Ubiquitous Learning: An Agenda for Educational Transformation

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Abstract

Ubiquitous learning is a new educational paradigm made possible in part by the affordances of digital media. This paper sets out to explore the dimensions of this proposition. We can use new technologies to do learn old things in old ways, but the learner's relationship to knowledge and the processes of pedagogy have not changed in any significant way. The emergence of ubiquitous computing creates new conditions for all working as education professionals and learning as students. The key is not the logic or technical specifications of the machines. Rather it is the new ways in which meaning is created, stored, delivered and accessed. In this paper, we suggest seven moves which are characteristic of ubiquitous learning. Each explores and exploits the potentials of ubiquitous computing. None, however, is a pedagogical thought or social agenda that is new to the era of ubiquitous computing. The only difference today is that there is now no practical reason not to make each of these moves. The affordances are there, and if we can, perhaps we should. And when we do, we may discover that a new educational paradigm begins to emerge. And as new paradigms emerge, we might find they take a leading role on technological innovation.

Keywords

Ubiquitous learning, ubiquitous computing

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Ubiquitous Computing

At first glance, it is the new machines of the information age that make ubiquitous learning different from heritage classroom and book-oriented approaches to learning. These appearances, however, can deceive. Old learning can be done on new machines. Using new machines is not necessarily a sign that ubiquitous learning has arrived. And some features of ubiquitous learning are not new—as Chip Bruce highlights so clearly in his paper also at this conference, they have a proud place in the history of educational innovation which stretch back well before the current wave of machines.

But to focus on the machines for the moment, there is an obvious link between ubiquitous learning and ubiquitous computing. The term 'ubiquitous computing' describes the pervasive presence of computers in our lives. Personal computers and laptops have become an integral part of our learning, work and community lives, to the point where, if you don't have access to a computer you can be regarded as disadvantaged, located as a 'have not' on the wrong side of the 'digital divide'. Meanwhile, many other devices are becoming more computer-like (in fact, more and more of them they are computers or have computer power built in): mobile phones, televisions, global positioning systems, digital music players, personal digital assistants, video cameras, still cameras and game consoles, to name a few. These devices are everywhere. They are getting cheaper. They are becoming smaller and more portable. They are increasingly networked. This is why we find them in many places in our lives and at many times in our days. The pervasive presence of these machines is the most tangible and practical way in which computing has become ubiquitous.

Does ubiquitous computing lay the ground work for ubiquitous learning? Yes, it does. Does it require us to make a paradigm shift in our education paradigms? Certainly. However, our definition of ubiquitous learning in the first paragraph of our introduction was more conditional than this. We said 'ubiquitous learning a new educational paradigm made possible in part by the affordances of digital media'. The qualifications in this statement are crucial. 'Made possible' means that there is no directly deterministic relationship between technology and social change. Digital technologies arrive and almost immediately, old pedagogical practices of didactic teaching, content delivery for student ingestion and testing for the right answers are mapped onto them and called a 'learning management system'. Something changes when this happens, but disappointingly, it is not much. And another qualifier: 'affordance' means you can do some things easily now, and you are more inclined to do these things than you were before simply because they are easier. You could do collaborative and inquiry learning in a traditional classroom and heritage institutional structures, but it wasn't easy. Computers make it easier. So, the new things that ubiquitous computing makes easier may not in themselves be completely new—modes of communication, forms of social relationship or ways of learning. However, just because the new technology makes them easier to do, they become more obviously worth doing than they were in the past. Desirable social practices which were at times against the grain for their idealistic impracticality, become viable. The technology becomes an invitation to do things better, sometimes in ways that some people have been saying for a long time they should be done.

Here's an apocryphal technology story about the connections between technology and social relationships. PLATO, the world's first computer learning environment was invented where we work at the University of Illinois in 1960, going through extensive research and development processes resulting in a number of iterations over the next two decades. PLATO can be credited as the beginnings, not just of e-learning, but the computing world we know today. It only took the form it did in order to meet specifically educational needs. In this sense, education drove, not technology. Some remarkable inventions came out of this educational laboratory. In the 1960s, the plasma screen was invented because learners needed a visual interface, not computer punch cards, for ease of interaction in the learning context. The touch screen was also invented, so students could interact with the questions and information on the screen. In the 1970s, a pioneer messaging system was created so teachers and learners could communicate with each other. This was perhaps the world's first online community, and the beginnings of communications technologies which soon became message boards, email, online chat and instant messaging. The first multiplayer online games were created for PLATO. The capacity to connect peripheral devices was also created, and one of the first was an early music synthesiser used in music education and research, which also had the capacity to play computer-recorded music. Now that these technologies have become cheap and accessible, we find ourselves using their descendants every day of our lives. But it is salutary to know that they were invented in a moment of educational exploration, to support the endeavour of learning. Education led. The technology followed. (And to make progress with ubiquitous learning, this needs to happen again.)

