



technology, children, schools and families

Forms of literacy

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1. Introduction

In this review, we outline ways in which literacy is changing due to developments in technology, and review the implications for educational institutions in the future. A number of key themes are addressed in this review, which can be summarized as follows:

Multimodal representational forms and configurations

We suggest that communication is becoming increasingly multimodal in nature due to changes in the media of dissemination and that this is creating new textual configurations that challenge a traditional focus on the written, print mode. This trend will continue in the years ahead as modes continue to be transformed and new modes emerge.

New forms of literacy and knowledge production

Increasing access to a wider range of semiotic resources for meaning-making will impact upon the forms of knowledge that are currently privileged in educational institutions. These will be challenged in the years ahead by the production of knowledge by learners themselves, and pupils' abilities to determine the epistemological and ontological bases for knowledge claims will become more salient.

New purposes for literacy

Traditional distinctions between author and reader/reader and writer are becoming indistinct as we move further into the digital age. In addition, developments in access to a range of representational resources mean that one-to-many communication is becoming more prevalent and creating diverse social contexts for literacy and a strong role for new forms of literacy in identity construction. This trend will continue to develop and will create more opportunities for creative knowledge production by individuals and groups.

Intersections with emerging technologies

Key developments in literacy will intersect with the following patterns in technological development in particular: ubiquity, convergence, mobilization, and personalisation.

Reconfigurations of resources in sites of learning

Classrooms will become increasingly able to address pupils' needs in relation to multimodal analysis and design and there will be greater capacity for pupils to access out-of-school texts and practices within formal educational institutions through, for example, GIS technologies. Classrooms will work to address issues of access and entry level access for disadvantaged groups and will orient more strongly towards embedding literacy instruction in authentic communities of practice.

Pedagogies for design

There is a growing body of work which attests to the way in which pedagogies that enable pupils to design multimodal texts need to be grounded in attention to issues of identity, agency and links to 'real world' concerns. These pedagogies need to be fostered in the future if classrooms are to become participatory knowledge production sites that support creative literacy learning.

Implications for educational goals, structures, methods and resources

The implications of the trends outlined in this paper relate to the spatial and temporal structure of schooling, the transformation of curricula, pedagogy and assessment, the relationship between schooled and out-of-school literacy practices, the provision of resources, and the professional development of teachers. Unless these issues are addressed, formal education will not be able to offer pupils opportunities to develop the literacy skills, knowledge and understanding required in the decades ahead.

The following overview does not offer an exhaustive review of the literature in this field. Rather, we identify key trends and emerging patterns based on our knowledge of the current research base in this area of study and we indicate how these trends and patterns might develop in the next 10-20 years. An historical review of the development of literacy would indicate that new practices and texts emerge, travel in parallel, and compete and intersect over time, although we acknowledge the way in which technological developments have accelerated transformations in literacy practices over the past 20 years. If this rate of acceleration continues, then we would argue that it is not possible at this moment in time to make firm declarations about literacy in the period 2025-2050. Nevertheless, in the following account we anticipate some of the key changes, the outlines of which can already be discerned, and identify how educational institutions need to respond to them if they are to meet the needs of learners in the decades ahead.

Keywords: literacy, technology, multimedia, design, society, creativity, knowledge

2. Key trends

2.1 Multimodal representational forms and configurations

The increasing use of multiple modes of communication and changes in the technologies of dissemination is the focus of this section. However, we would like to begin by emphasising the continuities between past, present and future. Technology has always been an integral part of literacy. In order to write, one needs tools and the nature of those tools shapes the literacy event itself. Communication has always involved a number of modes; multimodal texts were present in the form of the earliest of cave drawings, or the rituals of ancient cultures. Letters, words and symbols will continue to be an integral part of many texts, whatever the means of dissemination, and print-based texts will continue to perform important social work for individuals and communities. Therefore, we cannot anticipate a time in the future when learners will not need to learn the principles of reading and writing alphabetic print. However, developments in digital technologies mean that printed text is no longer the predominant or most highly valued

form of communication. While writing on surfaces other than screens or touchpads will still permeate the practices of everyday lives for the foreseeable future and the relationship between cognition and technology means that for some, the physical act of writing will remain important, developments in technological interfaces will mean that modes other than writing will become increasingly pervasive when undertaking everyday activities. Forms of text and the repertoires of textual practice associated with them will expand. Inevitably, voice-recognition software will develop to the extent that at some stage it will be sophisticated enough to facilitate extensive on-screen writing. Nevertheless, the relationship between speech and writing means that writing will always be a significant mode of communication and will continue to carry high cultural value.

Notwithstanding this emphasis on continuities, there are many ways in which the nature of communication will continue to develop in the decades ahead. Learners will have access to a wider range of multimodal forms of representation both within and outside of the classroom and these forms will become increasingly powerful as cultural practices. Image, sound and movement already increasingly challenge the dominance of writing and both the extent of the use of these modes and their functions within texts will continue to be transformed (Kress, 2003; Jewitt, 2006), with new modes emerging over the next decades (Jewitt, 2008). As a consequence, there will be a need for classrooms to broaden the range of texts that are currently authenticated to include non-canonical texts such as computer games (Beavis 2004, 2007; Burn, 2007) and social networking sites. This is because such texts will become so pervasive in pupils' out-of-school lives that schools will need to offer a platform for critical engagement with them. In addition, social networking sites and games have value in educational settings because of the range of skills, knowledge and understanding they can develop, if used appropriately, and their affordances, which include the opportunities for participation, collaboration, peer feedback and the construction of affinity spaces (see Section 2.3.1 for further discussion of online texts and practices).

