E–Learning and Digital Media
Volume 10, Number 4, 2013
www.wwwords.co.uk/ELEA

e– Learning and Digital Media

Towards a New Learning: the *Scholar* social knowledge workspace, in theory and practice

BILL COPE & MARY KALANTZIS
University of Illinois, Urbana-Champaign, USA

ABSTRACT This article describes the thinking behind the development of *Scholar*, a 'social knowledge' technology developed as part of a series of research and development projects at the University of Illinois. Seven pedagogical openings are identified in this article, possibilities for the creation of innovative learning environments afforded by a new generation of educational technologies: ubiquitous learning, active knowledge production, multimodal knowledge representations, recursive feedback, collaborative intelligence, metacognitive reflection and differentiated learning. The article explores these ideas in general terms, and also describes the ways in which the *Scholar* environment attempts to translate these ideas into practice.

For the past several years, we have mainly been working in two spaces. One has been primarily theoretical, as we revised our *New Learning: elements of a science of education* (Kalantzis & Cope, 2012b). The other has been practical, to design and trial *Scholar* (http://CGScholar.com), a web working space for learners, grounded in we want to call a 'social knowledge' technology. The initial results of the *Scholar* work are described in the articles of this special issue of *E-Learning and Digital Media*. This article attempts to tie the theoretical ideas together with the practical agenda established in *Scholar*. It builds upon our earlier work on pedagogy, diversity and literacy (Kalantzis & Cope, 1999; Cope & Kalantzis, 2009a; Kalantzis & Cope, 2010).

The narrative of *New Learning* (Kalantzis & Cope, 2012b) goes something like this. Earlier in the modern period, mass-institutionalized education was established. For the first time in human history, schools were created which served as a publicly enforced site of socialization and knowledge transmission. The main epistemic artifacts of modern schools were teacher talk and factually or deductively definitive textbook content. Student response was framed in terms of right and wrong answers, either to questions the teacher asked in class, or doing assignments, or responding to questions in tests. Several centuries later, much schooling is still a variant of this didactic paradigm. From the beginning of the modern period, but rising as a distinct alternative voice in the twentieth century, the progressive movement created what we characterize as a more 'authentic' pedagogy, truer to students' needs and interests, 'constructivist' insofar as it attempted to harness student volition, more experiential and connected to the real world, and more democratic in temper than authoritarian. By the beginning of the twenty-first century, authentic pedagogy also seemed to have become stale. This was not only because it had managed to make only small inroads into didactic pedagogy, now re-institutionalized with its standardized systems of testing and accountability. It was called out because, even when comprehensively applied, it did not seem to have an impact on the distressingly unequal impact when patterns of educational outcome are analysed according to variables such as social class and race/ethnicity. It also seemed to be manifestly inadequate to serve what was touted as an emerging 'knowledge society' (Peters & Beasley, 2006).

So, what is to be done? What do we, as educators and researchers, do that will contribute meaningfully to the shape of possible future worlds of learning? The times seem to be on our side,

 http://dx.doi.org/10.2304/elea.2013.10.4.332

not only in the form of emerging positive openings, but also in greater awareness of the conditions of educational and social inequality that demand our attention. Technology is one such opening, one of the revolutionary changes of our times. In particular, information and communications technologies have transformed human representational and communicative capacities – whether this be for better in the democratization of processes of knowledge creation and distribution, or for worse in the case of the 'digital divide'. So too diversity and globalization have transformed our social and communicational environments – forces that require different responses in our time than the 'one-size-fits-all', mass socialization approaches of older educational regimes. So too the idea that we live in a knowledge society, whose basis is a knowledge economy, in which know-how, skills, inventiveness, intellectual risk-taking, culture-work and human service-work are more valuable and more central to economic progress than ever before. This means that an education system that routinely in the industrial era sent a large tail of failed students into unskilled work is fast becoming anachronistic.

If this is, in the roughest outline, our general social context, what do we do in the classroom? Following on from our theoretical work, the *Scholar* intervention is an attempt to reframe the relations of knowledge and learning, recalibrating traditional modes of pedagogy in order to create learning ecologies which are more appropriately attuned to our times. Technology provides one opening for us, and in particular the new, social media, underpinned by 'cloud computing' (Reese, 2009) and 'semantic publishing' (Cope et al, 2011a) processes.

These technologies offer a number of pedagogical openings, or affordances. In this article, we are going to explore seven: ubiquitous learning, active knowledge production, multimodal knowledge representations, recursive feedback, collaborative intelligence, metacognitive reflection and differentiated learning.

None of these aspirations is new. However, the new media facilitate an economy of effort that makes these ideals more pragmatically realizable than in the past (Cope & Kalantzis, 2009b). Not that the technology itself is intrinsically a catalyst for educational change. In fact, the very same technologies that offer these practical openings for educational transformation, can also be used to breathe new life into the most didactic of pedagogies, even intensifying and prolonging the legacy of teaching methods such as transmission of content, stimulus-response learning behavior modification, and rigid standardized testing. For this reason, we want to explore some of the ways in which technologies can transform education, not just reproduce old practices.

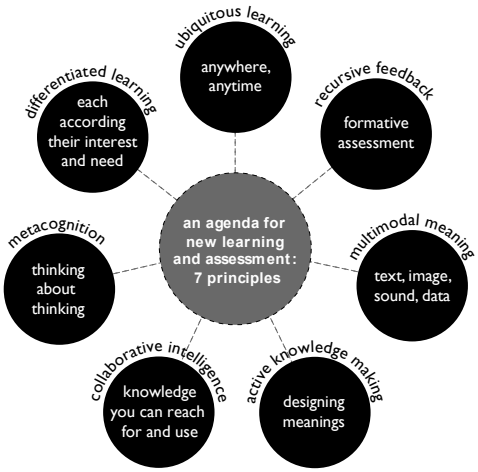


Figure 1. Seven openings, seven affordances.

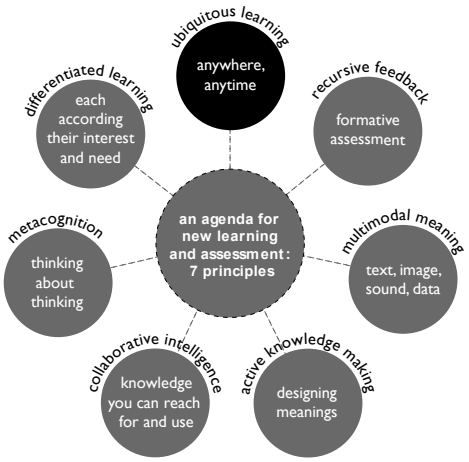
Scholar evolved from a research and development project, the Assess-as-You-Go-Writing Assistant.[1] Other projects have followed as the work has grown. However, our key research questions have remained constant, each bridging the traditional divide of instruction and assessment.

1. *From individual intelligence to collaborative intelligence.* What are the conditions of learning that best acknowledge the distributed character of knowledge as 'stuff you can reach for', and 'stuff

created through a process of collaboration'? How do we assess collective intelligence? (By way of contrast with the individualized memory work of didactic pedagogy and assessment.)

2. *From external motivation to intrinsic motivations.* How does one nurture intrinsic motivations – intrinsic to the task and the sense of necessary and socially rewarding engagement generated in a dynamic community of knowledge collaborators? (By way of contrast with the extrinsic motivations of grades and beating competitor-students on an assessment distribution spread across a bell curve.)
3. *From homogenizing teaching to differentiated learning.* How does one create a 'productive diversity' in learning, whereby learner differences are honored, alternative paths to learning offered, and comparability of outcomes insured? (As opposed to one-size-fits-all curricula and standardized assessments, with undifferentiated interventions and measures that produce subtle and not-so-subtle patterns of exclusion.)

Opening 1: Ubiquitous Learning



'Ubiquitous learning' means learning any time, any place (Cope & Kalantzis, 2009b). It is a riff on the idea of 'ubiquitous computing' (Twidale, 2009). Once science fiction, with the rise of laptop computers, tablets and smartphones, ubiquitous computing is an idea that has arrived in a very ordinary and pervasive way – in every store, every workplace, and almost every home, handbag or pocket. But hardly in schools. And when it has arrived there, it is mostly in ways that often does little justice to the dynamic knowledge potentials of the medium. To capture what is distinctive about these potentials, we want to label this key aspect of new information and communications technologies – the first of our seven openings – 'ubiquitous learning'. One of the key practical entry points is web browser-based software – the availability of browsers on many kinds of device, without the need to install software locally or adapt software to different devices and operating systems.

Older versions of the same kind of idea of included homework, self-paced textbooks and 'distance education'. Internet-mediated computing, and particularly the more recent 'Web 2.0' (O'Reilly, 2005), 'cloud computing' (Reese, 2009), and 'semantic publishing' (Cope et al, 2011a) technologies create possibilities for something that is more thoroughly transformative. In fact, they offer all the benefits of traditional classrooms, and some more. In addition to computer-mediated and internet-delivered content presentation by teachers and curriculum designers, these technologies can support intensive teacher-student and student-student interaction, and machine-calculated assessment results. This is what the most effective of traditional classrooms and educational systems did, even if they were more expensive for their reliance on 'manual', human assessment labor. However, the significantly new things which can be offered by ubiquitous learning environments range from student discovery of multimodal content originating from a variety of authentic sources, to intensive simultaneous interactions in which everyone in the

learning community can be actively engaged, and the far-more-responsive feedback and assessment systems that we will begin to sketch later in this article.

Perhaps most significant, however, is that the traditional educational distinctions of time and space no longer matter. Before, the central point of all learning was necessarily confined to the four walls of the classroom, and the times delimited by the cells of the timetable. Ubiquitous learning means you can do all the stuff of traditional classrooms, and more, and anywhere, and anytime.

Not that we won't still have classrooms in a new era of ubiquitous learning. It's just that learners using ubiquitous computing technology will be able to perform the same acts of knowledge making and knowledge interaction – and new ones as well – outside of the classroom as they can inside the classroom. Does this spell the end of the classroom? Not necessarily, because a classroom is as good a place as anywhere to work in these technology-mediated ways. Also, society has devolved to schools the responsibility of keeping children in a relationship of duty-of-care during specific times. Paradoxically, however, the distinction between classroom learning and online learning becomes nearly irrelevant, when all learning, in the classroom or not, is mediated by ubiquitous learning technologies, and in the same kinds of ways.

Public discussions today are full of optimisms and anxieties about the shape and ramifications of disruptive information and communications technologies and participatory media. However, as educators we tend to follow, apply and adapt technologies that have been created for other purposes – word processors and spreadsheets for the office, wikis for the production and distribution of empirical knowledge, blogs for the presentation of argument. We have also attempted to retrofit didactic pedagogy into 'learning management systems' and automated assessments.

In the *Scholar* project, we have set ourselves the task of rethinking learning technology from the ground up. We have had to write code from scratch. This is what it has taken in order to do justice to the openings we describe in this article. We call the result a 'social knowledge' technology – not social media, which implies the transmission of information – but social knowledge, in the sense of creating a place for systematic engagement that produces new artifacts of knowledge and culture. Every artifact is new to a learner or group of learners, and often new to the world, things that have never been said or thought in quite this way ever before, however subtle or substantial the intellectual or cultural innovation.

With these ambitions, we drew together a multidisciplinary team of educational researchers, software engineers, computer scientists, computational linguists and psychometricians. Even if our ambitions have thus far only been realized in modest ways, they started high and have remained high.

