Postprint of journal article available at http://www.wwwords.co.uk/rss/abstract.asp?j=elea&aid=4517.

The published article should be used for citing specific page numbers.

Citation:
Casey, Leo, & Bruce, Bertram C. (2011). The practice profile of inquiry: Connecting digital literacy and pedagogy. *E-Learning and Digital Media*, 8(1), 76-85. [ISSN 2042-7530]

The Practice Profile of Inquiry: Connecting Digital Literacy and Pedagogy

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Abstract: This article elaborates on the Inquiry Cycle as an appropriate model of learning for the digitally enhanced classroom. Its goal is to provide a useful link between theory and pedagogic practice. This involves taking a new look at the concept of digital literacy. The authors propose a conceptual framework connecting classroom practices and elements of the Inquiry Cycle. This framework, including a specific definition of digital literacy in primary schools, draws on the theoretical work of Dewey from which the Inquiry Cycle is derived. The approach was developed and validated in a study of the teaching practices in eight Irish primary school classrooms reported here. A further outcome of this research, the Practice Profile of Inquiry, is introduced and discussed here. The authors propose this as a useful framework to connect instructional strategies and digital media in classroom practice. Furthermore, they suggest that the Practice Profile of Inquiry may be used as a tool to facilitate teachers as they plan projects and classroom activities to optimise learning.

Background

We have a task to prepare our children for a future – a future that we cannot predict. As Dewey (1938) suggests, the best we can do is to help them experience the present world and reflect upon those experiences to the fullest extent. This involves extracting or making meaning from experience. Our task, as teachers, is to facilitate, support and direct children as they experience the world and strive to make their own meaning. Today, we have new

options available to support this process. Digital technologies make it possible to capture the world through pictures, sounds and audiovisual sequences; and to assemble, organize and present in these modes with or without text. In the classroom, children of all ages and abilities can use many of these tools to participate in activities – explore, engage, create and share – thereby they experience and make meaning. This is why we need to understand digital literacy and how it connects to learning and teaching.

Digital technologies offer new opportunities and pose new challenges for educators. Teachers and parents see value in active, creative and collaborative new media engagement (Smeets, 2005; Turvey, 2006). However, reports are anecdotal and effects are not reflected in standard formal teaching practice. The task of translating these opportunities to curriculum and instructional practice remains a significant challenge for educators and policy makers (Mulkeen, 2003; Tondeur, van Braak, & Valcke, 2007).

There is a need for a new pedagogic approach, a collection of conceptual tools to take account of new digital technologies and their use in learning and teaching practice. As a starting point we suggest it is necessary to review the concept of digital literacy and to seek a specific understanding of what digital literacy means in the setting of the primary school classroom. We argue that digital literacy should be framed in terms of the process of learning, particularly the model of learning suggested by the Inquiry Cycle (Bruce, 2009; Bruce & Bishop, 2002, 2009).

Digital Literacy

We start by asking what digital literacy is and why is it so important in the context of education in the 21st Century? When we use the term literacy in the everyday sense we often refer to a set of skills associated with the ability to read and write. But a deeper look shows that literacy is much more than isolated skills, and that it extends beyond reading and writing as usually conceived. Literacy implies the capacity to communicate meaning – from speaker to listener, from writer to reader, from creator to viewer. Literacy is best understood through the concept of participation. Literacy enables participation and new technologies give rise to new forms of participation hence new literacies.

Digital literacy is often described as a new literacy. However, we should bear in mind that as adults we get to name the world and what we regard as new technologies are so described because they are new to us. They are not new for many of our primary school children – they have not known the time before. As adults, we can reflect on our own childhood and ask ourselves how many new forms of communication are available today that were not part of our childhood experience – text messaging, e-mail, pictures, and digital video are but a few. The impact of these technologies in the classroom is of interest.

We can identify three ways in which digital literacy can influence the practices that take place in the primary school. Firstly, digital technology has and continues to shape the life experiences of young people (Hull & Zacher, 2004; Lankshear & Knobel, 2008; Leu, Kinzer, Coiro, & Cammack, 2004). Secondly, as technologies continue to develop, primary teachers to varying degrees become aware of and strive to appropriate new digital tools for use in the classroom. This sphere of influence is described in Mishra and Koehler's framework for teacher's Technological, Pedagogical and Content Knowledge (TPACK) (2006). The third area of impact, what is of interest here, is in how digital technology is enacted through classroom practice. This influence is not solely as a result of the teacher's technological competence or the student's level of comfort with digital tools – it is something new; it is practice based and arises from what teacher and pupils do together. From a literacy perspective, it is not about the children's digital literacy nor is it about the teacher's digital literacy rather it is about the literacy of the classroom.