Increasing access to digital technologies will lead to greater participation in the production of multimodal, multimedia texts and mobile, networked technologies will mean that physical location across spaces will become increasingly porous in terms of textual production and exchange. Differential levels of economic, social and cultural capital will continue to create barriers to engagement but the move away from the privileging of linguistic modes of communication will challenge the dominance of canonical forms of knowledge.

In order to participate successfully in the communication landscapes between 2025 – 2050, individuals will need to be able to identify appropriate modes for specific purposes and understand the affordances of each mode in order to use or decode them effectively. The ability to understand what happens when semiotic material is transformed across representational modes, and the capacity to determine the appropriate media of dissemination for specific texts will be fundamental to text production and meaning-making. The ability to mix, mash and remix media to suit a range of social purposes, enabled by digital technologies, will lead to the emergence of new genres. As Green's (1998) 3D model of literacy suggests, in addition to the operational aspects of literacy (which relate to the skills and knowledge required to achieve competency in literacy), learners will need to be able to engage with cultural and critical aspects of meaning-making in a digital context (Burnett, in press, a). The cultural dimension emphasises the social and cultural practices that shape literacy in specific contexts eg discourse patterns in online forums, and the critical dimension focuses on the way in which texts are always imbued with particular ideologies and position readers in particular ways. In terms of the latter, this is significant in online contexts in which, often, the authorship of texts is difficult to discern and therefore readers need to draw on a range of cues in order to identify issues of power and ideology.

The role of the screen has shifted the technologies for creating text. Where we once handheld pencil/pens, the focus of text production onscreen has shifted to keyboard and screen proficiency. It has also been to display the layered and inherently multimodal nature of literacy in the contemporary era. Jewitt (2006, p14) notes that while the page is about writing 'the screen is the domain of the visual and is organized according to the organizational rules of the visual'. The screen scrolls rather than sits in static, standardized pages. The screen, in rich complex colours, combines 'image, moving image, writing, speech, sound and other modes' (p14), with the result that print is no longer the only culturally powerful form of text or mode of meaning-making. The layers of visual symbols, audio, print and hyperlinked meaning-making pathways (Jewitt, 2006) requires a deeper understanding of how modal layers create meanings, the skills to construct alternate readings and to mix and remix the layers for a variety of purposes.

This transformation in the communication landscape will take place in a context in which tensions between the global and local will continue to operate. Monocultural approaches to literacy education will be increasingly challenged by a world in which multiple languages, modes and scripts interact and intersect. Linguistic diversity means more than diversity in relation to oral and written modes; multilingual, multimodal communication will become more prevalent through online practices and will need to inform pedagogical practice.

In essence, it is our view that the range of texts in use across the range of technologies (old and new) will continue to expand, as will the repertoires of practice that are required in order to develop mastery. To be 'literate' in this era of expanded textual production will require a commitment to ongoing learning and engagement with new forms of text and the technologies that produce and distribute them. Print literacy and heritage text will always be culturally significant. However, to be truly literate in the next twenty years will require skill sets and attitudes that go beyond those associated with static print.

2.2 New forms of literacy and knowledge production

The transformations that are taking place in relation to the semiotic resources available to text designers also have implications for new configurations of knowledge. As Kress (2003) indicates, knowledge and textual form are interlinked and therefore the key changes ahead will relate to the ways in which knowledge is transformed in new genres and textual forms. The current patterns in relation to the modularization of knowledge (Jewitt, 2006) will continue, in addition to the changes brought about by greater participation by learners in the production of knowledge. This will mean that pupils' abilities to determine the epistemological and ontological bases for knowledge claims will become more salient. Issues relating to new patterns in terms of learners' participation in the production of knowledge are considered further in Section 4.2

A further challenge to traditional knowledge claims lies in the increasing move away from page to the screen (Kress, 2006). This facilitates a greater capacity for the co-construction of knowledge as groups can more easily collaborate across different locations to reconstruct knowledge. However, as Moss et al (2007) point out, there are dangers that technologies such as interactive whiteboards will solidify transmissive pedagogical modes, although this is not inevitable. The work of Hennessy, Deaney, Ruthven and Winterbottom (2007), for example, outlines how whiteboard technology, when used appropriately, can create dialogic classroom communities.

The capacities afforded by digital technologies mean that knowledge production will increasingly be informed by the processes of 'remixing', 'mash-up' and 'sampling' which involves cutting and pasting, reformulating and recontextualising texts (Lankshear and

Knobel, 2006). Again, this has implications for the development of learners' ability to make judgements about sources and evaluate their appropriateness.

2.3 New purposes for literacy

As we began the previous section by emphasising continuities as well as discontinuities in forms of communication, it is also worth noting as we move into this section that there are few 'new' purposes for literacy. The desire and need to engage in social interaction and communication has always been at the root of literacy practices. What *is new* is the range and type of media that facilitate this interaction and the emphasis that different media place on various modes. New purposes also emerge from the ability to communicate across space and time with known and unknown interlocutors. In what follows, therefore, we will focus on the nature of the changes that are occurring with an understanding that some underlying principles and practices remain constant.

2.3.1 Digital cultures and literacies

It is well established that young people are increasingly engaged in literacy practices that take place via, and in relation to, digital technologies (Carrington and Marsh, 2005; Gee, 2004; Lankshear and Knobel, 2006). At time of writing, these technologies include mobile phones, networked desktop computers and laptops, and handheld gaming consoles. The list will grow and change. This is an important shift away from the technologies and artifacts of print. Being competent and able to participate in one's community increasingly requires a repertoire of skills for using these technologies, and for the production, dissemination and 'reading' of innumerable types of text (Carrington, 2008; Kress and van Leeuwen, 1996, 2001; Kress, 2003). New ways of engaging with others, representing oneself across multiple communities, accessing and processing information, and being creative, result from the use of new technologies and the affordances associated with them.