Here is an apocryphal story from our own university. PLATO was the world's first computer-mediated learning system, created at the University of Illinois in the 1960s. Incidental to its development, the plasma screen was invented. The reason was that, for the first time, a computer required a visual user interface. Also incidental to its development, a messaging system was invented. For the first time, a computer was required to transmit human-linguistic meanings. In both cases, educational requirements led fundamental technological developments. So, why must we educators follow the lead of business and media innovations? Educators can lead technology development, particularly in the creation of social knowledge technologies when available technologies created for other purposes do not support knowledge and educational processes that might require fundamental technological innovation.

In this spirit and buoyed by this inspiration, we set to work developing *Scholar*. We encountered practical barriers. One was simply the matter of using social media technologies in classrooms. Stringent duty-of-care and privacy concerns mean that publicly accessible, mainstream social media cannot be used in classrooms. Nor can educators require purely self-managed authentication that is dependent upon having an email address. On the other hand, there are adults in these spaces – including teachers and adult learners – who need to be able to communicate more widely. So we created from scratch a two-tiered authentication system of regular and sponsored accounts. Sponsored accounts can only operate within strictly delimiting walls of 'organizations' defined as securely enclosed social media. Other account holders can conduct their knowledge interactions more broadly, selecting a broader range of privacy options.

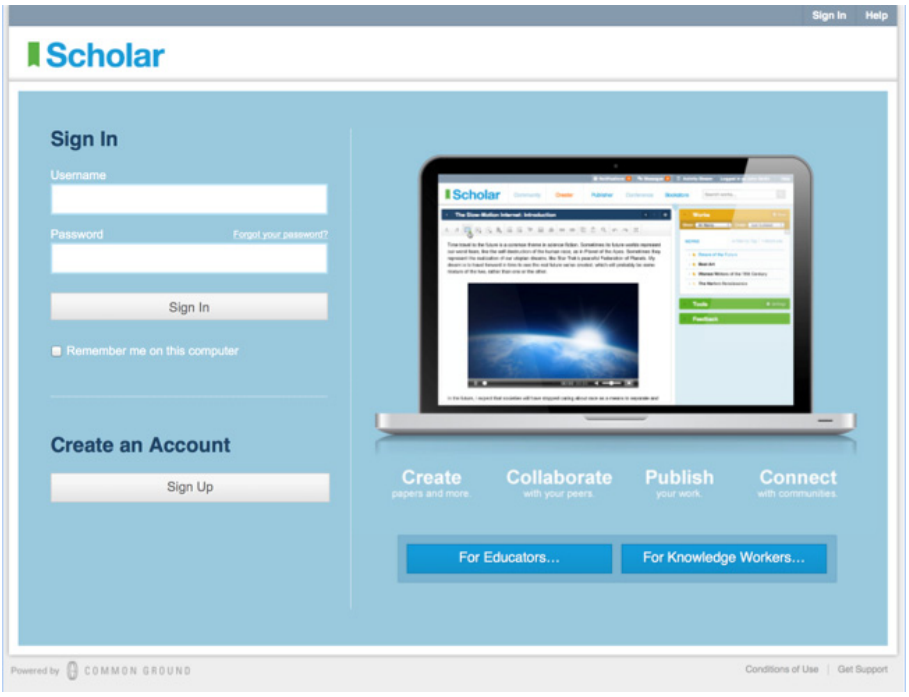


Figure 2. *Scholar* sign in: self-authentication for regular accounts, usernames and passwords generated by sponsors for sponsored accounts.

A second major barrier we encountered is that the social media technologies from which we initially took our lead were not nuanced in a way that meshed well with the tone we wanted for knowledge collaborations and learning. Neither 'friend' nor 'follower' is the right social glue to hold together a knowledge environment – so we replaced this with the notion of 'peers', working together in a knowledge 'community'. Nor did we think that the small spaces for conversing with 'friends', or the 140 characters for broadcasting short pronouncements to 'followers', were really suitable frames for dialogue in a knowledge-producing community. So, in the Community space of *Scholar*, we created an activity stream like other social media, but where the space provided for updates suggested sustained intervention, followed by extended dialogue. We created a space that is dialogical like a social media wall, but discursive like a blog.

We also designed the Community space to be somewhat like a professional profile website, including a bionote and résumé page, and a portfolio of the scholars' publications – works that they have developed in the Creator space within *Scholar*, that have been peer reviewed and then published by the 'publishing admin' of their knowledge community (normally but not necessarily the teacher).

A number of deceptively large discursive shifts are happening here. For a start, the oral discourse of the classroom is being supplemented and at times replaced by the more formally framed written discourse of blog-like interaction. If oral discourse is closer to the informal relations of the lifeworld, this move to written dialogue is an incremental step towards more the more formal, more public language that underpins academic discourse (Kalantzis & Cope, 2012a, chapter 12).

Then, responses are simultaneous, where equivalences are required – not just the same kids who always answer the question first. Or the other kids who are singled out to answer a question because they rarely do, and when they are, they're not ready. Everyone updates, everyone comments, everyone sees everyone's comments, all together. This is an environment of simultaneous, public contribution. It is a space which makes all contributions transparent, and valorizes them through interactivity. But also, for better or for worse, at the same time it operationalizes the obverse of transparency – surveillance. The teacher can see everything that is

going on. This is not such a bad thing, because they need to be able to know if and when they choose to look.

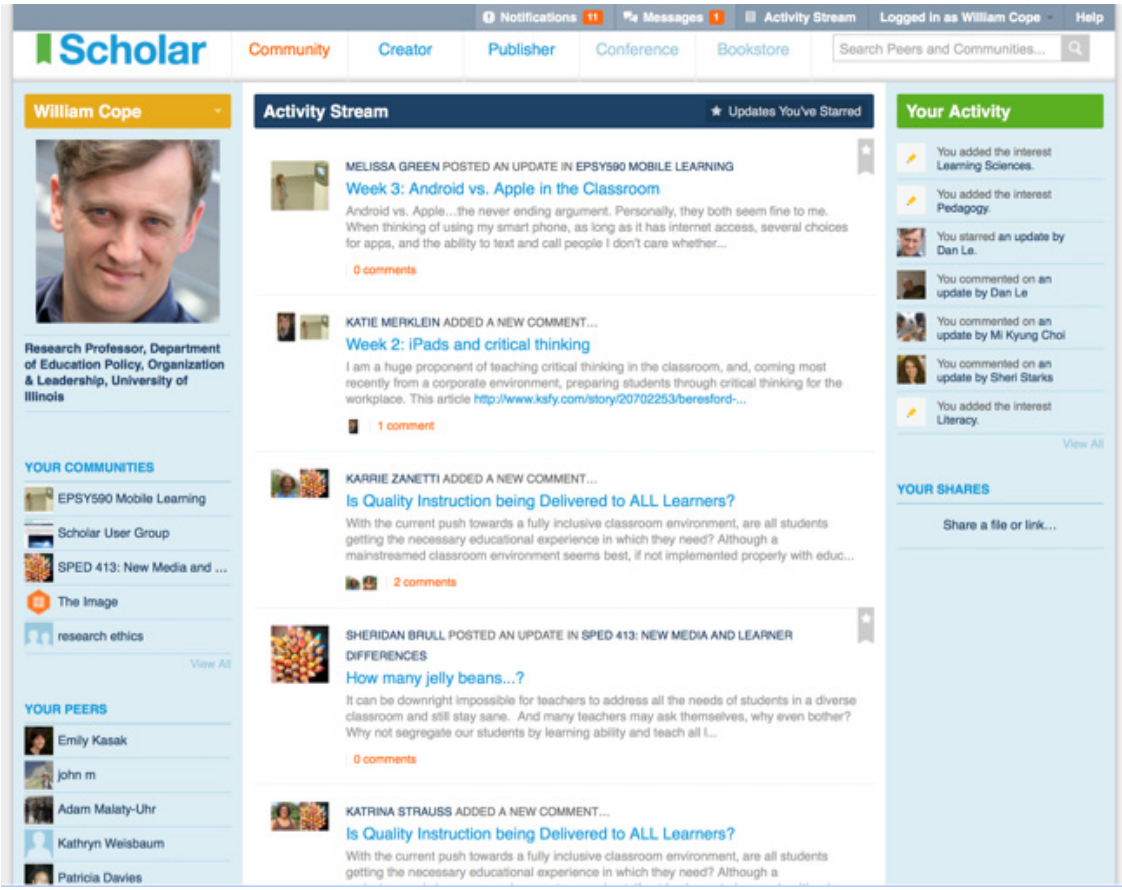


Figure 3. The activity stream.

The reactions of teachers to this transformation, moving away from oral classroom interaction and handwritten student responses to a social media infrastructure, are as insightful as they are sometimes funny. 'No excuses any more about leaving your worksheets or books at home,' one of our trial teachers tells their class. 'Middle school students,' says another, 'are always losing their stuff so I always have a writing folder, but even then they spill stuff on it and, you know, they left it at home and now they can't do their draft today'. Now she and they all have 'access to the copy at home and in the classroom and they [can't] lose it' (Olmanson & Abrams, this issue). Another teacher says his Grade 8 class jokes with him that he is doing 'academic stalking', because through *Scholar* he is able to log into their work and see where they are up to at any time, wherever he is. He likes the joke, and they do too.

Abrams invokes Foucault to account for the processes of surveillance in new media regimes generally, as well as *Scholar* in particular (Abrams, this issue). Equally, however, these environments offer new avenues for sociability – in this case, a transparent, participatory culture, a milieu of meaningful dialogue, collaborative knowledge creation, and at-hand help.

The key theoretical question raised for us is, to what extent might the historically hierarchical knowledge relationship between teachers and students be supplemented by dialogic peer-to-peer knowledge relations? Moving out to a wider social context, there is the follow-on question of how this aligns with larger social changes where authoritarian hierarchies are becoming anachronistic – ranging from the social sources of new media, to workplaces run by teamwork and collaborative culture, to families with the decline in traditional gender-based authority, to the welcomed demise of unsavory authoritarian political regimes. So, the 'surveillance' of new media regimes, as Abrams (this issue) concludes, may be more benign than Foucault's reading of an earlier modernity. It may

also support modes of sociability based on productive lateral relationships of participation and collaboration, rather than hierarchical relations of command and consent.