Drawing from the wider discourse on the nature of literacy two conceptual approaches can be contrasted: literacy defined as 'technical skills' (OECD, 2000) and a wider view of literacy that emphasizes contexts and 'social practice' (e.g., Barton, Hamilton, & Ivanic, 2000). When we use the term literacy in the everyday sense we often refer to the skills approach. However, the situated or social practice approach is now widely accepted as a more useful and comprehensive perspective particularly for adult literacy (Papen, 2005); literacy is regarded as much more than isolated skills – it is embedded in social practice. Literacy activities occur in social, cultural and technological contexts, and are created and sustained by contextual factors – literacy is a social product and like language itself is interactive and dynamic (Barton & Hamilton, 2000; Bruce, 2003; The New London Group, 1996).

As is the case for literacy in general, digital literacy has a power dimension; in the last few decades, it has transformed from technical or specialist literacy into an everyday literacy. Teaching with digital technology has therefore also to do with preparation of pupils for future participation in an evolving society where new media practices are deeply embedded in the associated structures and processes. As such, digital literacy encompasses the purpose, setting and practices in which technology is used. In this way digital literacy has a special meaning in the classroom – bound up in the relationship between activity and purpose – learning and literacy are interlinked.

For research, contrasting conceptions of digital literacy give rise to different research orientations and methodologies. In primary school contexts, the skill-no-skill approach is particularly limiting – there is little to be gained by testing nine year olds for specific sets of discrete digital skills. On the other hand, the social practice model suggests research based on observation of classroom practices in their totality. In this way we can investigate digital literacies as embedded in learning activities (Casey, 2008). Thus, digital literacy is framed in relation to the learning process and associated teaching practices – the Inquiry Cycle provides a means of exploring this relationship.

The Inquiry Cycle

Inquiry-based learning is often described as a philosophical and pedagogical response to the changing needs of the information age, but its roots are much deeper. It assumes that all learning begins with the learner: what people know and what they want to learn. This idea appears in the earliest writings on education, including Plato and Socrates in the West and Confucius in the East, but is more commonly traced back to Rousseau and Pestalozzi. Its fullest articulation can be found in the writings of John Dewey (1991/1938, 1997/1910).

For Dewey the connection between what happens in the classroom and lived experience outside the school walls is essential for successful education. The best education constantly reconstructs experience, relating it to both the past and to contemporary life. As Dewey (1991/1938 p 51) points out:

> We always live at the time we live and not at some other time, and only by extracting at each present time the full meaning of each present experience are we prepared for doing the same in the future. This is the only preparation which in the long run amounts to anything.

Thus, inquiry requires active learning in authentic contexts. Authentic contexts require that teachers, pupils, and community members become partners in inquiry, including inquiry into the world and inquiry into pedagogy.

Thus, curriculum should be defined neither as a set of skills to be mastered nor as a set of concepts to be learned, as we typically attempt to do in formal education today. Dewey argued that we need to build curriculum around the impulses, or instincts, of the learner: (i) the social instinct – conversation, personal intercourse, and communication; (ii) the instinct of making – the constructive impulse; (iii) the instinct of investigation – doing things and watching to see what happens; and (iv) the expressive impulse – the desire to extract meaning from experience.

Dewey saw these impulses as the natural resources, or the uninvested capital of education, out of which active learning grows. If people are to understand and participate fully in the complex world in which they live, they need to have opportunities to engage with challenging problems, to learn through hands-on investigations, to have supportive experiences, to articulate their ideas to others, and to explore a variety of resources in multiple media.

We are all participants in inquiry, not spectators: we change a problematic situation and are changed in turn through our actions. This leads to a view of inquiry as, "the controlled or directed transformation of an indeterminate situation into one that is so determinate in its constituent distinctions and relations as to convert the elements of the original situation into a unified whole" (Dewey, 1991/1938 p 108).

The emphasis in Dewey's concept of inquiry is on transformation, on remaking the world along with ourselves. Because situations often include interactions with others, inquiry typically involves collaboration. The usual categories (teacher/pupil, technology/concept, knowledge/skill) are replaced with a need to understand the

process of transformation: What means are employed to transform an indeterminate situation? What are the varied roles played by tools, ideas, and people in inquiry? How does an inquirer evaluate the unity of a situation? How do multiple inquirers coordinate their activities? How do individual experiences and needs coordinate with those of the community?