These same digital technologies are increasingly embedded in the every day, making possible new social practices around mobile technologies (Boyd, 2006; Ito, Okabe and Matsuda, 2005), emergent and fluid sub-cultures (for example citizen journalism, fan culture, wikis, podcasting, machinima production, photo and video sharing networks such as *youtube.com* and *flickr.com*, and fan culture), new learning styles and attitudes (Gee 2003, 2004), and enabling new practices with text (Carrington, 2006; Dowdall, in press, a, in press b; Willett, in press). As we noted previously, there is a blurring of traditional distinctions 'between writer and reader, producer and consumer and require a complex range of skills, knowledge and understanding, a fact which is often overlooked by those who seek to suggest that these practices are inferior to traditional literacy pursuits' (Carrington and Marsh, 2005, p281).

The valued practices and capitals in many dominant social fields – corporations, education, government, military, popular culture – are shifting to include those linked to the types of skills and knowledges characteristic of digital texts and the technologies and practices that produce them. These now include texts and practices created within Web 2.0 and Web 3.0 orientations.

2.3.2 Web 2.0 and 3.0 social spaces – new literacies

Recent research strongly suggests that a key driver of the growth of digital literacies is their potential for developing and maintaining a range of social relationships. Web 2.0

social networking sites such as *Bebo.com*, *Facebook* and *MySpace* provide opportunities and drivers for young people to create dense, sophisticated texts that do particular kinds of social work on their behalf. These texts mash together print, audio, animation, and image and allow individuals opportunities to speak to diverse audiences, across geographic locations, to craft representations of self and to reinforce intimate social connections with friends and family (Davies and Merchant, in press).

Earlier 2.0 social networking has been supplemented by the emergence of immersive Web 3.0 virtual worlds. Bell (2008) defines a virtual world as a "synchronous, persistent network of people, represented as avatars, facilitated by networked computers" (p2). This definition means that there is: the use of a digital representation or puppet that is controlled by a human in real time, a sense of co-existence and sharing of time and space, along with the perception of distance, a persistent existence that goes on whether or not a particular participant is in the world, the ability to interact with other participants and/or the environment, and a network of computers that facilitates the transmission of complex data and communication. In early 2008 there were already 350 million avatars (more than the population of the USA) created and registered in virtual worlds. By 2011, more than 50% of all children in countries with accessible broadband will be engaging in virtual worlds (Reppen, 2008) and creating and deploying avatars (digital representations controlled by a human in real time). In 2007, Weinstein and Myers noted that, of the 34.3 million kids and teens with Internet access, fully 24% of them (or 5.3 million) were currently logging onto a virtual world at least once a month. That figure is expected to more than double to over 53% in the next four years.

This is significant. A new generation is growing up in an era and culture where it is normal social practice to design and deploy an avatar (or many) in a range of online worlds. Space and social networking are key here. The decline of public spaces in which young people can congregate and engage in social interactions is a significant shift, the ramifications of which are playing out in the growth of social networking and virtual worlds as social destinations for this group. As part of this process of engaging in virtual worlds, young people are engaging with and producing a range of digital texts in addition to traditional print texts. In terms of the recent literature around digital media and digital literacies (Carrington, 2008; in press; Jenkins et al, 2006; Marsh, 2008), there are grounds to further examine young people's engagement with virtual worlds in relation both to the skills sets and attitudes and to the practices with various forms of text they develop as a consequence. In their use of virtual worlds, children and young people engage with a range of written texts, such as messages from friends and in-world books, catalogues and newspapers. They create written texts and have opportunities to submit stories and poems to some of the sites (Marsh, 2008). It is significant, therefore, that users of virtual worlds are also creating a wide range of multimodal, digital texts both within world and on websites related to their favourite virtual worlds. For example, 'Club Penguin' machinima are a popular genre on YouTube.

It is increasingly valuable to be able to create multimodal texts that can operate across a range of platforms, to rapidly critique information from a range of sources, to move back and forward between basic skill in print literacies and skill in multi-literacies, and to participate in peer learning contexts and informal settings (Sefton-Green, 2004). The term 'produser' (Bruns, 2006) – a user and producer – is appropriate here as young people increasingly both use and produce content and information and take on roles as active participants in online and offline social groupings.

A key focus of a view of literacy as key to effective engagement in a participatory culture is the communality of many of the practices. This is also the philosophy underlying contemporary views of literacy as a socially situated practice. Of course, while Jenkins et al (2006) suggest that students must be able to read and write before they can engage in the emerging participatory culture, many of us working in literacy education would now argue that this same participatory culture should form the context in which

practices around text (including baseline reading and writing around print) are developed. There is not a neatly sequential and linear relationship between basic print skills and the analytic skills and higher order interactions necessary for engagement with digital texts and the participatory cultures they allow. The four resources model of Freebody and Luke (1990) outlines how learners need to undertake four inter-related roles in order to become successful readers and writers: code breaker (coding competence), meaning maker (semantic competence), Text user (pragmatic competence), Text critic (critical competence). We would suggest that these four roles can be developed alongside each other from the earliest years in relation to engagement with a variety of texts across a range of media. Further, there must be opportunities for these skills to be embedded in a pedagogical approach that encourages and supports customized learning experiences and life pathways and makes effective use of new technologies.

