read. Further, that enhancement now represents an additional contribution to a globally shared resource, rather than only ever being available to one isolated class group. Even very small individual enhancements can, if aggregated on a global basis, give rise to large scale developments. Thus the contributions of individuals can mutually support and re-inforce each other in a "virtuous circle".

However, that said, even this is not the most important potential for wiki technology in learning. The much more profound opportunity is to invite *learners* to participate in collaboratively building resources through a wiki themselves. An essential part of reflective, constructivist, learning is that learners should be invited to reflect on their knowledge and make it explicit. This, of course, is the role of the traditional essay, worked problem, project report etc. However, the wiki allows this reflection and progressive articulation to be done *collaboratively* - moving us to a fully *social* constructivist mode of learning. In theory, of course, this can be achieved without the technological support of a wiki; students have long been required to (sometimes) work in groups, and (sometimes) review or critique each others' work. But the practical difficulties and barriers are significant, to the extent that this tends to be an exceptional rather than typical mode of learning. By contrast, wikis, with their very low technological barriers, yet very rich and flexible function-

¹² <http://www.techcentralstation.com/111504A.html>

¹³ <http://alex.halavais.net/news/index.php?p=794>

ality, offer the opportunity to embed collaborative, constructive, learning much more extensively in our educational environments.

bloggers and blogging

What is it?

Though “blogging” has become one of the most visible (and hyped) phenomena of the online world in recent years, there is no single definition of what constitutes a “blog” (or “web-log”). In general, the term refers to something like an online journal or diary, but with a number of distinctive new characteristics arising from the Web medium:

- A blog is most usually published by a single person, with, perhaps, occasional “guest” bloggers;
- It consists of a series of individual “postings” issued frequently, and fairly regularly. To properly deserve the name blog, the frequency should probably be no less than one post every two or three days - and might be as high as nine or ten in a single day.
- Postings rely heavily on hypertext linkage; these can be links to arbitrary Web resources, but links to other blog postings are especially common.
- Arising from the heavy use of linkage, individual postings are typically brief - perhaps one to three paragraphs of text (but sometimes as short as a single - hyperlinked - phrase!).
- Blogs may be simply browsed on the web, in the manner of normal web pages. However, because they are relatively dynamic, this imposes a burden on a reader to regularly check for new postings. To overcome this, blogs usually also offer a “syndication” service. This means a reader can use a tool called an “aggregator” to “subscribe” to one or more blogs - and will then automatically receive new postings to those blogs as they are generated.
- Blogs usually provide for readers to post reactions or commentary, attached to an original blog post and archived along with it.
- The technology for blog publishing - as with wikis - presents very low barriers to entry. Again, a user normally needs no tools beyond a basic browser, and can quickly master the requisite simple, plain text, authoring format. (Indeed, in some cases, one can use very similar or identical authoring formats for both blog and wiki publishing.)
- Consequently ... blog content is highly variable, idiosyncratic, and personal to the particular blogger. Bloggers are somewhat reminiscent of the traditional newspaper or magazine columnist - yet also very different. *Anybody* can start a blog, open to the world. Given the wide availability of free and low-cost blog servers, a novice blogger can begin publishing to a global audience in as little as 10-15 minutes!

What has this got to do with *learning* ?

Public blogging has an obvious and immediate application in any education for “public writing” - journalism, communications, etc. It provides an immediate opportunity for such students to engage in *authentic* publishing from the earliest stages of their studies. Of course, there is no guarantee that they will garner an authentic readership; but the very act of exposing their writing to an unconstrained, public, audience will certainly feel much more meaningful (and challenging) than merely writing for their teacher or classmates, as would more traditionally have been the case. And, of course, because of the vast scale, and dense interconnection, of the so-called “blogosphere”, they *may* attract at least some interested readers, from whom they will surely learn valuable lessons.

These are opportunities that simply did not exist before the infrastructure of the Internet and the Web, and more recent arrival of the low barrier publishing tools of modern blogging servers.