Drawing from Dewey's four impulses, his stages of reflective action, and the fundamental idea that learning begins with the curiosity of the learner, we can envision a spiral path of inquiry: asking questions, investigating solutions, creating, discussing our discoveries and experiences, and reflecting on our new-found knowledge, and asking new questions (Bruce & Bishop, 2002). Each step in this process (see Figure 1) naturally leads to the next: inspiring new questions, investigations, and opportunities for authentic *teachable moments*. Each question leads to an exploration, which in turn leads to more questions to investigate (Bruce & Davidson, 1996).

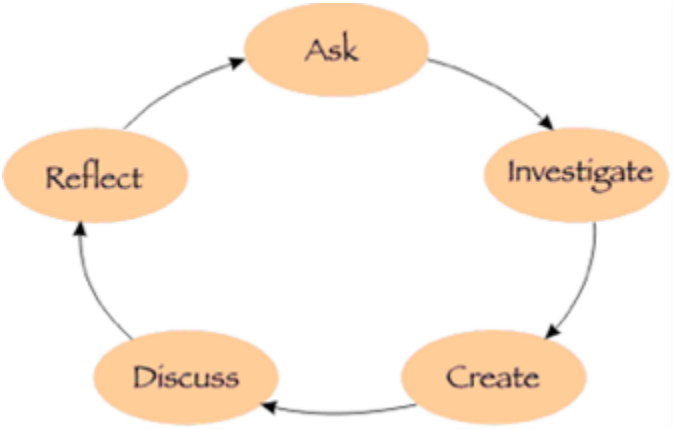

Figure 1 The Inquiry Cycle

We need to interpret the cycle as suggestive, neither the sole, nor the complete, characterization of inquiry-based learning. Inquiry rarely proceeds in a simple, linear fashion. The five dimensions in the process – ask, investigate, create, discuss, reflect – overlap, and not every category or step is present in any given inquiry. Each step can be embedded in any of the others, and so on. In fact, the very nature of inquiry is that these steps are mutually reinforcing and interrelated. Together, they comprise a cycle that can be used to inform and guide educational experiences for learners.

'Ask' reminds us that inquiry develops from a question or problem arising out of experience. Meaningful questions are inspired by genuine curiosity about real-world experiences and challenges. 'Investigate' relates to the varieties of experience possible and the many ways in which we become part of an indeterminate situation. It suggests that opportunities for learning require diverse, authentic, and challenging materials and problems. Through investigation, we turn curiosity into action. Learners gather information, study, craft an experiment, observe, or interview. 'Create' picks up the "controlled or directed transformation" part of Dewey's definition of inquiry. It insists that inquiry means active, engaged hands-on learning. Inquiry thus implies active creation of meaning, which includes new forms of collaborating and new roles for collaborators. The learner now undertakes the creative task of shaping significant new thoughts, ideas, and theories extending his/her prior experience. 'Discuss' involves listening to others and articulating our own understandings. Through discussion (or dialogue), construction of knowledge becomes a social enterprise; learners share their ideas and ask others about their own experiences. Learners compare notes, share experiences, and discuss conclusions; activities now enriched through the use of multiple media, including new online social networks. 'Reflect' tells us that only the inquirer can recognize the indeterminate situation and further, say whether it has been transformed into a unified whole. Reflection means

expressing experience, and thereby being able to move from new concepts into action. Reflection may also mean recognizing further indeterminacies, leading to continuing inquiry.

Digital Literacy and the Inquiry Cycle

We are now in a position to propose a definition of digital literacy appropriate for primary school contexts. Taking into account the previous discussion it will be based on a situated view of literacy appropriate for the specific context of the primary school and concerned with the practices associated with this context – namely teaching and learning practices. Our model of teaching and learning practices is based on the Inquiry Cycle and this is reflected in the definition: "Digital literacy in primary schools involves pupils and teachers using digital technology to enable, sustain and enrich all aspects of the inquiry cycle of learning as: ask, investigate, create, discuss and reflect" (Casey et al., 2009 p 7).