Technologies are the product of social needs. When they work for us, their social affordances sometimes prove to be more revolutionary than their technical specifications. Before we get back to the educational story, here are some of the social effects of what has, since the days of PLATO, become ubiquitous computing:

Situated Computing: ubiquitous computing situates information processing, communications, recording and playback devices everywhere in our lives. We make meanings through these devices (to others as well as making sense of things for ourselves). We represent ourselves through digitised media, recording more and more of our lives—deliberately, impulsively or incidentally. We do this in many media: image, text and sound, because one of the key features of the world of computing is to reduce image, sound and word to the same stuff, the stuff of zeros and ones.

Interactive Computing: ubiquitous computing is interactive. One move is this: person connects with machine; machine answers on the basis of its programmed functions. The machine is 'smart' insofar as the programmer has only supplied abstract variables. Somewhat intelligently, the machine returns to the user whatever data it has been given the chance to record, sometimes in combinations which neither the person who entered the data nor the programmer quite anticipated. Another interactive move is this: person connects to person through the machine. Until recently, this happened through different,

monomodal and relatively separate analogue media. Now the media are (literally, technically) converging around digitisation. We can connect in more ways, more easily and more cheaply.

Participatory Computing: ubiquitous computing spawns ubiquitous media, which spawns participatory culture. Here are a few the signs of our times: the centrally designed voice of experts, the print encyclopedia, is supplanted by the tens of thousands of unnamed authors, a 'general public' which has contributed to Wikipedia and which updates and extend it daily. Competing with the traditional newspaper, blogs provide information and commentary on the events of the day; anyone can set one up; any reader can talk back. And competing with broadcast television, anyone can post a video to YouTube. Unlike the old media, they are cheap, accessible and easy enough for anyone to do. This is the stuff of computer-enabled participatory culture in which the distinctions between writer and readers, and creators and audiences are rapidly becoming blurred (Jenkins 2006).

Spatial Computing: ubiquitous computing creates new senses of space. Where you work, where you shop, where you learn, where you are entertained and where you live—these all used to be defined spaces: built, institutionalised, impressively solid. Ubiquitous computing makes the boundaries between these spaces porous at least, but possibly even throws into question the long term relevance of the what were until recently regarded to be unshakable spatial, institutional and life boundaries.

Temporal Computing: ubiquitous computing also creates new senses of time. Ubiquitous computing brings together the 'now' and the 'whenever'. The start of the class, or the movie, or the working day does not need to be a specific 'now', when, the capacity to record easily and cheaply facilitates asynchronous communication. Now can be made sooner or later. Observing other people's timetables is increasingly replaced by calendaring for oneself.

Cognitive Computing: ubiquitous computing requires new ways of mental getting around, new logics of social navigation, new uses of the computer as appendage to our thinking. We think by weaving our way through icons and hypertextual links. We search rather than follow instructions. We create our own reading paths rather than read things in the order in which the author thought would be good for us. New ways of thinking are emerging in which the mind uses the computer as a supplement to its own cognitive powers. Users work their way around the world of knowledge and imagination having mastered 'semantic technologies' of ubiquitous computing: search algorithms, menus, formal schemas, user-generated tags and folksonomies and ontologies. All of these allow you to work your way through the structured data of files and databases. In these activities, our thinking becomes computer-mediated.

Intuitive Computing: as a matter of habit, ubiquitous computing becomes a deeply intuitive part of our lifeworld experience. Adults have managed to learn their way into the world of ubiquitous computing, or at least those on the 'have' side of the digital divide. They become fluent second-language speakers of the languages of ubiquitous computing. They speak it very well at times, by with an accent revealing traces of a pre-digital childhood. Like ducks to water, however, today's children have grown up as 'digital natives'. They speak ubiquitous computing as if it had always been a natural part of human affairs. So ubiquitous has this computing become that, for native and second language speakers alike, it is at hard to notice that it is even there. It's just what we do to live today. It is as though we look through it, hardly noticing it is there.