Effective literacy programmes can no longer legitimately focus on sequential individual development around predominantly print-only skill sets. Teachers and students must build palettes of skills and attitudes that enable collaboration, a sliding expert-novice relationship, online and offline networking using a range of texts, creative remixing of content and media, and ethical engagements with diverse and mobile communities.

3. Intersections with technology: key concepts for the future of literacy

There are a number of ways in which developments in technology are impacting upon literacy and we anticipate that these developments will intensify those transformations in the years ahead. The key developments relate to the following concepts:

Ubiquity – Bell and Dourish (2006) argue convincingly that we already have ubiquity. The 'real world' of ubiquitous computing is however 'messy' and 'we will always be assembling heterogeneous technologies to achieve individual and collective efforts' (p7). Seamless, shiny, futuristic ubiquity is an illusion. In the same way, ubiquitous literacy is also an illusion. We will always be 'assembling heterogeneous' texts created across a range of mismatched technologies in order to achieve individual and collective goals. However, daily life is moving towards greater integration as digital technologies become deeply embedded, creating intelligent environments. It is likely that the ways in which young people perceive and experience digital technologies that are pervasive across space and time will continue to evolve. There are a number of projects that currently use technology to engage people in activities that involve interaction with texts embedded in a range of physical locations and artefacts outside of formal educational institutions, such as the Leeds 'City Poems' project in which users can access text message poems at various points across the city. These kinds of engagements with text in specific locations are significant for building connections between people and the spaces in which they live and work and such projects have the potential for developing children and young people's sense of agency in relation to their location and communities of practice. As Greenfield (2008, p57) suggests, with this technology, teaching will be 'transformed by objects, transactions and places endowed with the ability to speak themselves – an ability inherent in almost all schemes for the deployment of ubiquitous informatics now being contemplated.' The development of more sophisticated context-sensitive technologies will mean that pupils will have access to relevant information and texts at the point of need.

Convergence – As technologies, their affordances and the repertoires of practice associated with them converge (Jenkins, 2006), we believe that there is an accompanying convergence of distinct forms of text into new integrated forms of digital

text. Examples of such texts are blogs that draw on multiple modes, and machinima. These integrated texts will not replace more traditional forms of texts. Their emergence will broaden the set of literate practices and technologies with which citizens are required to achieve levels of mastery.

Personalisation – One of the lessons of emerging virtual worlds is that young people coming of age as literate citizens in the early 21st century have an expectation of endless customization, both of experience and of self-representation. Many of their uses of digital text and the technologies that enable their production and distribution reflect high levels of personalization. Laptops, mobile phones and hand-held gaming consoles are highly personalized with stickers, skins, charms and musical tones; the digital texts produced via these technologies are also personalized via the distinct mixes and remixes of media and genre (see for example, the very distinct home pages characteristic of *bebo.com* and *Cyworld*). This trend towards customization will impact on the learning styles and expectations of individual students and will ultimately begin to shape the pedagogies of classroom instruction. For example, learners will expect to be able to work independently at times on textual construction, adopting a bricoleur approach that will require work on aspects of intellectual property and copyright. Issues of identity construction and performance of identities will need to be more centrally embedded in some classroom practice. The ongoing emphasis on personal customization locks children and young people into consumerist discourses in which they become a focus for commercialization in a globalised market. Whilst a number of moral panics have ensued around this issue, Cook (2008) reminds us that the relationship between childhoods and the economic market is two-way; some process of co-construction occurs and children and young people are able to exercise agency at some level, albeit frequently framed by the structures of capital. The well-being of children and young people becomes a central site for contestation in this scenario and the way in which new technologies and digital practices contribute to well-being, as well as the disbenefits related to such engagement, need to be considered.

Mobility - Handheld computing devices are making inroads into educational settings, just as they are in settings outside of school. The work of Ito, Okabe, and Matsuda (2005) on personal and portable digital devices describes the ways in which they have become embedded in everyday life. The trend for technology to be embedded in personal, portable devices will continue so that clothes, jewellery and other artefacts will increasingly facilitate a technological navigation of everyday tasks such as finding directions, communicating with others and extracting information from online databases. This scenario is not too far away from pupils' experiences in the immediate years ahead. For example, Disney have recently launched a new virtual world for children, *Pixie Hollow*, that incorporates clickable technology so that users can trade information via bracelets. Increasing mobility allows young people to maintain co-presence across a range of social and geographical locations. Young people living in Melbourne or London are able to maintain strong connections to communities physically located in other countries. This is particularly interesting in relation to the movement of individuals and groups – voluntary and involuntary - as part of increasing globalization and environmental change. The incorporation of handhelds into classroom learning contexts allows for personalisation of learning, facilitates a more seamless embedding of ICT into everyday learning activities (as opposed to the computer lab or suite), and creates a bridge between in- and out-of-school learning activities (Faux, McFarlane, Roche and Facer, 2006). From the perspective of sustainability and resourcing in schools, the increasing sophistication and power of handhelds is providing a cost-effective alternative to older forms of ICT access, such as laptops, tablet PCs, and desktops. Importantly, this movement toward portable and personal technologies matches the ways in which early adolescents engage with digital technologies outside the classroom, and may lead to more authentic and engaging learning experiences that bridge school and community contexts, opening up new forms of inquiry.