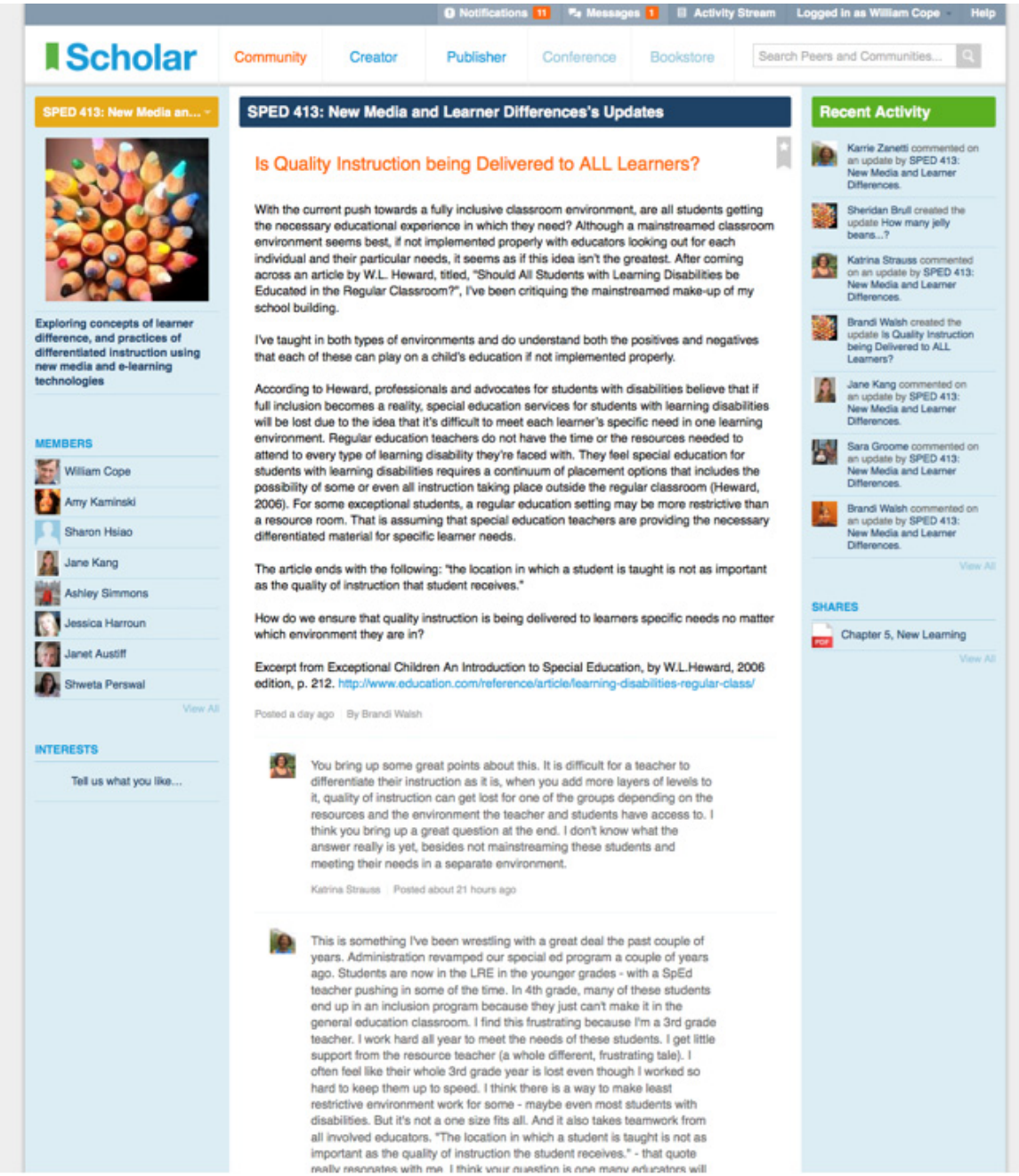
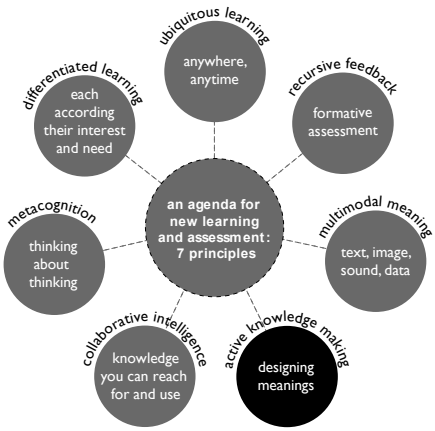


Figure 4. An update, with comments.

Opening 2: Active Knowledge Production



The traditional classroom is, in essence, an epistemic architecture grounded in a communications technology. The communications technology is defined by the walls of the classroom, containing thirty or so children and where one teacher or one student can speak at a time. Here, teachers and textbooks present pithy concentrations of the world in the form of history, grammar, mathematics, or whatever. These are essentially monologues, bodies of knowledge spoken in a singular, synoptic voice, whether the voice be that of the teacher or textbook author. Students read silently, write quietly, and avert their eyes from lateral 'copying' glances as they fill out their worksheets or respond to tests. These are almost solitary process, even when other learners are so close at hand. The aim is that that facts are to be committed to memory and theorems learned from which unequivocal answers can readily be deduced. Memorized facts and the generation of correct answers by the application of theorems can be measured in tests that eleicit right and wrong answers, at the end of a lesson, or week, or a chapter, or a course.

In this knowledge architecture, students are primarily configured as passive knowledge consumers rather than active knowledge producers. The knowledge that is transmitted to them takes the form of a univocal narrative. The moral economy of singular content transmission demands unquestioning compliance in the face of epistemic authority, lack of critical autonomy, and an absence of responsibility. This may have been appropriate, perhaps, for an earlier era of industrial discipline and mass conformity. But the sensibilities, habits of mind, knowledge and skills of this heavily didactic pedagogy are not well aligned to the spirit and practical needs our times. Going forward into the future, workers, citizens and learners will not be well served by these kinds of knowledge architectures.

Rather, we need to create environments of participatory learning, where learners are knowledge producers at least as much as they are knowledge consumers. Now, they will examine multiple sources (discovering texts with different perspectives, conducting their own observations, indeed acting as researchers themselves). They will collaborate with peers in knowledge production, as co-authors, as peer reviewers, and as readers and discussants of finished works shared with other learners. They will create always-original knowledge syntheses based on unique life experiences and perspectives. Now we'll be supplementing the predominantly hierarchical knowledge flows of our recent past (expert to novice, authority to authorized, teacher to student) with relations of lateral knowledge co-creation. This fits nicely with wider contemporary shifts in the 'balance of agency' (Kalantzis & Cope, 2012b), where consumers are becoming 'prosumers' with their customizable products and interfaces, where reading (insofar as it is a kind of consumption) is intermingled with writing (insofar as it is a kind of production) in the 'new media', where amateurs are barely distinguishable from professionals in web knowledge spaces like Wikipedia, and where the pleasure of the narrative in gaming is not simply vicarious as it is in television or cinema, because you are a character with shared responsibility for the story's ending.

Scholar attempts to capture the spirit of this huge change in the social relations of knowledge and culture. To get away from the heritage connotations associated with 'teachers' and 'students',

in *Scholar* we use the terminology of the social relations of knowledge production. We have 'creators', who take credit for the works that are created. We have 'contributors', who review and annotate works. We have 'publishers', who co-ordinate groups in the collaborative knowledge production workflow. And we have a 'community' where works are published and discussed. Publishers and knowledge community admins may be teachers, but not necessarily so. Our focus is on the logistics of knowledge production, not heritage teaching learning or relations. Designed for Grade 4 and above, we have made a decision not to infantilize children with jolly cartoon characters or primary colors. We wanted to emote *Scholar* with an aura of intellectual seriousness – not fun, not game-like. With a minimalist design, the feel of the space will be what learners do there – their own imagery and texts, not our projections of an appropriate look-and-feel for a childish culture.

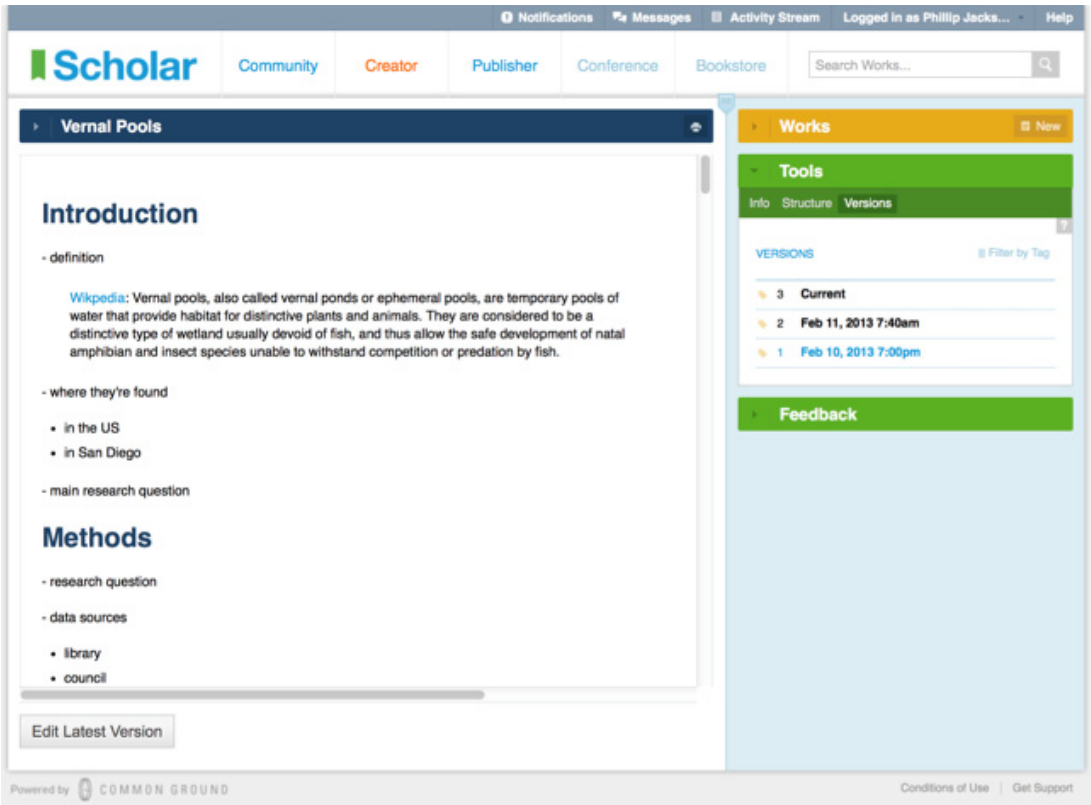


Figure 5. A learner's notes, planning a life cycle study, taking notes from various sources, for instance here a block quote cut and pasted from Wikipedia, with a link to the source page.

Several distinctive models of knowledge work and learning are happening in the exemplars provided in Figures 5 and 6. First, there are no vernal ponds exactly like the ones in San Diego that this student is documenting. This is knowledge that has been created in this form for the first time. This reflects the potential for a profound transition from schooling as a regime of knowledge reproduction (trying always to get the putative 'right' answers based on the memorization of presented content), to one of knowledge transformation (where new knowledge is being created by resynthesizing material from different sources, in this case a science schema about life cycles applied to the specifics of some local ponds). Instead of knowledge reproduction, students are knowledge designers. Not that they reinvent knowledge *de novo*. They access available designs of meaning; they do work of designing; and they leave the world and themselves redesigned as they share an artifact that is the trace of their designing work (Kalantzis & Cope, 2012a, chapter 7).

Second, we are harnessing the varied agencies of students by positioning them as responsible knowledge producers. This makes for engagement. It recruits their identities as every work brings the timbre of each student's voice and the weight of their life experience to their representation of knowledge. It prompts critical thinking and creativity. It positions them as 'makers'.