Causes for Caution

For all the optimism about the social transformations that might be wrought as we explore the affordances of ubiquitous computing, we need to have a cautious eye to its ever-present dangers. We need to work hard at the digital divide in a world where inequality comes easier than equality: the 'bandwidth disadvantaged', the dead zones, and the people who can't afford to buy the latest and best devices, even though they are getting cheaper (Mitchell 1995; Virilio 1997). In education, the champions of ubiquitous computing are working on this, in the form for instance of the One Laptop Per Child initiative.

We need to make sure we do more than mechanise and automate practices of the present out of conservative inertia when we have the opportunity to implement better ones or invent new ones. The machine-marked tests and the back-to-the-future learning management systems with their lock-step curriculum, spring to mind.

We also need to guard against 'grey ecologies' in which we are tethered to machines, or caught on one side or the other of the Cartesian dualism of mind and body. We might be able to make the machines more life-like, better able to represent embodiment. However, just because the computing is ubiquitous, not all learning has to be machine-mediated and distanced from its natural and embodied sources. To achieve this, the machines need to be seen, not as ends in themselves, but as a documentation devices for off-screen learner activity—for instance, digital photographs taken by learners engaged in nature study, video or audio recordings of oral or gestural performance and the like. In other words, we need to guard against any reduction of the richness of person-to-person or hands-on activity. The solution for ubiquitous learning is 'out there' documentation (take the documentation devices with you everywhere). In other words, the learner does not have to be confined to human-machine interaction or human-machine-human mediation because the machine also serves as an ancillary documentary device for human-human, and human-activity learning.

And, as Caroline Haythornthwaite points out in her paper at this conference, we need to watch out for networked individualism, outsourced learning-on-the-cheap that bypasses the teacher, and an anti-intellectual populism where the only thing that trumps the wisdom of the crowd is the wisdom of the sponsored link.

Ubiquitous Learning

We can use new technologies to do learn old things in old ways. We can set up the ubiquitous computing devices in our contemporary world to do old-fashioned didactic teaching: the teacher or publisher puts content into a learning management system; the learner works through the content step by step; the learner does a test at the end and gets a mark which says they have passed or failed. We can use computers to recreate traditional, transmission pedagogies which anticipate a mimetic relationship to knowledge—absorb the theories, the practice formulae, the facts, the greats, the canon, the socio-moral truths that others have deemed will be good for you. There are some differences, to be sure—the image of the solar system in the old science textbook stays still but the planets move around the sun in the digital 'learning object'—but the learner's relationship to knowledge and the processes of pedagogy have not changed in any significant way (Kalantzis 2006; Kalantzis and Cope 2008).

Following, we suggest seven moves which are characteristic of ubiquitous learning. Each explores and exploits the potentials of ubiquitous computing. None, however, is a pedagogical thought or social agenda that is new to the era of ubiquitous computing. The only difference today is that there is now no practical reason not to make each of these moves. The affordances are there, and if we can, perhaps we should. And when we do, we may discover that a new educational paradigm begins to emerge. And as new paradigms emerge, we might find they take a leading role on technological innovation.

Move 1: To blur the traditional institutional, spatial and temporal boundaries of education. In the heritage educational institutions of our recent past, learners needed to be in the same place at the same time, doing the same subject and staying on the same page. The classroom was an information architecture, transmitting content, one to many: one textbook writer to how every many thousands of learners; one teacher to thirty something children or one lecturer to one hundred and something university students. The spatial and temporal simultaneity of this information and knowledge system practically made sense. Today, in the era of cheap recording and transmission of any textual, visual and audio content anywhere, such classrooms are not needed. Education can happen anywhere, anytime. Proud traditions of 'distance education' and 'correspondence schools' mean that these ideas are far from new. The only difference now is that ubiquitous computing renders anachronistic and needlessly expensive for many educational purposes, the old information architecture of the classroom, along with its characteristic forms of discourse and social relationships to knowledge. Even the problem of duty of care for children is surmountable with mobile phones and global positioning devices. Knowing the location of a child was never better than the one metre margin of error of GPS devices. And another problem with the old classroom: the idea was that this was preparation for life, enough to assume whatever one's lot would be, and the rest could be left to experience. Today, everything is changing so rapidly that today's education easily becomes tomorrow's irrelevance. So, there have been moves to make ongoing training and formally accredited education 'lifelong and lifewide'. For people in work and with families, not able to commute to an institution or able to schedule their time easily, ubiquitous computing can be a conduit for