But there are much more general opportunities for the use of blog-like technologies, outside of these specific domains. In particular, while blogs *can* be completely public, they *need* not be, and this opens up a variety of other possibilities.

Thus, blogs might be shared among a single class group, or even small groups within a class. In the same manner as a wiki, this then allows very dynamic and flexible social interaction in constructing and responding to each others' postings. Yet, in contrast to the wiki mechanism, in blogging, the individual postings clearly remain the property of their *individual* authors, and are - deliberately - frozen once posted, rather than continuously re-edited. At its simplest level, blogging is therefore immediately useful for students of any discipline to develop their personal writing skills - in a social, yet still private, space. But it also opens up potential for much deeper peer-to-peer, and teacher-mediated, critique and discourse. Of course, other Internet technologies, such as shared mailing lists and Web discussion forums, might also be employed in this way; but the particular architecture of personal ownership in blogging provides a distinctively structured and nuanced discussion framework.

Taking this to its extreme form, essentially the same technology can support classic "learning diaries" - where individual students are invited to regularly reflect upon and document their own learning experiences - but these are private to each individual student and the teacher. Of course, the idea of a learning diary is not new in itself; but the technology of the blog can make it much more practical to implement. With minimal administrative or bureaucratic overhead, both learner and teacher can then efficiently concentrate on substantive learning issues.

moodling through

What is it?

From moodle.org:

Moodle is a software package for producing internet-based courses and web sites. It's an ongoing development project designed to support a social constructionist framework of education. Moodle is provided freely as Open Source¹⁴ software (under the GNU Public License¹⁵).

On one level, moodle is simply an example of (yet another) "Virtual Learning Environment" (VLE), in the same genre as the more widely known Blackboard¹⁶ and WebCT¹⁷ systems. That is, it comprises a web based platform supporting a more or less integrated suite of tools to support "online learning". At its most basic level, it offers easy "transmission" of electronic resources to (only) the authorised and authenticated members of each class group. It also implements a variety of other typical VLE functionalities such as class-based threaded discussion forums, online assignment submission and simple online "quizzes". Of course, seen in this way, it is hardly particularly distinctive.

But the quotation above signals two much more radical aspects of the moodle project:

- It is explicitly inspired by, and committed to, a particular pedagogical framework, namely *social constructivism*.
- It is distributed under an "open source" software licence.

First then, although moodle does support a naive "transmission" oriented pedagogy, it is *primarily* designed to facilitate and encourage social interaction and collaborative construction of

¹⁴ http://www.opensource.org/docs/definition_plain.html

¹⁵ <http://www.gnu.org/copyleft/gpl.html>

¹⁶ <http://www.blackboard.com/>

¹⁷ <http://www.webct.com/>

knowledge. To this end, it already incorporates a number of the distinct facilities already described in previous sections, and provides additional variations or enhancements:

- Option of “open content”. A typical VLE is specifically designed to prevent uncontrolled access to the resources provided within. Moodle *can* operate in that mode; but it can equally operate in a mode where such resources are browsable, indexable and searchable without special permission or authentication. This is very flexible, can be set at the discretion of individual teachers, and, in any case, still protects the privacy of individual participant interactions and communications. Alternatively, teachers can export fully designed and packaged course materials through moodle.org; this is a feasible and practical way of sharing course content precisely because the required supporting software - moodle itself - is available without any licencing cost barrier.
- wiki activity. A wiki activity is integrated within moodle, making it easy to create wikis for individual courses, class groups, or even smaller groups or projects within a class or course.
- blog activity. Moodle forums can be configured in the generic threaded discussion format; but can also be flexibly configured to function as individual learning journals (private to a teacher and student) or as blogs (private to a class group, or public to the world).
- Survey instruments, such as COLLES¹⁸, specifically designed to facilitate and promote social constructivist learning, have been built in to moodle. Use of such instruments serves both to inform and sensitize students to their learning styles and approaches and to inform teachers as to the effectiveness of the particular learning activities they are facilitating.