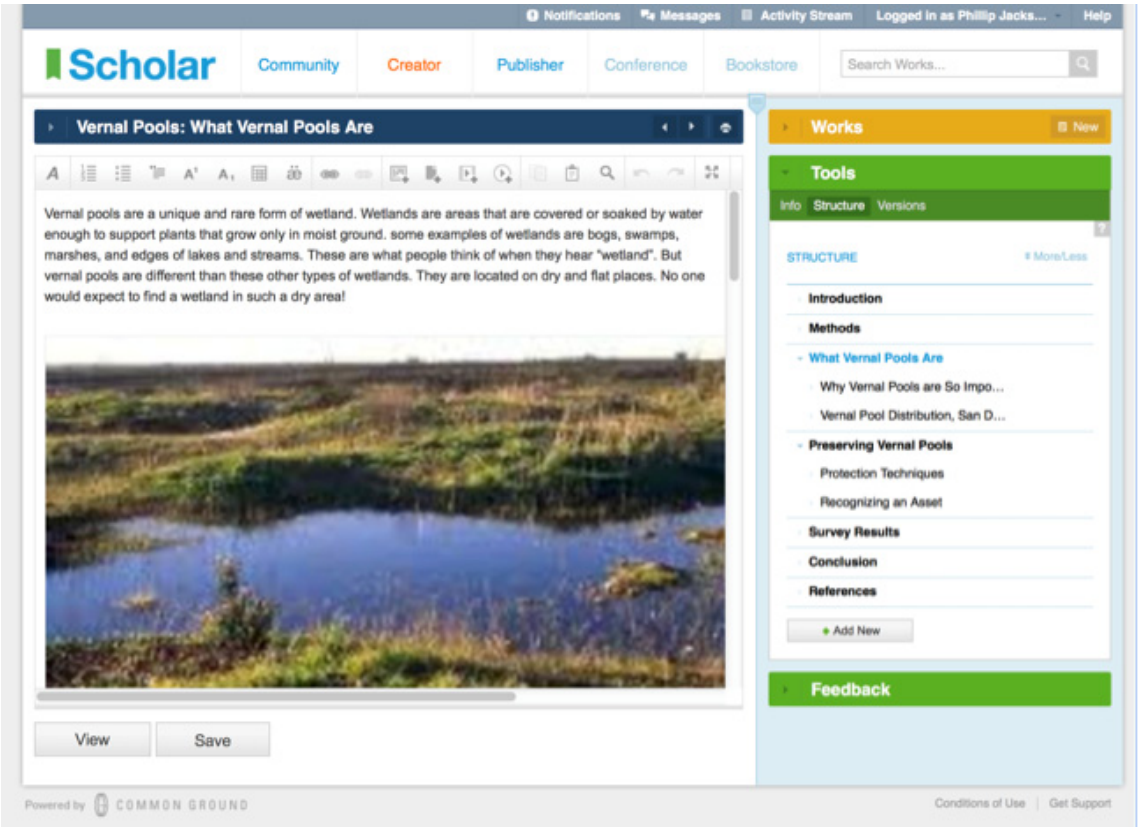


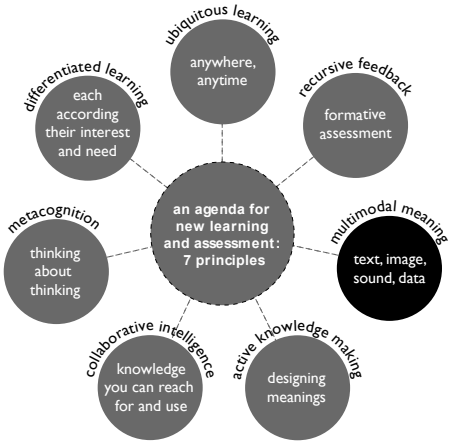
Figure 6. Turning the notes into a work. (Common Core State Standards Initiative, 2010, Appendix C, pp. 42-45).

Third, when we come to assess educational outcomes, our focus is not on cognition (memorization and deduction), but on knowledge representations (artifacts). This is not to imply that we have abandoned cognition. It's just that we are looking for capacity to document and reason as evidenced in the artifact, rather than memory. In any event, memory has becomes less relevant in a world where so much knowledge is within reach within seconds. Learning nowadays is about navigation, discernment, induction and synthesis, more than memory and deduction.

In this special issue, Carlin-Menter shows students at work, searching, discovering, interpreting, sourcing and synthesizing multiple sources of knowledge. They have lots of tabs open in their web browsers. They are taking notes. They are cutting and pasting text and media. They are keeping citations. They are bringing their works together into complex and original syntheses. High-order cognitive stuff is going on, for sure, and of a much higher order than remembering things or getting calculations right. Drawing on Kellog (1994, 2008) and Kellog and Whiteford (2009), she asserts:

> Writing makes demands of a writer's cognitive systems for memory and thinking, as processes like planning, what text to include, and how to structure the text need to be kept in working memory ... The interchange of the cognitive processes of planning, translating, and reviewing puts a heavy load on a writer's attention and capacity. (Carlin-Menter, this issue)

Opening 3: Multimodal Knowledge Representations



In an earlier modernity, different forms of representation were kept fairly separate from each other, and for some simple technological reasons. For example, written text in letterpress sections of books were separate from images in sections of lithographic 'plates'; radio and sound recordings were the pre-eminent sites for the transmission of audio; television offered moving image with very little writing; and printed datasets were put in tables that were not readily manipulable by readers.

A revolution has occurred with digitization where so much of our capacity to record and deliver meanings remotely across time and space can now be done using a shared technological platform. Text, image, sound and data can all be reduced to the zeros and ones of computer code. Before, different technologies had to be used for the recording and distribution of these media. Because these things can all be in the same space, our means of representation of meaning are converging. They can be overlaid and mixed in the same space – the screen. But our actual tools often do not reach their potential because they are often needlessly tethered to older technological means – word processors, for instance, still mainly do writing and use anachronistic logics of documents, pages, and typographically ordered text. Even on the web, we keep the modes relatively separate – blogs for writing, podcasts for sound, YouTube for video, Flickr for still images. And of course, in schools, we still have a separate subject for reading and writing ('literacy'), and different subjects for image making ('art').

Now that we have at hand the tools for fully multimodal knowledge representation, it is time we offer these to our learners. We need to move beyond the handwriting book or the word processor. Instead, our learners should be working in the twenty-first-century world of web communications. This is a pedagogical imperative as well as a practical one, so students can represent their meanings independently and simultaneously in different modes – written, oral, visual, audio and dataset. Each mode complements the other – the diagram and the text, the oral and the written explanation, manipulable data and its synthetic summary. Each can say the same kind of thing as the other, and is also an irreducibly different mode of representation. Much can be learned by moving backwards between modes, representing meaning in one mode then another – a cognitive process we have called 'synesthesia', extending by metaphor the meaning of a word whose origins lie in cognitive psychology (Kalantzis & Cope, 2012a, chapter 7). Take the science experiment – the representation of its results can include words, diagrams, tables, dataset, and also a video demonstrating the experiment itself. Learning is deepened as students shift from one mode to another, making their meanings one way, then another complementary way.

This is also our rationale for creating a purely 'semantic editor' in *Scholar*. There are no fonts or point sizes or colors. There is none of the bewildering and practically irrelevant range of options presented in the toolbars, ribbons, sidebars and formatting palettes of word processors. In the *Scholar* toolbar, there is simply 'emphasis' (and that happens to look like italic), numbered and bullet point lists, 'block quotes' (these are indented), tables and hyperlinks. There are also things that word processors don't do or can barely do, such as an image, video, audio, dataset and any

other file – all of which can be seamlessly inserted within the body of the text. There are no documents or folders – we don't need these cumbersome nineteenth-century office filing metaphors in the twenty-first century. Instead, there are works that you can reach again by tagging, and which don't need to be on one metaphorical place (a folder) to be found again. There are no pages or endless 'scrolling' because longer texts are ordered into multiple-section information architectures by *Scholar*'s structure tool.

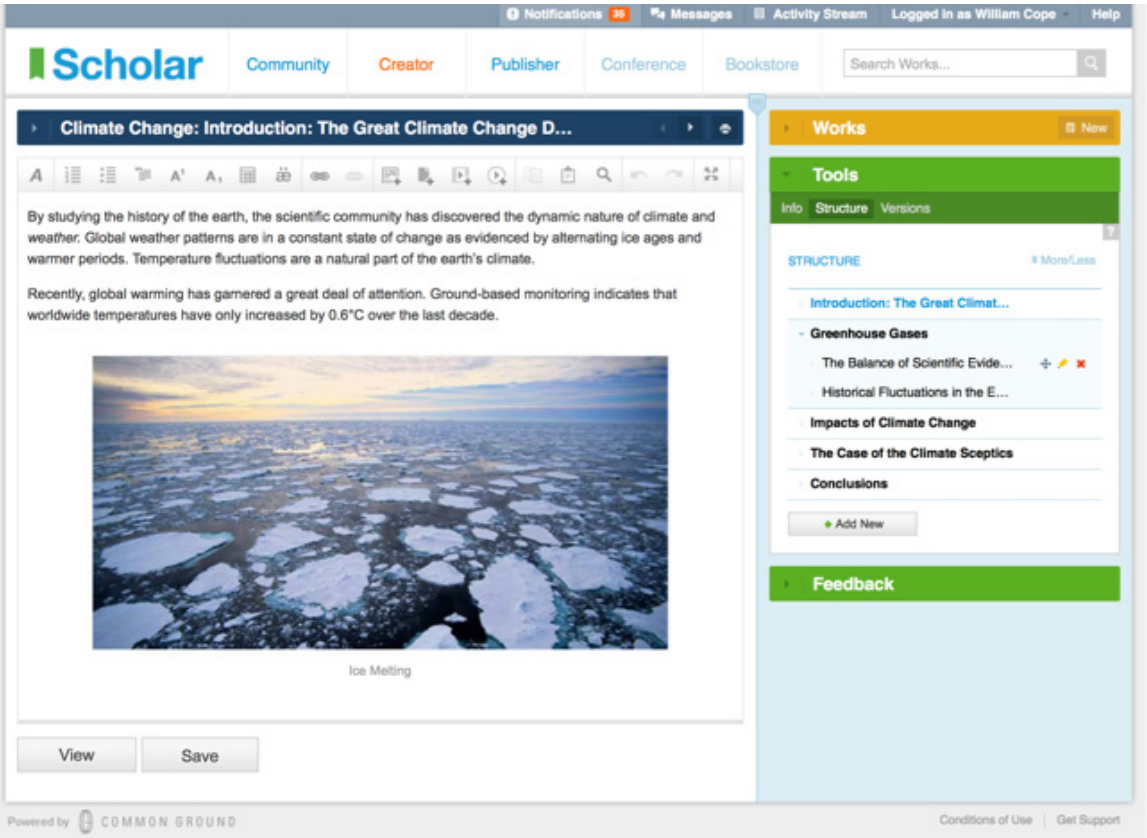
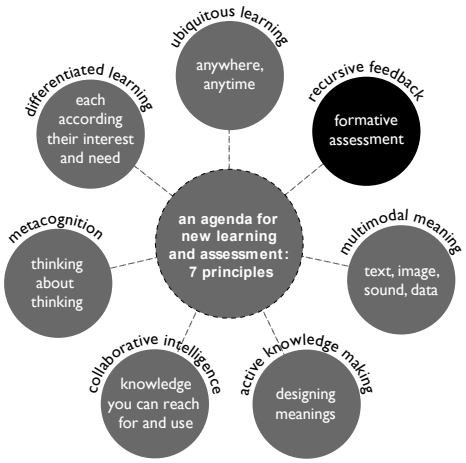


Figure 7. *Scholar*'s 'semantic editor'.

This is twenty-first-century writing. Incidentally, in a practical way, this is also an essential prerequisite to rendering content in alternative formats (e.g. PDF or webpage) and to multiple devices. And it is also a way, as Carlin-Menter argues in her case study, to optimize 'cognitive load' for students (Carlin-Menter, this issue). It helps them conceive and execute their work focusing on semantic architectures. It offers clarity to the metacognitive task of representing one's thinking.

Opening 4: Recursive Feedback



One of the strangest artifacts of traditional schooling is the test. It is strange for its separation from learning (an at-the-end managerial thing, a retrospective judgment which can do little in an immediate sense to further learning). It is strange also for its ways of conceiving knowledge, using as it does quite different devices from the ordinary processes of engaging with knowledge and learning themselves (such as the game in which students discriminate atomized right responses from trick 'distractors', designed to look right but which are deceptively, deliberately not right). In recent decades, the obsession with testing for the purposes of institutional accountability has magnified everything strange and problematic about the heritage processes of testing. Social knowledge technologies, however, mean that assessment does not have to be this way any more (Cope et al, 2011b).