education beyond the traditional spatial and institutional boundaries. Coming together in specific times and places will, of course, remain important, but what we will choose to do when we come together may be different from what happens in classrooms today—these may be special times to focus, on face-to-face planning, collaborative work and community building. Then there's the new pervasiveness of pedagogy in spaces of informal and semi-formal learning—help menus, 'intuitive interfaces', game-like staged learning, and what Mike Twidale calls, 'over-the-shoulder-learning' from friends and colleagues. This kind of learning only ever needs to be just in time and just enough. It is now integral to our lifeworlds, a survival skill in a world of constant change.

Move 2: To shift the balance of agency. In the traditional classroom, the teacher and blackboard were at the front of the room. The learners sat in straight rows, listened, answered questions one at a time, or quietly read their textbooks and did their work in their exercise books. Lateral student-student communication was not practicable, or even desirable when it could be construed as cheating. Underlying this arrangement was a certain kind of discipline (listen to the teacher, read authority into the textbook), and a particular relationship to knowledge (here are the facts and theories you will need to know, the literature which will elevate and the history which will inspire). This kind of education made a certain kind of sense for a certain kind of world, a world where supervisors at work shouted orders or passed down memos in the apparent productive interests of the workers, where the news media told the one main story we were meant to hear, and where we all consumed identical mass-produced goods because engineers and entrepreneurs had decided what would be good for us. Authors wrote and the masses read; television companies produced and audiences watched; political leaders led and the masses followed; bosses bossed and the workers did as they were told. We lived in a world of command and compliance. Today, the balance of agency has shifted in many realms of our lives. Employers try to get workers to form self-managing teams, join the corporate 'culture' and buy into the organisation's vision and mission. Now the customer is always right and products and services need to be customised to meet their particular practical needs and aesthetic proclivities. In the new media, ubiquitous computing has brought about enormous transformations. There's no need to listen to the top forty when you can make your own playlist on your iPod. There's no need to take on authority the encyclopedia entry in Wikipedia when you, the reader, can talk back, or at least watch other people's arguments about the status of knowledge. There's no need to take the sports TV producer's camera angles when you can chose your own on interactive television. There's no need to watch what the broadcast media has dished up to you, when you can choose your own interest on YouTube, comment on what you're watching and, for that matter, make and upload your own TV. There's no need to relate vicariously to narratives when you can be a player in a video game (Gee 2003; Gee 2005). Haythornthwaite, in her paper at this conference, calls this the 'new relational order'. This new order applies equally well to learning. There is no need to be a passive recipient of transmitted knowledge when learners and teachers can be collaborative co-designers of knowledge. There are many sources of knowledge, sometimes problematically at variance with each other, and we have to navigate our way around this. There are many sites and modalities of knowledge, and we need to get out there into these to be able to make sense of things for ourselves. There may be widely accepted and thus authoritative bodies of knowledge to which we have to relate, but these are always uniquely applied to specific and local circumstances—only we can do this, in our own place and at our own time. This is a phenomenon of blurring distinctions between teachers and learners, and knowledge makers and knowledge users. In this environment, teachers will be required to be more knowledgeable, not less. Their power will be in their expertise and not in their control or command routines.

Move 3: To recognise learner differences and use them as a productive resource. Modern societies used to value uniformity: we all read the same handful of newspapers and watched the same television channels; we all consumed the same products; and if we were immigrant, or indigenous, or of an ethnic minority, we needed to assimilate so we could all comfortably march to the same national beat. And so it was in schools: everyone had to listen to the teacher at the same time, stay on same message on the same the page, and do the same test at the end to see whether they had learnt what the curriculum expected of them. Today there are hundreds of television channels, countless websites, infinite product variations to suit one's own style, and if you are immigrant or indigenous or a minority, your difference is an aspect of our newfound cosmopolitanism. This is all part of the shift in the balance of agency. Give people a chance to be themselves and you will find they are different in a myriad of ways: material (class, locale), corporeal (age, race, sex and sexuality, and physical and mental characteristics) and symbolic (culture, language, gender, family, affinity and persona). In schools today, these differences are more visible and

insistent than ever. And what do we do about them? Ubiquitous learning offers a number of possibilities. Not every learner has to be on the same page; they can be on different pages according to their needs. Every learner can connect the general and the authoritative with the specifics and particulars of their own life experiences and interests. Every learner can be a knowledge maker and a cultural creator, and in every moment of that making and creating they remake the world in the timbre of their own voice and in a way which connects with their experiences. Learners can also work in groups, as collaborative knowledge makers, where the strength of the group's knowledge arises from their ability to turn to productive use the complementarities that arise from their differences. In this context, teacher will need to be engaged members of cosmopolitan learning communities and co-designers, with learners, of their learning pathways.