Remix, mashups and copyright - The new remix culture and its implications for the design and creation of screen-based texts will require ongoing dialogue about fair use, delineations of text and writing (versus media production) and the ways in which the young understand what a digital text is and does. Increasing access to digital technologies is already leading to the democratization of the tools of remixing media across a range of modes, purposes and audiences and to a greater expectation of individual creativity rather than static reception of heritage text forms. Copyright issues and debates notwithstanding (O'Brien and Fitzgerald, 2006), this process will continue and escalate into the foreseeable future.

4. Interventions, developments and strategies of relevance

There are a number of studies which point towards the key pedagogical and curricula challenges to be faced in the forthcoming decades. The 'D-I-Y' media culture outside of schools (Sharp, 2006) is inevitably impacting upon the school curriculum as educational establishments begin to respond, however slowly, to the 'digital capital' (Merchant, 2007) pupils bring with them to nurseries and schools. This has led in recent years to interventions and developments that focus on reconfigurations of resources and new pedagogical strategies that focus on design.

4.1 Reconfigurations of resources in sites of learning

The Multimodal Production of School English Project (Kress et al, 2005) indicated the extent to which multiple modes are used in the co-construction of knowledge in the classroom. Space and time are also key factors in this production of knowledge. Leander (2007) illustrates how schools bracket space and time in ways that do not happen in pupils' out-of-school digital practices, which proffer simultaneity rather than linearity. Space and time are also being transformed in classrooms that attend to new configurations of modes and work with a wider range of legitimated representational forms (see Jewitt, 2008, for an excellent summary of recent work in this area).

Davies (in press) argues that Web 2.0 spaces are significant learning spaces. Her work examines the ways in which playful collaboration helps individuals to learn from others through sharing and discussing content online. She suggests that the organisational templates that structure text-making within many online social spaces can help scaffold learning and develop creativity. Davies and Merchant (in press) contend that social networking software provides classroom-based opportunities for developing a range of literacy skills and to reflect with learners upon the affordances and constraints of various technologies and software. While the educational possibility for using such applications to create virtual communities (Rheingold, 1993), and to promote situated learning (Lave and Wenger, 1991), is well documented, research into implications for literacy is still in its infancy (Merchant, in press). Central to this work, we believe, is an engagement with the implications of identity work around avatar construction and ongoing customization. In addition, attention needs to be paid to the way in which virtual worlds facilitate intricate patterns of interaction, given the extent of their use in children's out-of-school practices and the way in which virtual networks reinforce offline social capital. As Gillen (in press) suggests, in a study of literacy practices and texts within virtual worlds, that 'in the complexity of the communicative tools and the relations between them, literacy practices involve cultural knowledge, the employment of artifacts and representations of the world'. This will be a key area of research in the forthcoming decades as Web 3.0 developments enable learners to integrate identities, artifacts and practices across virtual spaces.

Print literacy instruction has tended to take place in socially sanctioned institutional settings: the school classroom, the family home, the Sunday School. As young people transition back and forth between these institutions, instruction remains adult-mediated. Teachers, caregivers and other adults choose texts, provide 'appropriate' skills and knowledge, model correct 'readings' and provide feedback. In this sense, adults operating within these institutional frames, and drawing upon the sanctioned authority afforded them, decide which texts, literacies and therefore the kinds of identities, social and economic access to which young people will be entitled. This sits in stark contrast with the ways in which new technologies enable the construction and distribution of new narratives of identity via new forms of text (Carrington, in press).

4.2 Pedagogies for design

The pedagogical moves identified in the multiliteracies framework (Cope and Kalantzis, 2000) - situated practice, overt instruction, critical framing, transformed practice - have been implemented in classrooms that attend to multimodal design (Walsh, in press). Such pedagogical strategies demand attention to the way in which learners' identities and agency underpin both textual production and analysis. This approach to design must, we suggest, be located within a participatory pedagogy that prioritises communities of practice (Lave and Wenger, 1991) that pivot around social and group interaction and learning (rather than the individual growth model of traditional literacy instruction), shared and authentic purpose and a shared narrative. A participatory framework for literacy learning would also explicitly include a fluid expert-novice learning relationships linked to specific aspects of tasks and technologies rather than traditional adult-child hierarchies.

This increasing focus on the development of pedagogies that facilitate transformational practice and participation has precipitated research that has focused on the digital literacies of pre-service teacher education students in countries around the world. Burnett (in press) and Robinson and Mackey (2006) have investigated the digital literacies of undergraduate students in the United Kingdom and Canada. Kerin (in press) is working to chronicle the challenges, successes, and problems associated with the introduction of a digital portrait as a mandatory assessment task for a literacy course within an Australian teacher education programme. This unit represents part of a larger priority of equipping a new generation of teachers with the knowledge necessary to expand their students' experiences and skills around text. In the United Kingdom, a range of postgraduate programmes are explicitly building a professional knowledge base around digital literacies (for example, the University of Sheffield has developed an online MA in New Literacies). The Daiwa Foundation is supporting collaborative research between the United Kingdom Literacy Association (UKLA) and institutions in the United Kingdom and Japan directed at building capacity for teaching digital literacies in pre-service teacher education programmes.

Jenkins et al (2006) have identified the emergence of a new participatory culture and as a corollary, a set of key competencies essential for engaging effectively in contemporary meaning-making practices with new media. It is our belief that the shift to a new moment of participation and the need for particular approaches and skill sets has significant import for the ways in which literacy should be conceptualized and developed. Carrington (in press) outlines how the categories identified by Jenkins et al (2006) relate to digital literacy practices (Table 1).