With this definition we suggest that digital literacy involves pupils and teachers using technology for a purpose and we are clear that the purpose relates to inquiry and learning. The definition suggests three ways in which digital media practices can enhance the Inquiry Cycle. Firstly, practices can enable the cycle by offering new entry points such as taking pictures for investigating or facilitating discussion through on-line connection. Secondly, practices can sustain the cycle through expansion as in when new questions arise from reflection facilitated by reviewing creative outputs such as a photo story or web site. Thirdly, digital media practices can enrich the Inquiry Cycle by facilitating different modes of experience and engagement such as visual (the fine detail of the flower), aural enrichment (the sound of the wind), narrative, music, text and symbols.

Furthermore, the complex question of 'whose literacy are we investigating, student or teacher' is set aside as digital literacy is regarded as shared and connected with the practices rather than the individuals concerned. However, there are important differences in the role of the teacher and the pupil in relation to the learning activities. Dewey emphasizes that education conceived in terms of experience and inquiry will require more rather than less guidance from teachers (Dewey, 1991/1938). Teachers need to scaffold and bridge aspects of the cycle – for example, stimulating questions, promoting reflection and guiding inclusive discussion. Digital tools may be regarded as extending the capacity of the teacher to guide and sustain the Inquiry Cycle. Pupils see the same tools as objects of experience – they take pictures and make recordings as a means of acting on the world. Digital technologies support the making of meaning – they are the stuff of inquiry – no more or less important than any other means through which they experience the world.

The DLIPS Research

We report here on a study of digital literacy in primary schools in Ireland (Casey et al., 2009) based on the definition and theoretical orientation outlined above. In order to investigate digital literacy as a contextualized practice we sought appropriate school settings. We were keen to produce findings that could be generalized to a wide range of contexts. Therefore we avoided schools with an established tradition of technology use; instead we sought teachers who were at the early stages of use of digital tools but with access to sufficient support for such practices to be within grasp. Four Irish primary schools provided an ideal target for the research; they were classified as disadvantaged and part of a supported cluster of schools in the vicinity of Dublin's Digital Hub. Eight classes within these schools provided the specific contexts for the study.

The question of how digital media practices relate to learning and teaching in schools was at the heart the investigation. The goal was to observe what teachers and pupils do – how they use the technology and how this supports learning. The investigation focused on class projects rather than wider school contexts; these projects were initiated and devised by teachers and not experts. Participating teachers were asked to develop a project activity over a number of weeks and to use technology where they felt it would be appropriate. In many cases teachers were using the hardware and software for the first time.

We observed pupils and teachers performing tasks and activities that involve media such as digital still cameras, video cameras, audio recording devices, and using software to build picture stories, create web sites, interact on-line, edit material, and present digital outputs. In framing the research question, we focused on the notion

of *practice* rather than on technology or media per se. The term practice incorporates the activities that take place and the goals and purpose of these activities; put simply, practices are what we do.

Approach

A team of six investigators worked in pairs to observe classroom activities and subsequent data analysis. Researchers, collaborating with the classroom teachers, devised a Component Checklist (see Table I) based on the elements of the Inquiry Cycle and additional ratings for participation, print literacy and use of digital media. The checklist was modified and improved as the research evolved – with changes agreed upon among the participating teachers and researchers.

From the onset it was understood that the Component Checklist had the potential to function not just as an observation tool but also as the basis of a new framework for conceptualizing digital literacy. For this reason much attention was given to naming and characterizing each of the components and the levels within each component. Thus, the appropriate levels for the component "ask" (Table II) ascended from "Little evidence of questioning or inquiry" to "Significant questions e.g. recognizing the affordances & the constraints and/or the nature of the mediation of the topic". In this case the key dimension was identified as the level of criticality in the questioning. For readers interested in the full component checklists see Casey et al (2009).

Component					
Ask	Rating 1	Rating 2	Rating 3	Rating 4	Rating 5
Investigate					
Create					
Collaborate					
Reflect/Express					
Participation (depth)					
Participation (scope)					
Print literacy					
Media ecology					
Use of digital media					

Table I Elements of the Component Checklist

Rating 1	Significant questions e.g. recognizing both the affordances and the constraints and/or the nature of the mediation of the topic
Rating 2	Questions tend to be more considered and purposeful
Rating 3	Questions are somewhat connected but tend to be immediate and limited in scope
Rating 4	Some inquiry but questions are disconnected from one another and from other aspects of learning and from lived experience
Rating 5	Little evidence of questioning or inquiry

Table II Ratings for the component "Ask"

Prior to the study all of the participating teachers and school principals were invited to a meeting with the research team. At this meeting the process of investigation was fully explained. Teachers were asked to select an appropriate project-based activity for researchers to observe during the two school visits – the choice of project was left entirely up to the teacher. For the purposes of this research, each project was classified as a 'case'. The eight cases were titled: Bills New Frock, Vikings, The Digital Dog, Banana Split, The Three Little Pigs, Fractions, Memories and St Patrick. These titles reflect the content themes as either book titles or story lines.