Move 4: To broaden the range and mix of representational modes. Ubiquitous computing records and transmits meanings multimodally—the oral, the written, the visual and the audio. Unlike previous recording technologies, these representational modes are reduced to the same stuff in the manufacturing process, the stuff of zeros and ones (Cope and Kalantzis 2004). Also, like never before, there is next to no cost in production and transmission of this stuff. Now, anyone can be a film-maker, a writer who can reach any audience, an electronic music maker, a radio producer. Traditional educational institutions have not managed to keep up this proliferation of media, although, as Chip Bruce says in his paper, educators have known for a long time the value of 'learning through the senses'. But, if educators have not picked up on the easy affordances of the new media, the students have. When they do catch up, the learning seems more relevant, and powerful, and poignant (Cope and Kalantzis 2000; Cope and Kalantzis 2007; Kress 2003). Educators will need to understand the various grammars of the multiple modes of meaning making that the digital has made possible, in the same depth as traditional alphabetic and symbolic forms.

Move 5: To develop conceptualising capacities. The world of ubiquitous computing is full of complex technical and social architectures that we need to be able to read in order to be a user or a player. There are the ersatz identifications in the form of file names and thumbnails, and the navigational architectures of menus and directories. There is the semantic tagging of home-made folksonomies, the formal taxonomies that define content domains, and the standards which are used to build websites, drive web feeds, define database fields and identify document content. These new media need a peculiar conceptualising sensibility, sophisticated forms of pattern recognition and schematisation. For these reasons (and for other, much older, good educational reasons as well), ubiquitous learning requires higher-order abstraction and metacognitive strategies. This is the only way to make one's way through the impossibilities of information quantity. Teachers then need to become masterful users of these new meaning making tools, applying the metalanguage they and their learners need alike in order to understand their affordances.

Move 6: To connect one's own thinking into the social mind of distributed cognition. In the era of ubiquitous computing, you are not what you know but what you can know, the knowledge that is at hand because you have a device in hand. Even in the recent past, we had libraries on hand, or experts we could consult. Cognition has always been distributed, and the most remarkable technology of distributed cognition is language itself (Gee 1992). However, today there is an immediacy, vastness and navigability of the knowledge that is on hand and accessible to the devices that have become more directly an extension of our minds. Those who used to remember telephone numbers will notice that something happens to their minds when the numbers they need are stored on the mobile phone—the phone remembers for you. It becomes an indispensable extension of your mind. This should spell doom for the closed book exam. Educators will need to create new measures to evaluate learners' capacities to know how to know in this new environment.

Move 7: To build collaborative knowledge cultures. Ubiquitous computing invites forms of social reflexivity which can create 'communities of practice' to support learning. In the ubiquitous learning context, teachers harness the enormous lateral energies of peer-to-peer knowledge making. This builds on the complementarity of learner differences—experience, knowledge, ways of thinking and ways of seeing. Learners also involve people who would formerly have been regarded as outsiders or even out-of-bounds in the learning process: parents and other family members, critical friends or experts. The digital workspaces of 'social networking' technologies are ideal places for this kind of work, at once simple and highly transparent when it comes to auditing differential contributions. Teachers will need higher order

skills in building learning communities if they to ensure inclusivity and that all learners reach their potential.

Clearly, the emergence of ubiquitous computing creates new conditions for all working as education professionals and learning as students. The key is not the logic or technical specifications of the machines. Rather it is the new ways in which meaning is created, stored, delivered and accessed. This, we believe, will change the educational world in some fundamental ways—and also allow some older but good and disappointingly neglected educational ideas to work at last and work widely. The journey of ubiquitous learning is only just beginning. Along that journey. we need to develop breakthrough practices and technologies that allow us to reconceive and rebuild the content, procedures and human relationships of teaching and learning.

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