Table 1: Digital literacy practices in a participatory culture

Capacity	Practices with text
<i>Play</i>	Playing with font, text, mixing and matching formats, trialling new media; playing with narrative structure using photographs and hidden notes.
<i>Performance</i>	Foregrounding particular identities in online sites – blogger, researcher, story maker, photographer.
<i>Simulation</i>	Narratives that demonstrate understanding of the nature of linear time sequence; demonstrating capacity for research process and interaction in multiple communities and across multiple forms of text.
<i>Appropriation</i>	Use of photos from other sites, combined with information and narrative to create new texts; use of range of aspects of digital technologies to develop and distribute texts.
<i>Multitasking</i>	Construction of narrative sequences in images and text; planning blog and wiki entries; mixing/matching instant messaging and social networking site change/maintenance
<i>Distributed Cognition</i>	Ability to interact with the internet and with other technologies (eg digital cameras). These expand their capacity to interact with a range of audiences and to develop a range of skills and capacities as they draw from a communal pool of knowledge.
<i>Collective Intelligence</i>	Texts created within social networking sites and engagement with communities in fluid expert-novice relationships; contribution to shared sites (eg Wikipedia)
<i>Judgement</i>	Research skills around areas of interest, using online and offline texts and other sources
<i>Transmedia Navigation</i>	Use of podcasting, images, text, hyperlinks
<i>Networking</i>	Use of networks to distribute information and texts gained by research and constructed narratives; participation in community to develop and distribute texts
<i>Negotiation</i>	Scaffolding/mentoring into a range of communities. The feedback received from audiences as well as direct mentoring provides opportunities for developing skills to negotiate multiple communities.

(Adapted from Jenkins et al, 2006)

The move to participatory textual practices has inevitably created shifts in how children and young people access and use information. Concerns about plagiarism through cutting and pasting often bypass considerations of the complex way in which texts are produced and reproduced in digital contexts, through the processes involved in searching, analysing, reproducing and collating. Recontextualisation of texts has also taken place in relation to print-based practices for many years (Dyson, 2002) – children and young people have always drawn on their textual experiences across a range of canonical and popular forms in their construction of new texts. What is new about the process of digital textual production is the breadth of texts accessible to authors and the necessity to refine and extend techniques relating to searching and reproduction. The rhetorical styles developed through these processes conform more readily to Bakhtinian (1981) notions of dialogic engagement with the authority of texts.

Assessment

There will need to be radically different forms of assessment in 2025-2050 if educational institutions are to respond appropriately to the developments in forms of literacy. Emergent work in this area indicates that current modes of assessment are too focused on the alphabetic principle and are inadequate to meet the needs of pupils who are engaged in the analysis and production of multimedia, multimodal texts. In a number of

national and local projects in England which involved primary and secondary pupils in the analysis and production of multimodal texts Marsh (2007) identified an additional range of skills, knowledge and understanding important in the digital age (Table 2):

Table 2: Key competencies in new literacy practices

<i>Key competencies</i>	<i>Examples from projects</i>
<i>Understanding of the affordances of various modes and the ability to choose appropriate modes for specific purposes</i>	Children produced a wide range of multimodal texts that required understanding of the affordances of modes and how modes could work best together to achieve goals. These included: texts that were solely written or oral or consisting of only still images or moving images; texts combining one or more of these modes; animated films; live action films; podcasts; animated powerpoint presentations; photostories.
<i>Understanding of various media and the ability to choose appropriately for specific purposes</i>	Children used a wide range of media in the production of texts and made critical judgements about which media to use.
<i>Skills in the various modes that enabled them to decode, understand and interpret, engage with and respond to and create and shape texts</i>	Children developed a wide range of skills including: knowledge of the alphabetic principle and abilities in reading and writing print; ability to read both still and moving images; understanding of the features of various genres; understanding of the principles of transduction in the production of multimodal texts; ability to navigate texts across media, follow hyperlinks, read radially etc.
<i>Ability to analyse critically a range of texts and make judgements about value, purpose, audience, ideologies</i>	In the development of multimodal texts, children were reviewing a wide range of online and offline texts in order to inform their work. They also regularly reviewed their own and peer's work.
<i>Ability to select and use appropriately other texts for use in the design process</i>	In the blogging project, children produced texts that remixed media content. Children made animated and live action films, and powerpoint presentations, that incorporated music.
<i>Ability to collaborate in text production, analysis and response</i>	Children were successful in collaborating both with known and unknown others in the production and analysis of texts. Social networking software, for example, enabled them to comment on others' work and develop an understanding of the value of networks.

It is our contention that these skills must be developed within a participatory framework that takes account of the emergence of culturally significant digital technologies. Being competent and able to participate in one's community increasingly requires a cocktail of skills around technologies and the production, dissemination and 'reading' of innumerable types of text. The affordances of these new digital texts - which include multimodal media productions, text messaging across various media, computer games, and social networking sites, provide and require different sets of aptitudes and skills

(Bearne et al, 2007; Carrington 2005, 2007). The challenge in the years ahead, therefore, is to develop assessment frameworks that recognize the range of skills, knowledge and understanding outlined in Tables 1 and 2.

There is currently a lack of attention to issues of continuity and progression in learners' abilities to make meaning from and produce multimodal texts. This will be the focus for research in the next decades and will lead to new understandings regarding the construction of a curriculum that scaffolds learners' skills and knowledge. From 2005-2007, the British Film Institute conducted a project, 'Reframing Literacy', in which lead practitioners in over 60 Local Authorities in England took part in a range of curriculum initiatives that focused on moving image media education. Marsh and Bearne (2008), in a review of the outcomes of that project, identified the need for research that enabled practitioners to understand key stage phases in the development of pupils' knowledge, skills and understanding of multimodal texts. There are currently two UK research projects in progress focusing on this area – a QCA-funded project led by the BFI, UKLA and CLPE and an ESRC-funded project based at the Institute of Education and led by Buckingham and Burn. In 2025-2050, we anticipate that there will be a fuller understanding of continuity and progression in relation to multimodal, multimedia texts and that will lead to more focused teaching strategies that enable practitioners to identify the individual needs of learners.