One of our aims in the *Scholar* project has been to focus on formative assessment – assessment that is on-the-fly, and that makes in a detailed and constructive way a direct contribution to student learning. In the era of social knowledge technologies, no learning environment should be without always-available feedback mechanisms – machine feedback and machine-mediated social feedback. Then, when it comes to summative assessment, all we need to do is present a retrospective view of student progress, using no more and no less than all the data collected in the formative assessment process. *Scholar*'s Dashboard mines student data on-the-fly, all the work they have done in a period of time and up until the second when Dashboard is opened. It presents a view of individual learner progress and a comparative view of cohorts. This kind of technology means that we don't need traditional summative assessments. In fact, we might in the not-too-distant future be able to abandon summative assessment, and so its perverse peculiarity as an artifact and its baleful institutional effects. And this because there is so much assessment going on, all the time, from so many perspectives, of everything the learner commits as a documented knowledge work.

One area of focus in the *Scholar* endeavor has been to develop processes through which it is possible to 'crowdsource'. The machine itself can provide some feedback using natural language processing algorithms, and this feedback is computable, the results of which are provided through *Scholar*'s Dashboard. There are also the benefits of constant, machine-mediated human feedback, and from multiple perspectives – teacher, peers, and self. Teachers can, of course, provide feedback. So can peers. Revealingly, we have shown in our research that the mean of two or more peers' assessments is remarkably close to the score of an expert rater (Cope et al, this issue). Learners can also provide feedback, in self-assessments. Teachers and learners are all assessing learning, and every one of their perspectives is of some value. In fact, as their perspectives vary, the feedback may be more extensive, more thought-provoking, more rapidly provided and thus more valuable, than the most assiduous of lone teacher-markers. We can also moderate the various ratings and calibrate results via processes of inter-rater reliability, and the result may also be more reliable assessment. One effect of distributing assessment responsibilities in this way, is to remove

the trickery from assessment. This is also to democratize assessment, where teacher and students are all measuring learning against the same criteria, in the same ways.

Scholar offers four on-the-fly assessment mechanisms: review, annotations, checker and survey. 'Review' imports the historical processes of peer review as the canonical ecology of scholarly social knowledge production, into any classroom from about Grade 4. Peer reviewers in *Scholar* can be anonymous or named. However, review is somewhat differently modulated from rubric-based summative assessment. The intellectual raw materials (the 'review criteria') are the same, but instead of framing assessment in a retrospectively judgmental language (for instance, 'How effectively is the claim supported by evidence?'), it is framed in prospective and constructively oriented language ('How might the claim be strengthened with further or differently presented evidence?'). Our research shows that the quality of student response is dependent upon the review criteria established by the teacher (Kline et al, this issue). To elicit constructive response on the part of peers, review criteria need to be framed in terms of constitutive feedback rather than evaluative judgment (McCarthey et al, 2013; Woodard et al, this issue).

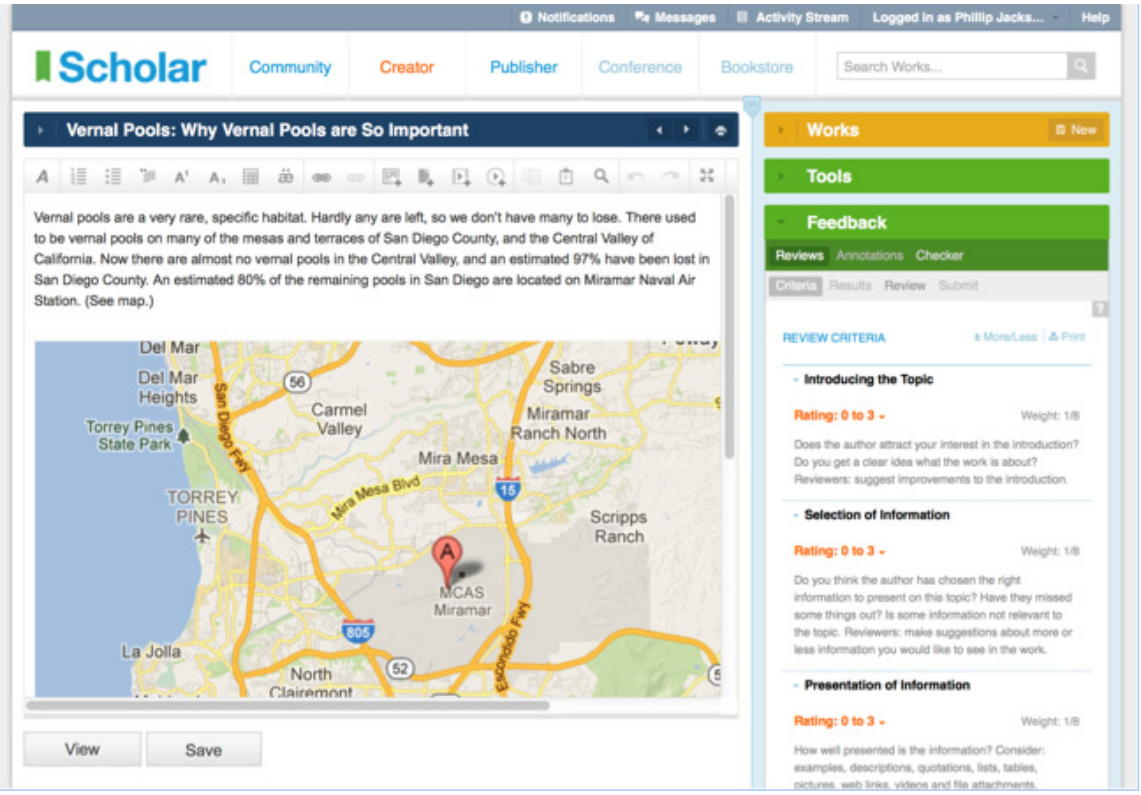


Figure 8. While writing, the creator views the review criteria.

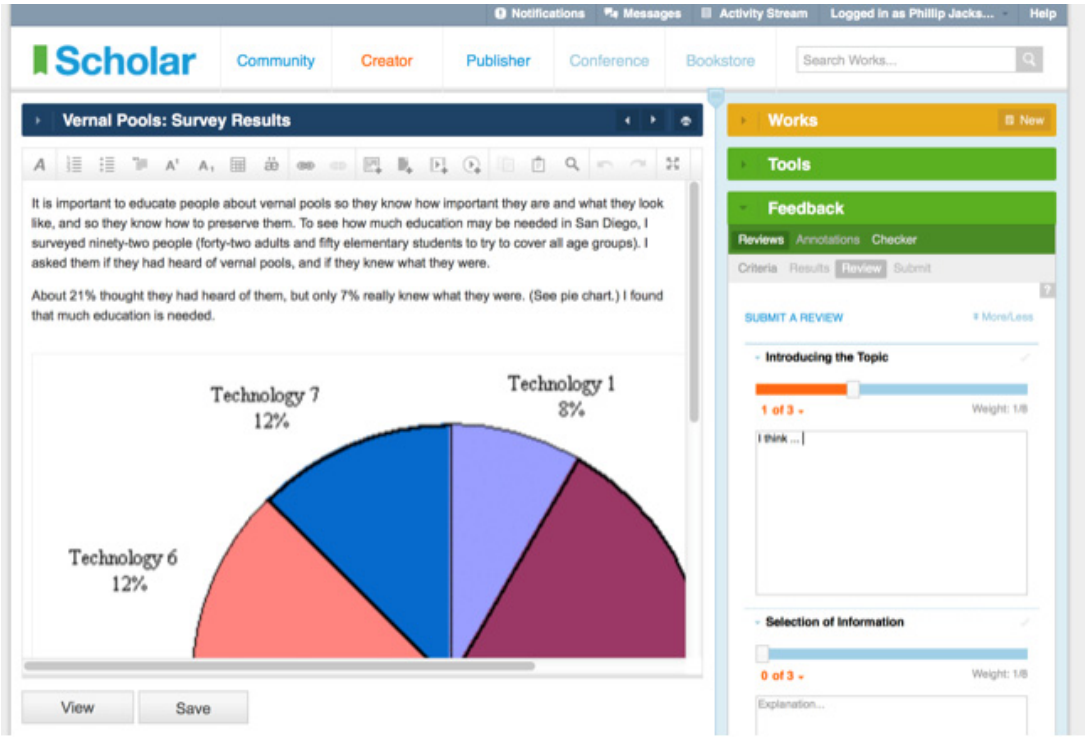


Figure 9. Starting to write a review – peer, self, or publishing admin (teacher) review.

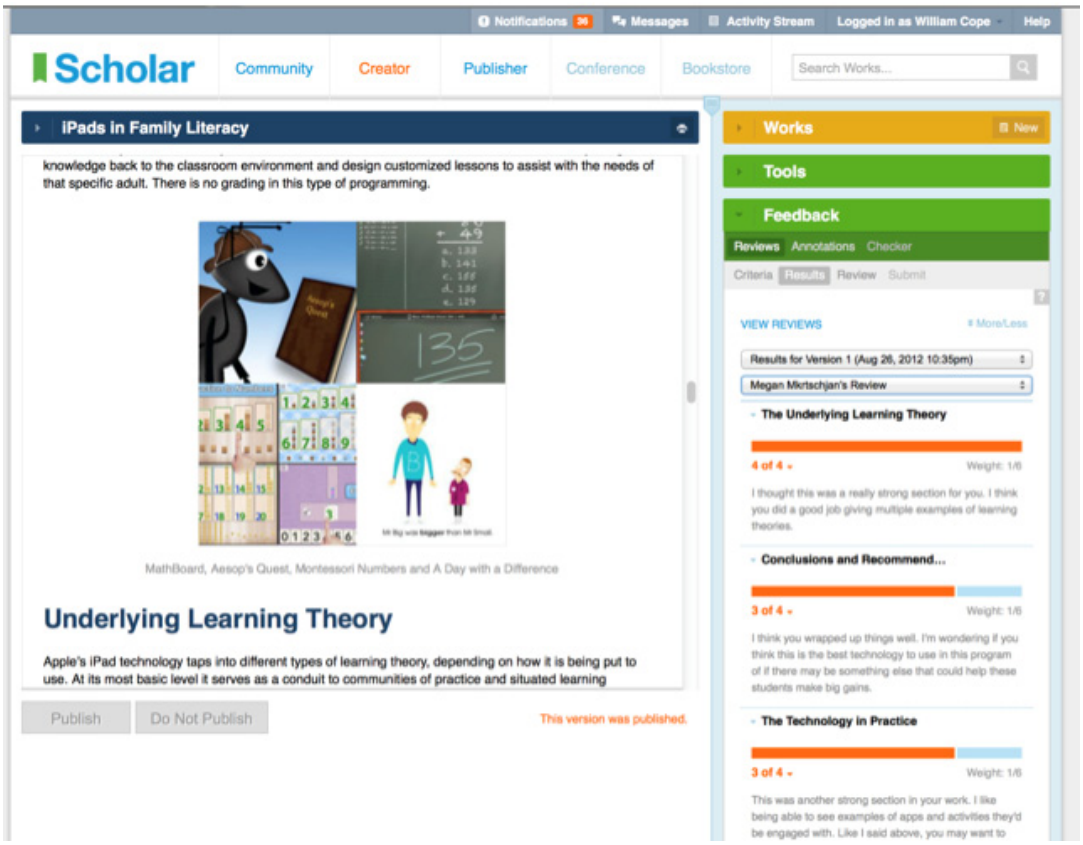


Figure 10. Viewing peer feedback.

Then there is *Scholar*'s annotations tool, where peers offer detailed in-test commentary and authors can request clarification.