A more detailed description of the research process is provided by Casey & Bruce (2010). The focus here is to introduce and discuss the Practice Profile of Inquiry (PPI) a proposed pedagogic tool for planning and analysis of classroom inquiry (see Table III). The PPI was derived from an interpretation of data; it represented the researchers' view of the relationship between class activities and the dimensions of the Inquiry Cycle. PPI tables were prepared for each case. They are based on the time span of the project rather than an individual class.

	ask		teacher?
	investigate		group work?
How is	create	facilitated by activity centered on	print media?
	communicate		digital media?
	reflect		other materials?

Table III Practice Profile of Inquiry

The PPI suggests that the project (or case) be presented as the connection between classroom activities and elements of the Inquiry Cycle – Ask, Investigate, Create, Discuss and Reflect. In this way the full span of class activities was considered with respect to each of the Inquiry Cycle dimensions. This structure provides us with a framework within which digital and print literacies, along with other practices, may be considered within primary class contexts.

To illustrate how the PPI was used we look in detail at the case titled Banana Split. The school, Scoil San Seamus CBS, is an inner city urban school classified as disadvantaged in the Irish education system. This all boys school has 140 pupils in 2nd to 6th class and over 25% of the pupils are non-Irish national. The school has extra staffing for pupils with special needs and a language support teacher for pupils whose first language in not English. The principal is a strong advocate for technology in teaching but feels that the school is under resourced in terms of technology hardware and technical support.

The Banana Split project described here involved a class of 23 boys of third class (8 to 9 year olds) being taught by a recently qualified female teacher with the aid of a special resource teacher. The project spanned three weeks and the aim was to develop a slide show on how to make a banana split. There were two observers at each class visit. Each investigator completed the component checklist independently and the Practice Profile of Inquiry (see Table IV) was derived from subsequent analysis of this and additional interview data.

The following description is based on the researchers' field notes: The project began when the teacher and pupils discussed what ingredients they would need to make the banana split; the teacher reviewed key vocabulary words on cards and helped them to follow the steps for the recipe. The boys then photographed their work as they made the banana split. Pupils worked in groups and when complete there was much fun in eating the finished banana splits. The class then used photo story software to make the slide show of the process. They had to order the photos, add text and effects to the images and add background music to the presentation. With teacher support, they discussed suitable background music for presentation and made a very appropriate selection. The boys made four movies and had a showcase in school of their work. The project appeared to help the boys develop their print

literacy skills through reading, remembering, writing and following instructions to create the banana split. There was also a lot of work done by them in describing orally how they made the movies. The boys reflection indicated that they felt they had learned new words and learned how to crop digital images. The use of the digital camera and computer gave the project an added stimulus and the boys enjoyed the practical aspects of making the banana split and the use of the technology to capture their work and tell their story.

	Activity centered on…	**Description**
Ask	Teacher	Initiates discussion on desserts and cooking
	Group work	Pupils discuss their favorite desserts and the steps to make a banana split. Students are assigned roles for group work.
	Print media	Teacher reviews key vocabulary on cards, uses poster-size instructions
	Digital media	Not used
	Other materials	Not used
Investigate	Teacher	Organizes groups and roles, distributes ingredients and cameras
	Group work	Pupils collaborate to plan the making of the desert
	Print media	Pupils use the poster size recipe and their own notes
	Digital media	Pupils prepare for photo shooting
	Other materials	Collection of ingredients for desert
Create	Teacher	With resource teacher, supports pupils with photo story software
	Group work	Groups make banana splits, take photos, make photo story
	Print media	Use of the printed recipe
	Digital media	Use of cameras and photo story software to create movies
	Other materials	Recipe ingredients
Discuss	Teacher	Organizes video playback on computers
	Group work	Discussion on the process
	Print media	Not used
	Digital media	Pupils review videos
	Other materials	Completed Banana Splits
Reflect	Teacher	Elicits reports from groups
	Group work	Pupils report on the tasting of the deserts
	Print media	Pupils write reflections
	Digital media	Provide a lasting record
	Other materials	Already eaten