5. Implications for educational goals, structures, methods and resources

Current research is indicating the way in which schools need to evolve if they are to enable pupils to develop literacy skills appropriate for the digital age. In relation to educational goals for literacy, there needs to be a move away from a focus on a restricted set of representational forms that legitimate particular ways of knowing to the recognition that knowledge construction requires attention to a wide variety of modes and media. Learners will still need to acquire a set of skills relating to particular technologies in order to become literate, but these skills are broadly configured and situated in specific contexts that shape understanding. This entails a move from a proscribed curriculum to one focused on the co-construction of knowledge and opportunities for authentic engagement and participation in a range of communities that draw on the identities, agency and everyday practices of pupils. Educators will begin to use remixing and mashing as a critical digital literacy tool, remixing media and textual content to read, critique and shift discourses and representations. Students will be provided with opportunities to submit remixes instead of print-based linear essays or narratives as assessment pieces. The relationship between curriculum, assessment and pedagogy is critical to transformative practice and, as suggested in Section 4.3, there is an urgent need to develop modes of assessment that meet more effectively the demands of digital communicative practices.

The structure of schooling needs to be transformed if the educational goals outlined above are to be achieved. Space and time are currently key restrictions on the development of pedagogies that facilitate the learning of new literacy practices. Removing vertical timetabling structures to enable prolonged and iterative activities is needed, in addition to the further breaking down of barriers between subjects. In addition, the education of children in distinct age phases that are separated by physical as well as curriculum structures needs to be challenged. Intergenerational literacy practices are part of the everyday lives of pupils; these should be made possible in schools. Intergenerational literacy learning is bi-directional between younger and older members of families, although developments in digital technologies have extended younger family members' roles in this process.

The resources needed to further the development of digital literacy within education are linked to technologies in ways that we have signaled throughout the paper, but not exclusively so. There are key barriers to progress that need to be addressed, such as the use of firewalls by Local Authorities, and access to fast speed broadband that will enable participation in Web 2.0 and Web 3.0 practices. Additionally, schools need to move away from the static laboratory model of computer access towards more portable technologies such as handheld computers and/or laptops that reflect more closely the ways in which young people access and engage with out-of-school technologies and digital literacies.

Further attention should be paid to the relationship between in- and out-of school literacy practices, both to the continuities (Bulfin, 2008) and discontinuities (Marsh, in press). Pupils who do not have access outside of schools to the key tools of participatory cultures will become increasingly disadvantaged if they do not have access to these tools and related spaces in schools. To ameliorate disadvantage, classrooms could profitably be built around participatory pedagogies that make use of a range of technologies to provide opportunities to recognise and incorporate fluid expert-novice relationships, establish the teacher as a primary model of an expert-learner, embed opportunities for pupils to strategise and form communities of practice, and draw explicitly on outside expertise and contribute expertise to other communities. The current dissonance between home and school practices may be ameliorated to some extent by the further development of mobile technologies (see for example, the 'Dreamcatcher' project led by Futurelab¹) and in the decades ahead we envisage further research that outlines how family literacy projects and home-school knowledge transfer projects can use digital technologies to ensure literacy practices seep across domains.

Pedagogical approaches will need to focus on the enhancement of pupils' critical digital literacy in the tracing of authorial intention and construction of power, agency and identity in texts. Recent research has identified a range of emergent issues that relate to participatory textual practices, such as trust, reputation and privacy, in addition to concerns regarding intellectual property and copyright (O'Brien and Fitzgerald, 2006). In online communities, trust and reputation are built up over time and are constructed from markers such as discourse styles, use of the textual practices of particular affinity groups, such as memes, and the deployment of intertextual references (Davies, in press). Ratings are also used to construct online reputations, on sites such as 'e-Bay' and 'digg'. Issues of privacy are salient in online contexts in which it is relatively easy to find personal information, and children and young people need to develop strategies that will enable them to manage their online identities in terms of the level of detail they are prepared to share with different audiences. In addition, childhood as a site of economic interest means that the commercialisation of texts and practices needs to be paid attention to in the literacy curriculum in ways which recognise the interaction between structure and agency in this process, as previously discussed. Because of lack of attention to these areas in schools, children and young people have developed strategies for the management of information and identities online, but not all children and young people are aware of these and they need opportunities for reflection on these issues in a classroom environment in which critical literacy practices can be enhanced.

Key to effective incorporation of appropriate and creative blends of digital and print literacies into classrooms in ways that have positive outcomes for pupils is the preparation of pre-service teachers and the ongoing professional development of teachers working in classrooms. While researchers have been addressing the implications of the changing communications and technological landscape for literacy and literacy education, pre-service and in-service programmes for teachers have been slower to respond. If schools are to meet the challenges of the new communication landscape and enable teachers and pupils to engage in new forms of literacy then there should be

¹ <http://www.futurelab.org.uk/projects/informal-learning-ideas/dream-catcher>

greater attention paid to the role of teachers as knowledge creators in this endeavour. There is much research that indicates the value of the development of national and international networks of teacher researchers, supported by academics, which can lead to new configurations of literacy curricula and pedagogy (Comber and Reid, 2007; Comber and Kamler, 2006).