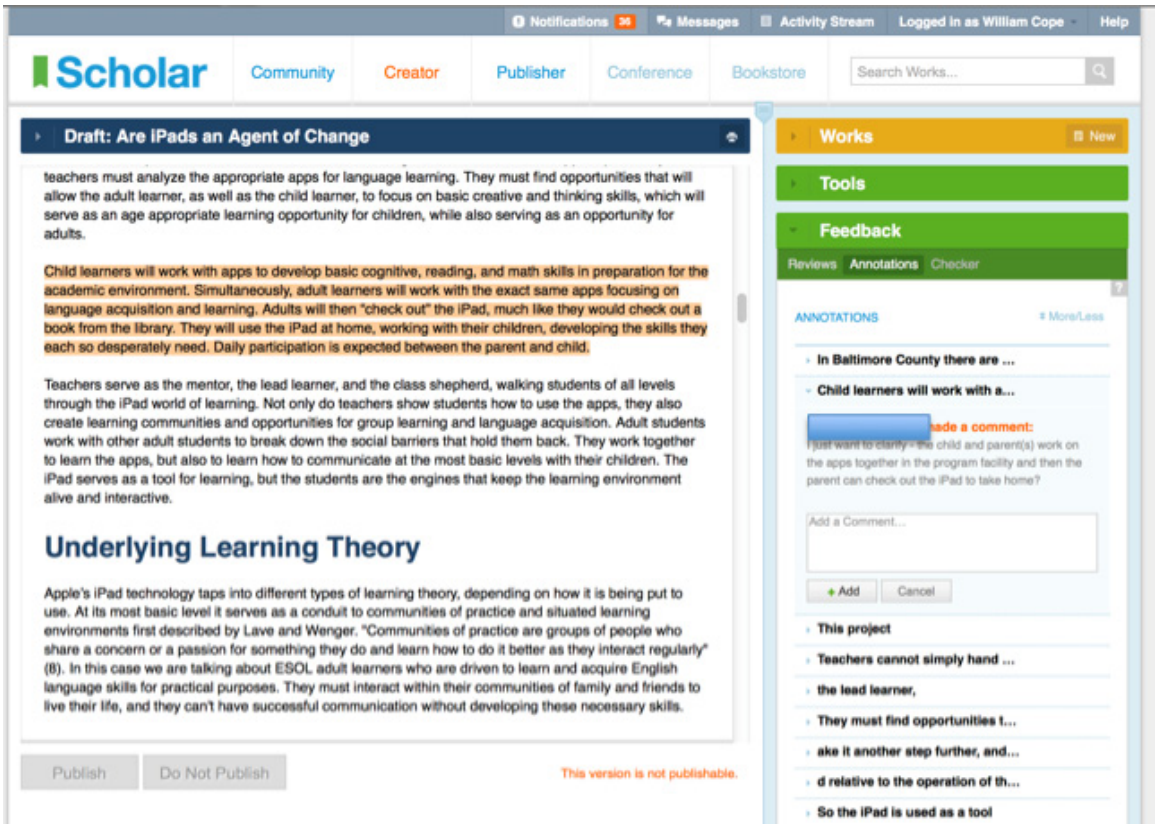


Figure 11. The annotations tool.

Next, the checker tool uses range of natural language-processing mechanisms to raise detailed questions about the text in the form of possible 'change suggestions', ranging from spelling alternatives, to synonyms and grammar. Unlike spelling and grammar checkers, there is no presumption that the item highlighted is necessarily wrong, and the reason it has been highlighted is offered.

Finally, the survey tool supports selected response and constructed response assessments, including information surveys (e.g. opinions) and knowledge surveys (with right and wrong answers). This last mode returns us to a traditional assessment mechanism whose cruder implementations we have criticized earlier in this article. However, mixed with and moderated against a variety of assessment modes, there remains value in survey-based assessment, particularly if it is used for formative purposes. Recent advances in survey psychometrics, including computer-adaptive testing and diagnostic testing, also offer new potentials for this assessment mode which our research team has been exploring.

So what might we achieve with these modes of assessment in a social knowledge environment? One effect may be reframe the assessment question from 'how did we do?' to 'how are we doing?' – 'we' being the learner, the class, the teacher. Assessment's primary reference point should not be managerial focus on results (framing our assessment question in the past perfect tense), but a formative focus on progress and improvement (framing our assessment question in the present continuous tense).

Social knowledge technologies mean that we can at any moment get an immediate answer to the 'how are we doing?' question. Unlike the world of pen and paper, or files lost in the clutter of hard drives that are chaotically unconnected with each other, *Scholar*'s semantic publishing technology means that we have kept all student material as always-mine-able, structured data – all the work they have done, their every version, their every review, their every annotation, their

every survey. Now we can parse their works and their interactions with all manner of algorithms and present the results in Dashboard. This provides teachers and learners with a new transparency, offering, for instance, early warnings when a learner is falling behind.

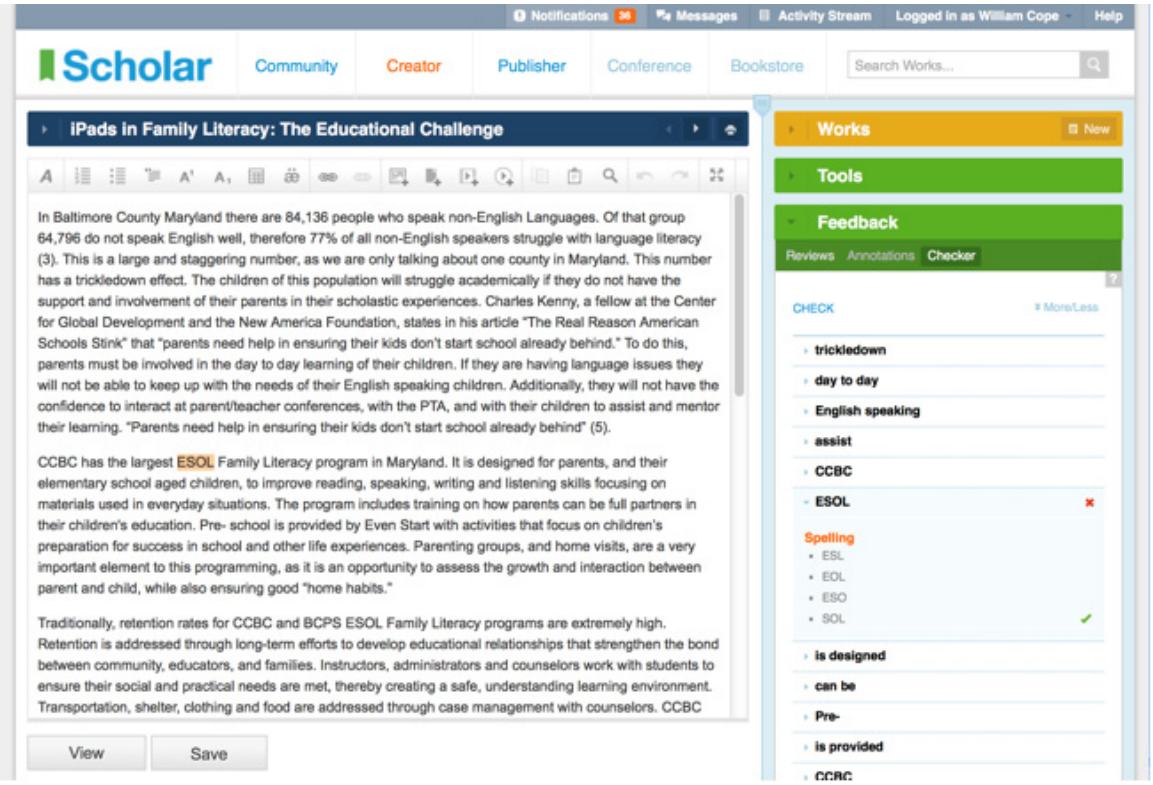


Figure 12. The checker tool.

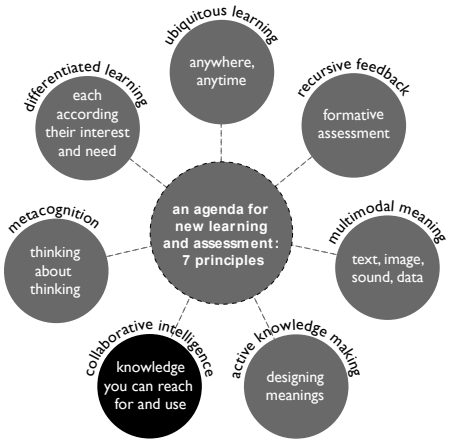
Moreover, as well as being able to measure individual work, we can measure social interactions and peers' contributions to others in the form of the feedback they have provided. In other words, we can assess learning interactions as well as learning artifacts. We can also build recursive feedback – feedback whose value is weighted by feedback on feedback, and ratings that are moderated by inter-rater reliability calculations. We can, in other words, calibrate crowdsourced assessment so it is increasingly reliable, and perhaps even more so than the expert marker assessment in isolation.

Perhaps also, we might move in the direction of a 'no failure' educational paradigm, where you can keep taking on feedback until you are as good as good is supposed to be. This is by way of contrast with distribution of students across a bell curve, where the few can succeed only because most are destined to be mediocre or fail.

Furthermore, a culture of mutually supportive constructive feedback models the ideals of a knowledge economy where teamwork and networked collaborations are more valuable than ever. Assistance helps the stronger as well as the weaker. It sets community standards, where the weaker see models in the works they review that are stronger than their own, and the finally published works of peers. And, in feedback-on-feedback and the measurement of constructive interactions, peers are offered help credits rather than being rewarded with the beating-the-other-person credits of the normal distribution curve.

Finally, this is an environment where you don't need to patronize learners with the cheap rewards of 'gold stars' or kitschy badges – extrinsic, artificially created motivations. Rather, the rewards are in the intrinsic motivations of the pleasure of the task and the affirmations of reciprocity in a knowledge community – helping and being helped, looking forward to others' feedback, improving one's work from version to version and project to project, and sharing one's creative output with the class (Magnifico et al, this issue).

Opening 5: Collaborative Intelligence



Traditionally schooling has been based on the idea of individual intelligence, where intelligence itself is narrowly conceived as personal memory and mechanical skills of deduction. The human mind, however, is an intrinsically social thing (Gee, 1992). Our cognitive capacities reside in the language we have inherited and the ways of seeing we have learned. Intelligence is our capacity to reach for always-available social memory and to apply available logics and computational tools. It is what we can do together in communities of practice. Today, through ubiquitous computing and the social web, externalized memory and computational tools are accessible that have historically unprecedented power. At the same time, work, public community life is more manifestly energized by collaborations. So much, in the twenty-first century, for the culture of closed-book examinations or isolated, individualized student work.

One of our primary research questions in the *Scholar* project, is how do we refigure the discursive positions of teachers and learners (Cazden, 2001) to reflect a more collaborative understanding of the nature of learning and intelligence? In the traditional classroom, peer-to-peer interactions are reduced to a minimum, often for practical reasons of 'noise' and classroom discipline.

Here are some typical discursive flows:

- Teacher talks -> students listen.
- Teacher Q. -> student A. ('Hands up!', 'One at a time!').
- Teacher says 'Read chapter 7' -> students silently read and memorize.
- Teacher sets test -> students respond with correctly memorized answers.
- Teacher sets assignment -> assignment submitted to an audience of one, the teacher, who gives a mark and perhaps also some comments.

All these interactions fit within the discursive scheme presented in Figure 13.

In *Scholar*, by contrast, here are some typical discursive flows:

- Teacher scaffolds peer <-> peer feedback.
- All students are involved simultaneously in constructive peer <-> peer learning dialogue.
- Continuous formative assessment supplements teacher assessments with structured self- and peer-assessments.
- Finished works are published for access by the whole class, positioning the knowledge community as audience.