The second distinctive feature of moodle is its “open source” licencing. I have already mentioned an immediate implication of this - the manner in which this open availability of the software platform facilitates open availability of content or resources to use with this platform. But the open source licence has a deeper significance: it means that - in principle at least - individual teachers, and even learners, can directly participate in and contribute to the ongoing development of this learning platform. It is early days, and it remains to be seen what the full implications of this may be. However, one immediate effect is that - as in the case of the wikipedia - this open content model has facilitated very early adaption and localization of the system for different language users (including minority languages, such as Irish). It is very difficult to see how this rapid adaptation could be practically achieved using any closed licencing approach.

Conclusion: Where to next?

The focus of this chapter has been on presenting a number of recent technological and cultural innovations, and attempting to relate these to challenges of improving learning in higher education. Clearly, all of these technologies overlap and interact, but I have suggested that, together, they offer a powerful set of tools for social reflection, collaboration, and construction of knowledge.

The discussion here has necessarily been brief. Hopefully, you have already noted the embedded opportunities for wider exploration (hyperlinked, of course, in the online version!). I close with some final, overarching, pointers to more comprehensive resources:

- Dougiamas (1998) concisely reviews the overall history and development of constructivism, and includes an excellent bibliography. This can also be read as the intellectual foundation for the design of moodle.
- The issues of intellectual property and copyright in the digital world are excellently analysed by Lessig (2004), including a concrete suggestion of one possible, radically new, digital publishing paradigm. Appropriately, the book itself is used as an exemplar: it has been made

¹⁸ <http://surveylearning.com/colles/>

available as a traditional, commercially published, “rights reserved”, hardcopy book, but also as an open access, online work, with a licence specifically permitting independent production of derivative works (provided these carry attribution, are “non-commercial”, and are released on the same terms). Among the interesting effects of this has been the rapid, spontaneous, appearance of alternative online versions, of independent translations into different languages, and of transpositions into other media (audio books).

- Downes (2004) provides a comprehensive, and constructively critical, review of the history, nature, and future prospects for the use of blogging in education. Alternatively, Ferdig and Trammell (2004) is a gentle introductory discussion, including some specific strategies for using blogs in the classroom.
- moodle.org is, of course, the primary source for information on moodle. It is also host to an extremely active and diverse community of moodle users from around the world.

References

- Berners-Lee, T. (1996). The World Wide Web: Past, Present and Future. <http://www.w3.org/People/Berners-Lee/1996/ppf.html>
- Carlile, O. and A. Jordan (2005). It Works in Practice But Will it Work in Theory? In S. Moore, G. O’Neill, and B. McMullin (Eds.), *Emerging Issues in the Practice of University Learning and Teaching*. Dublin: AISHE.
- Dougiamas, M. (1998). A Journey into Constructivism. <http://dougiamas.com/writing/constructivism.html>
- Downes, S. (2004, September/October). Educational Blogging. *EDUCAUSE Review* 39(5), 14–26. <http://www.educause.edu/pub/er/erm04/erm0450.asp>
- Ferdig, R. E. and K. D. Trammell (2004). Content Delivery in the ‘Blogosphere’. *T.H.E. Journal (Technological Horizons in Education)*. <http://www.thejournal.com/magazine/vault/A4677A.cfm>
- Higgs, B. and M. McCarthy (2005). Active Learning — from Lecture Theatre to Field-work. In S. Moore, G. O’Neill, and B. McMullin (Eds.), *Emerging Issues in the Practice of University Learning and Teaching*. Dublin: AISHE.
- Lessig, L. (2004). *Free Culture: How Big Media Uses Technology and the Law to Lock Down Culture and Control Creativity*. New York: The Penguin Press.
- Ramsden, P. (1992). *Learning to Teach in Higher Education*. London: Routledge.