Table IV Practice Profile of Inquiry for the Banana Split Project

Discussion

As tables III and IV illustrate, a Practice Profile of Inquiry may be regarded as a matrix of questions. These questions encourage the user to consider inquiry as embedded within the practices of the classroom. For each of the elements of the Inquiry Cycle – ask, investigate, create, discuss, and reflect – the user is invited to consider how inquiry is enabled, sustained and enriched throughout the entire range of activities that take place. The classification of the five types of activity – as respectively centered on: teacher, group work, print media, digital media and other materials – arises from the research observations. There is nothing special about this range of activity other than it

was largely representative of the manner in which the observed cases were organized. The essential characteristic of the Practice Profile of Inquiry is that it considers each component of inquiry for each of the observed or anticipated activities.

Three questions arise directly from the use of the Practice Profile of Inquiry and each relates to our particular understanding of learning and inquiry. First – if as presented here, the PPI relates to the entirety of the project (in the case of Banana Split over three weeks) can it also be used at the level of a specific activity? The second question relates to the cyclical nature of inquiry – there is a sequential order suggested in the Inquiry Cycle: ask comes before investigate then create and so on. Why this order and why is it that all the elements do not manifest themselves explicitly in the structure of an activity, class or project? The third, even more fundamental question, relates to nature of inquiry and asks essentially whether it is an individual or collective process.

We begin with this later question; fundamentally, inquiry takes place at the level of the individual; but also fundamentally, the individual is regarded as participating within a community – the class. The PPI encourages the user (researchers and teachers alike) to take account of this duality and regard learning in terms of experience – as a transaction involving curiosity, interaction (both with the environment and with others) and reflection.

Left unsupported, pupils may not have the ability to draw upon, manage and direct all of their instinctive capacity toward the project goals. Often the teacher will direct and guide classroom activities: at times seeking to arouse curiosity, at other times specifying individual roles within group work and at other times still, encouraging discussion and reflection. The pupils are learning the process of inquiry. In classroom practice the role of the teacher may be regarded as directing, modeling and often scaffolding the inquiry process. Likewise the sequential order in which project activities are organized illustrates the cycle of inquiry. At the beginning of the project the teacher focuses on curiosity and investigation and later moves on to creativity, discussion and reflection. In this way a PPI may be useful as preparation for an entire project or for a specific activity or class.

Notice also that digital media are given no special prominence in relation to the classroom activities. As far as the pupils are concerned the project required the use of a banana, some cream, a digital camera, a pen and note pad. Each of these ingredients served a purpose, they were used as tools to enable, enrich and sustain participation – the technology has already disappeared (Bruce & Hogan, 1998).

How then should we percieve a deficit of digital literacy, if at all? The answer arises from the definition provided earlier. Digital literacy is regarded as enabling, sustaining and enriching inquiry hence problems with digital literacy are manifest when technology limits and inhibits inquiry. One can speculate that this can occur for a variety of reasons: teachers' or pupils' technical skills may be limited, teachers may lack the technical skills but also lack the confidence to illicit support from more able pupils, teachers may be in awe of the technology or be uncomfortable with the prospect of allowing pupils use digital tools (e.g. a digital camera) on their own (fear of breakage, classroom management, privacy issues). Regardless of the issues, the emphasis for teacher training, professional development and school spending policy should be to bring about conditions in the classroom where digital tools may be used supportively and as a valuable resource for inquiry.

Conclusion

Digital literacy is often discussed as an entirely new phenomenon, dependent upon new media or new technological affordances. This leads to conceptions that cause us to contrast the old and the new literacy practices or to identify exactly how the new technologies have changed literacy. Such a path not only presents a false dichotomy; it also makes it difficult to understand how the new practices are integrated with other experiences and learning.

We propose here instead, a conception of digital literacy as a set of practices that can be assessed in terms of how they enable, sustain, and enrich the inquiry cycle. This approach has been validated in Irish primary school classrooms, but we believe it should be extensible to other situations.

We view literacy practices as involving both digital and traditional literacy tools, along with objects in the environment. The capacity to communicate through multiple media is then part of larger processes of problem solving, identity formation, and being in the world, which are encapsulated by the concept of inquiry. This view

gives us the means to understand the relations among new and old media, physical objects, classroom practices, as well as how literacy supports teaching and learning in the classroom.

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