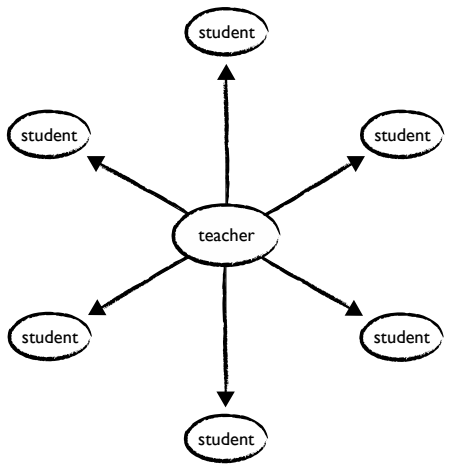


Figure 13. Classroom discourse, didactic pedagogy.

Every student is 'talking' all the time, and these interactions are scaffold by a teacher. In a traditional classroom, this would have been too noisy, undisciplined even. Using social knowledge technologies, the interactions can be nearly silent, no matter how intense and simultaneous. Schematically, this is a radically transformed discursive setup, as represented in Figure 14.

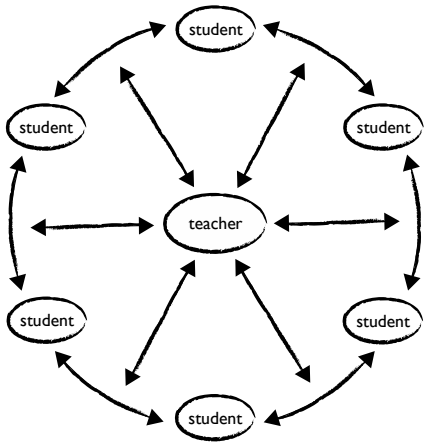


Figure 14. Scaffolding classroom discourse in *Scholar*.

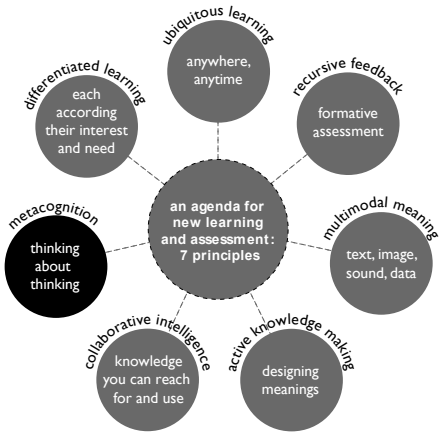
How productively do students interact in this new kind of classroom? Interestingly, our research shows that demeaning language is rarely used (Kline et al, this issue). This aligns with the pragmatic glue that binds contemporary social media – in order to be affirmed (getting a 'like', or having a 'follower'), it works best to affirm. Of course, at the negative extreme, there is also the potential for cyberbullying, to which we need always be alert (Espelage et al, 2013). In anticipation of this, we need to design socio-behavioral monitors and alerts into our social knowledge software. With these in place, there is every chance that environments can be built to be more aware of bullying than has ever been possible in person-to-person relations, using reputational systems and natural language-processing technologies.

Encouragingly, there is evidence from our team's research that new kinds of peer-to-peer interaction are emerging, quite uncharacteristic of traditional teacher-student response discourse. Here, Abrams reports:

> peer interaction did not necessarily include the hierarchy often related to traditionally evaluated work with the teacher/reviewer as the authority; rather, the student reviewer couched the feedback in relatable terms and associations (e.g. 'I like how you explain your thoughts but your grammar need to be worked on. I have bad grammar to so it okay. I like your essay though and I like the facts you put into the article.'). The space may have been structured by the teacher and the *Scholar* program, but the flexibility of the space enabled students' voices to emerge, fostering a collaborative writing process that seemed somewhat controlled by the student. (Abrams, this issue)

The key question emerging here, is to what extent might historically hierarchical knowledge relations of teachers to students be balanced with constructive and affirming peer-to-peer knowledge relations? And moving out to a wider social context, how does this align with larger social changes in which authoritarian hierarchies are becoming anachronistic – in the new media, in workplaces that have teamwork and aspire to collaborative culture, in families with less gender-based authority, and more broadly in a 'participatory culture' (Haythornthwaite, 2009)?

Opening 6: Metacognitive Reflection



Metacognition is a means to think more deeply, at a higher level of abstraction. It also produces efficiencies in thinking and learning, as conceptualization at higher levels of abstraction broadens the scope of application and transfer for ideas and understandings. There is a big and growing literature on metacognition in learning, the value of which we can take as given (Bransford et al, 2000; Bereiter, 2002).

Scholar does metacognition in several ways. One way is in the explicitness of a semantically framed knowledge-representation space, where learners learn about information architectures in an analytical way – in the organizational logic of the structure tool, or the tagging tool, and the markup requirements of 'emphasis' or 'block quote'. Another way is the requirement to self- and peer-assess against explicit criteria that are presented before the work even begins, a meta-reflective process which is now shared with the teacher. Students and teachers necessarily engage in dialogue about the fundamental nature of the task, as well as the specifics of task performance.

Practically speaking, the *Scholar* screen is divided into two juxtaposed and closely interconnected sides, as represented in Figure 15. On the left, there is a cognitive side where the learner does their work. On the right is a metacognitive side with various tools and social interaction for metacognitive reflection on the nature of the task. Learners think as they represent their knowledge on the left. They think about their thinking on the right.

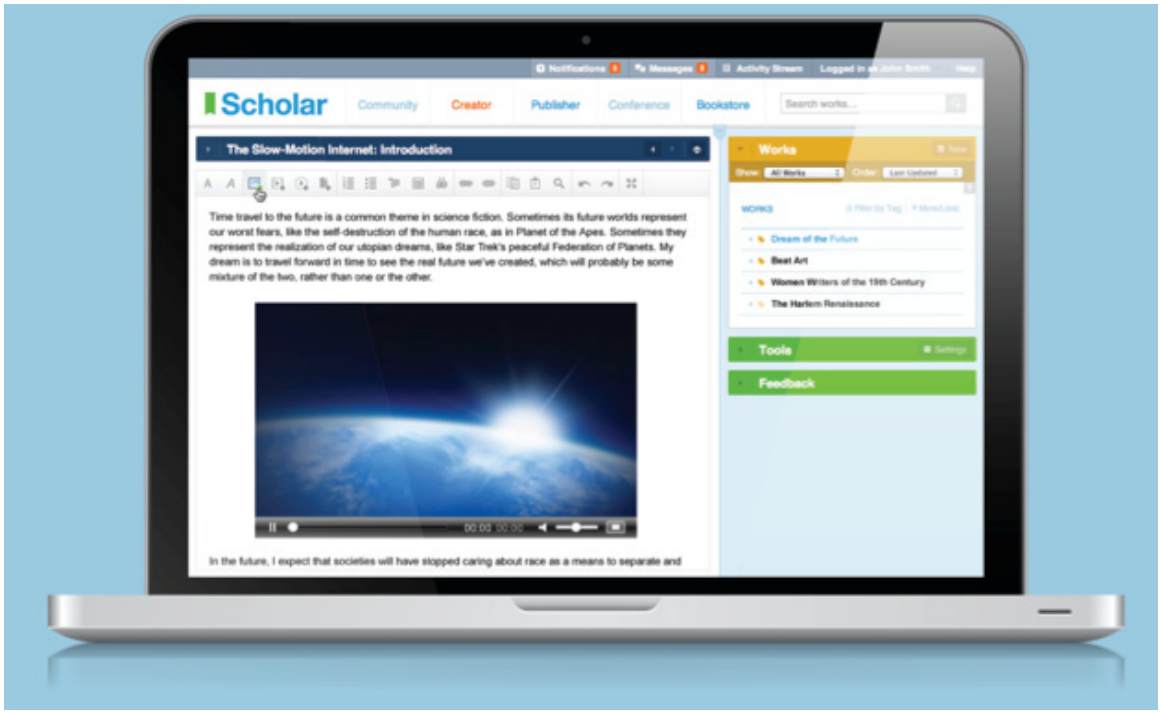


Figure 15. *Scholar* pedagogical architecture: left = the work; right = tools, feedback and interactions about the work; left = cognition; right = metacognition.

Here are some plays in this cognitive-metacognitive dialectic. The learner has the review criteria on the right as they create their knowledge representation on the left. On the right, they design the underlying logic of the work on the left, and articulate it explicitly in terms of the information architecture of the work designed in the semantic editor and using the structure tool. They run the checker on the right, which raises questions about their text on the left. They write a review and annotate others' text on the right, as they view their text on the left. They read feedback and annotations on the right, and compare this against their text on the left. They revise their work on the left, based on the feedback they have received on the right. They write a self-review on the right, reflecting perhaps on the changes they have made from version to version, influenced not only by the feedback they have received but their experience of reviewing others' works. Then, when it comes to assessment, their metacognitive, reflective work on the right is measured as well as the substantive cognitive material in the work on the left – the extent and quality of the feedback they have given, and the feedback they have received on their feedback.

Here is a student speaking about their experience writing a wiki entry in *Scholar*:

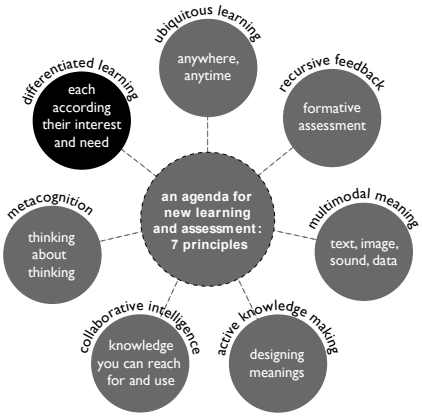
> The tools with *Scholar* helped me think about my project as it divided it into more categories than from what I thought it would have. Using a word processor such as Word, I would never think about the structure of the wiki. (Carlin-Menter, this issue)

> Yes, the tools in the project helped me think about my wiki and dissect the data even more because of the 'sections,' which let me think about all the aspects of the data. (Carlin-Menter, this issue)

And here's a teacher:

> It's not so much the traditional draft, mark it up, copy exactly what's in those markings onto a paper and that's your next copy. I like the idea of teaching them how to think and how to process what's being said to be able to apply those concepts to their next draft, which demonstrates much higher-order thinking than just simply copying what someone else told you to do. And it also helps them to take constructive criticism as well. (Abrams, this issue)

Opening 7: Differentiated Learning



Traditional classroom communication architectures were oriented to one-size-fits-all transmission of homogeneous content. The teacher spoke to the middle of the class, which meant that what they were saying was not understandable for some students and boringly obvious for others. Progressing through the textbook, all students needed to be on the same page at the same time. And when it came to the test, there was just one set of right answers. This arrangement was premised on homogenizing knowledge focus, content, pace and learning progress. This was a premise that failed as often as it succeeded to homogenize.

Few would disagree nowadays that differentiated learning is better. But it is harder work than homogenizing teaching. It is more of a logistical challenge for the teacher. It requires that you are a better teacher, with a broader repertoire of strategies, and superb classroom management skills.

Social knowledge technologies make differentiated instruction more feasible. Here's what we have tried to achieve in *Scholar*. Learners can be doing the same thing at their own pace. If a work involves research, drafting, review, revision and publication, not every student has to be up to the same stage in the process at the same stage. The teacher has an immediate view of where they are up to in the project status screen. Indeed they can click right into the student's work and see their most recent keystroke.