6. Conclusion

In this paper, we have outlined various emerging trends in literacy research and practice that will impact upon education to 2025 and beyond. For the most part, we see future developments as being firmly based in current practices and are therefore not predicting significant changes. Instead, we would argue that many of the aspects of literacy already present in today's society that challenge the traditional emphasis on writing will become more prevalent in the decades ahead and that multimodal communicative practices outside of educational settings will continue to drive change within schools. The scenarios outlined above relate to the BCH theme of **knowledge, creativity and communication** in the following ways:

Changing forms of literacy mean that **communication** in 2025-2050 will involve a greater range of modes than are currently prevalent in text production, and analysis and modes currently used will continue to be transformed as technologies advance. This has implications for the range and types of textual forms that learners will encounter across home and school domains.

Communication will continue to be multicultural in nature, with multilingual modes of communication becoming increasingly central to schooled literacy practices due to migratory practices and online communication, which offers potential for linguistic interchange and hybridity to occur.

Communication will take place across a greater range of domains and the boundaries between sites of formal and informal learning will further dissolve, in addition to the boundaries between 'real and 'virtual and 'online and 'offline' spaces becoming more fluid. Literacy practices across space and time will lead to transformations of texts and practices and challenge the current boundaries between semiotic domains.

Changing forms of literacy will impact on the extent to which learners have access to powerful texts and practices in the digital age. **Communication** will be more collaborative in nature and diverse 'affinity spaces' (Gee, 2004) will develop more extensive means to engage in participatory activities. However, greater access to communication technologies within and outside of educational institutions will not dissolve the structural constraints imposed by economic, social and cultural capital.

There will be an intensification of the current trend for many learners to participate in the **creative** production of a range of multimodal, multimedia texts.

Digital **creative** production needs to be informed by the operational, critical and cultural (Green, 1988; Burnett, in press) aspects of literacy education. There has been an over-emphasis on operational elements of literacy in the recent past and future developments will need to place culture and critical engagement more centrally.

Issues of identity and affect are central to **creative** approaches to literacy learning and will become more salient to curricula and pedagogy in the future.

Knowledge production will be a dominant trend in the decades ahead, fuelled by greater access to participatory networks in which a more diverse range of literacy texts and practices will be used in the construction/recontextualisation of knowledge. This will

need additional emphasis in the literacy curriculum on aspects of aesthetic, ethical and critical choices/judgements.

These pressures for change will not go unchallenged. 'Literacy' is always linked to strong views and conflict. Old debates will continue and the latent prestige of some forms of heritage print remain. However, it is clear that print-based literacies are *necessary* but no longer *sufficient* to ensure that all the students who enter our classrooms in the next generation leave them prepared to take on roles as active and effective citizens in communities where digital and older technologies coexist.

This new communication landscape brings with it a range of possible futures for schooling, dependent upon the social cultural, economic and political factors that will shape the field in the years ahead. There are a number of possible scenarios that might emerge. On the one hand, it is not unlikely that the education sector will experience a range of policies that have as their aim the rehabilitation of heritage print within a hierarchical schooling system. The focus on technology in relation to literacy will be on the use of hardware and software to increase competence with written, printed texts. However, policy and curriculum scenarios that prioritize heritage models of print will bring with them growing difficulties in engaging students and achieving desired outcomes around literacy as students' out-of-school practices become increasingly focused around new technologies and a broader range of modes and purposes. At the extreme end of this scenario, students and families with the economic and social means will attempt to find appropriate educational opportunities outside the mainstream education systems.

A further scenario is one in which there is no deliberate attempt by policy-makers to reinforce traditional literacy practices but instead there is evidence of apathy in the face of rapid developments in digital literacy practices outside of school. This may lead to some tinkering at the edges of the curriculum so that references to multimodal texts and practices permeate curriculum frameworks, but this will fail to address the widening gap between home and schooled discourses. Lack of sustained attention to such matters in pre- and in-service teacher education will mean that teachers are not prepared to drive further changes and the curriculum will become increasingly anachronistic. Teachers may become frustrated by a lack of attention to digital literacy and begin to introduce curriculum and pedagogical changes themselves, but this will be undertaken in a haphazard and individualised manner which will not lead to a coherent and progressive curriculum. Some Local Authorities may develop authority-wide action research networks around some issues relating to digital literacy, but these will be focused upon specific aspects of interest (such as film, computer games, virtual worlds) that are tied into enhancing the literacy skills of particular groups (e.g under-achieving boys) and will not enable a broad and balanced digital literacy curriculum to be created.

On the other hand, the emergence of new technologies has the potential to support a move towards schools and classrooms as learning organizations where notions of participatory culture and recognition of the affordances of new digital communications technologies underpin curriculum design and approaches to literacy and literacy instruction. In this scenario, students take on roles as knowledge producers and are mentored into models of ethical engagement with a range of learning networks in and outside the classroom. Teachers adopt roles as expert learners who model practice and learning relationships. This will need policy-makers to take a strong lead in drawing together relevant stakeholders, such as teachers, researchers, academics, subject associations, parents and children and young people themselves to identify ways in which curriculum and pedagogy need to be transformed and to develop a sustained and long-term plan for this change which includes attention to resources, professional development for teachers, training for parents and family members and changes to assessment frameworks that de-emphasise the focus on traditional literacy practices. Unless this work is undertaken, patterns of literacy teaching in the years 2025-2050 may

be firmly embedded in epistemological and ontological frameworks more readily suited to 19th and 20th century paradigms of alphabetic print.

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