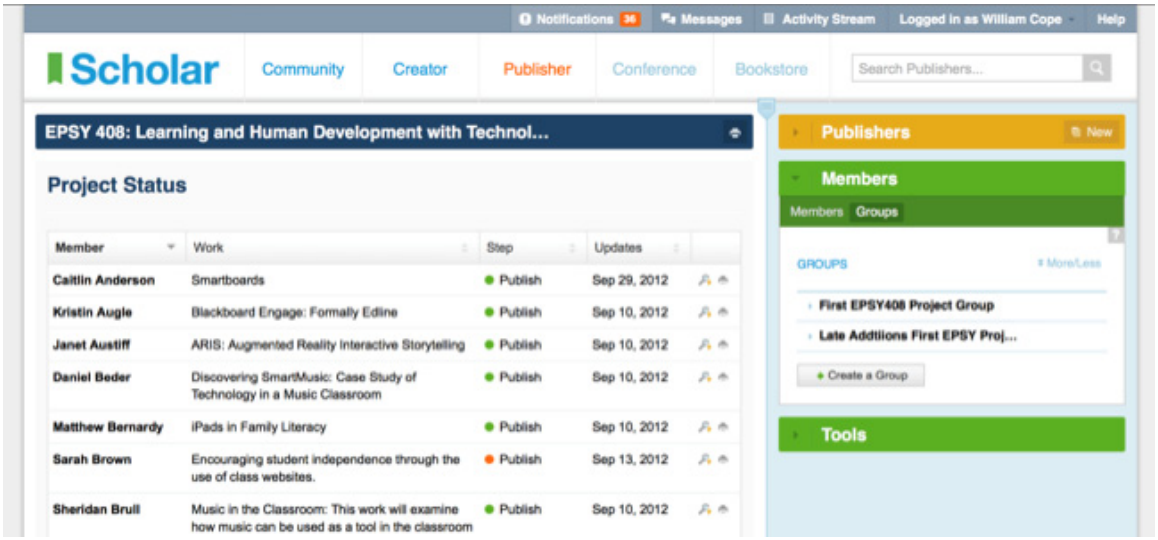


Figure 16. Different works, different pace, different groups of learners doing different projects.

Moreover, positioning the student as a knowledge producer affords more space for student voice, interest, experience and localized relevance. In general terms, the intellectual project might be the same, but the topics may vary. Or, where the aim is collaborative knowledge creation, every

student might be working on one distinctive piece in a jigsaw puzzle of class knowledge that is later shared when it is published and shared with the class community. Instead of forcing homogeneity, such a classroom operationalizes the principle of productive diversity or the complementarity of differential knowledge and experiences. Students might even go on to cite each other's works as knowledge sources, as distributed expertise. Such a learning ecology is one that harnesses learner identities, deepens their sense of engagement, and increases their motivation to devote time to task and engage with others in their knowledge community.

Then assessment becomes a somewhat different process than in the past, not measuring capacities to remember identical things or correctly deduce the same answers, but measuring higher order comparabilities and equivalences between knowledge artifacts which may in substance be different. In this assessment regime, you don't have to be the same to be equal. And at this point, managing learner differences may become easier than one-one-size-fits-all teaching.

Conclusions

None of the seven openings that we have outlined in this article is new to the theories or practices of education. In fact, each of them has its origins in pedagogical propositions that have been made, in one form or another, from the first moments of modern, mass-institutionalized education. Our *Scholar* research has attempted to explore ways in which what we have termed 'social knowledge' technologies might make each of these ideas easier to realize.

Along the way, we have encountered many challenges, some of which we have overcome in part, while others we are still attempting to address. There are problems around adoption, both in terms of the depressingly poor access to now-basic information and communications technologies in schools, and the challenge for teachers to modify heritage pedagogical practices (Olmanson & Abrams, this issue). We have also faced methodological challenges in our attempts to determine 'efficacy' against the measure of a comparison group – let alone 'fidelity of implementation'. Teacher practices and school conditions are so very variable. And our agile development methodologies with new releases based on user feedback every two weeks have meant that *Scholar* is always changing (Ahn & Greene, this issue). However, these very challenges have also brought with them rewards. One teacher tells of how one of the research team:

> came in and observed the kids using it and talked to them and they were telling her this should be more like Facebook and we should be able to click on this. Then the next week when they implemented that change the kids were just ecstatic; they loved being able to see it happen ... [participating] was worth it. The kids were the ones who remembered that we had used it. [They] were proud of the fact that they had a say in [the design]. (Olmanson & Abrams, this issue)

This is a moment of profound social transformation. 'Disruptive' is a word applied to new information and communications technologies, to the point at times where it is almost a cliché. It is high time we disrupt traditional schooling, not for disruption's sake but simply, pragmatically, to keep education relevant to our changing times. To return to our key research questions, it is time we create the conditions for learning and assessment which connect collaborative with individual intelligence, which supplement extrinsic motivations with intrinsic motivations in the work of knowledge making and sharing that work in knowledge communities, and which nurture a productive diversity in learning. We have tried to edge in these directions as we have collaborated with learners and their teachers in the development of the *Scholar* environment.

Notes

[1] We wish to acknowledge funding support from the US Department of Education Institute of Education Sciences: 'The Assess-as-You-Go Writing Assistant: a student work environment that brings together formative and summative assessment' (R305A090394); 'Assessing Complex Performance: a postdoctoral training program researching students writing and assessment in digital workspaces' (R305B110008); 'u-learn.net: an anywhere/anytime formative assessment and learning feedback environment' (ED-IES-10-C-0018); 'The Learning Element: a lesson planning and curriculum documentation tool for teachers' (ED-IES-10-C-0021); and 'Infowriter: a student feedback

and formative assessment environment for writing information and explanatory texts' (ED-ED-IES-13-C-0039). We also wish to acknowledge funding support from the Bill and Melinda Gates Foundation. *Scholar* code owned by the University of Illinois has been licensed by Common Ground Publishing LLC, directed by Bill Cope and located in the Research Park at the University of Illinois.

References

Bereiter, Carl (2002) *Education and Mind in the Knowledge Age*. Mahwah, NJ: Lawrence Erlbaum.

Bransford, John D., Brown, Ann L. & Cocking, Rodney R. (Eds) (2000) *How People Learn: brain, mind, experience and school*. National Research Council Commission on Behavioral and Social Sciences and Education. Washington: National Academy Press.

Cazden, Courtney B. (2001) *Classroom Discourse: the language of teaching and learning*. Portsmouth, NH: Heinemann.

Common Core State Standards Initiative (2010) Common Core State Standards for English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects. National Governors Association Center for Best Practices, Council of Chief State School Officers, Washington DC. http://www.corestandards.org/

Cope, Bill & Kalantzis, Mary (2009a) 'Multiliteracies': new literacies, new learning, *Pedagogies*, 4, 164-195.

Cope, Bill & Kalantzis, Mary (2009b) Ubiquitous Learning: an agenda for educational transformation, in B. Cope & M. Kalantzis (Eds) *Ubiqutous Learning*. Champaign, IL: University of Illinois Press.

Cope, Bill, Kalantzis, Mary & Magee, Liam (2011a) *Towards a Semantic Web: connecting knowledge in academic research*. Cambridge: Woodhead. http://dx.doi.org/10.1533/9781780631745

Cope, Bill, Kalantzis, Mary, McCarthey, Sarah, Vojak, Colleen & Kline, Sonia (2011b) Technology-mediated Writing Assessments: paradigms and principles, *Computers and Composition*, 28, 79-96. http://dx.doi.org/10.1016/j.compcom.2011.04.007

Espelage, D.L., Rao, M.A. & Craven, R. (2013) Relevant Theories for Cyberbullying Research, in S. Bauman, J. Walker & D. Cross (Eds) *Principles of Cyberbullying Research: definition, methods, and measures*. New York: Routledge.

Gee, James Paul (1992) *The Social Mind: language, ideology, and social practice*. New York: Bergin & Garvey.

Haythornthwaite, Caroline (2009) Participatory Transformations, in B. Cope & M. Kalantzis (Eds) *Ubiquitous Learning*. Champaign, IL: University of Illinois Press.

Kalantzis, Mary & Cope, Bill (1999) Multicultural Education: transforming the mainstream, in S. May (Ed.) *Critical Multiculturalism: rethinking multicultural and anti-racist education*, pp. 245-276. London: Falmer Press.

Kalantzis, Mary & Cope, Bill (2010) Introduction: learning by design, *E-Learning and Digital Media*, 7, 198. http://dx.doi.org/10.2304/elea.2010.7.3.198

Kalantzis, Mary & Cope, Bill (2012a) *Literacies*. Cambridge: University of Cambridge Press. http://dx.doi.org/10.1017/CBO9781139196581

Kalantzis, Mary & Cope, Bill (2012b) *New Learning: elements of a science of education*. Cambridge: University of Cambridge Press. http://dx.doi.org/10.1017/CBO9781139248532

Kellogg, R.T. (1994) *The Psychology of Writing*. New York: University Press.

Kellogg, R.T. (2008) Training Writing Skills: a cognitive developmental perspective, *Journal of Writing Research*, 1(1), 1-26.

Kellogg, R.T. & Whiteford, A.P. (2009) Training Advanced Writing Skills: the case for deliberate practice, *Educational Psychologist*, 44(4), 250-266. http://dx.doi.org/10.1080/00461520903213600

McCarthey, Sarah J., Magnifico, Alecia, Woodard, Rebecca & Kline, Sonia (2013) Affordances and Constraints of an Online Writing Environment: the case of Tom, in R. Ferdig & K. Pytash (Eds) *Exploring Technology for Writing and Writing Instruction*. Hershey PA: IGI Global.

O'Reilly, Tim (2005) What is Web 2.0? Design Patterns and Business Models for the Next Generation of Software. http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html

Peters, Michael A. & Beasley Tina (A.C.) (2006) *Building Knowledge Cultures: education and development in the age of knowledge capitalism*. Oxford: Rowman & Littlefield.

Reese, George (2009) *Cloud Application Architectures: building applications and infrastructure in the cloud*. Sebastatpol, CA: O'Reilly.

Twidale, M.B. (2009) From Ubiquitous Computing to Ubiquitous Learning, in B. Cope & M. Kalantzis (Eds) *Ubiquitous Learning*. Champaign, IL: University of Illinois Press.

BILL COPE is a professor in the Department of Educational Policy Studies at the University of Illinois. He is also Director of Common Ground Publishing, located in the Research Park at the University of Illinois, developing the internet publishing software *Scholar* for schools and scholarly publications. Recent books include *The Future of the Academic Journal,* edited with Angus Phillips (Chandos, 2009) and *Towards a Semantic Web: connecting knowledge in academic research*, co-authored with Kalantzis and Magee (Woodhead, 2010). With Mary Kalantzis, he is co-author or editor of: *Multiliteracies: literacy learning and the design of social futures* (Routledge, 2000); *New Learning: elements of a science of education* (Cambridge University Press, 2008/2012); *Ubiquitous Learning* (University of Illinois Press, 2009); and *Literacies* (Cambridge University Press, 2012).
Correspondence: bill.cope@illinois.edu

MARY KALANTZIS is Dean of the College of Education at the University of Illinois at Urbana-Champaign. She was formerly Dean of the Faculty of Education, Language and Community Services at RMIT University in Melbourne, Australia, and President of the Australian Council of Deans of Education. With Bill Cope, she is co-author or editor of: *Multiliteracies: literacy learning and the design of social futures* (Routledge, 2000); *New Learning: elements of a science of education* (Cambridge University Press, 2008/2012); *Ubiquitous Learning* (University of Illinois Press, 2009); and *Literacies* (Cambridge University Press, 2012).