The Practice of Inquiry:

A Pedagogical 'Sweet Spot' for Digital Literacy?

Bertram C. Bruce
Graduate School of Library and Information Science
University of Illinois
Champaign, IL 61820
USA

and

Leo Casey
Centre for Research and Innovation in Learning and Teaching
National College of Ireland
Dublin 1
Ireland

Abstract

Introduces the practice of inquiry and discusses the case for it as a signature pedagogy for digital literacy. The Inquiry Cycle is presented as a summary of important aspects of inquiry. Further, the Practice Profile of Inquiry provides a practical tool, which can be incorporated into everyday classroom practice. Examples from the Digital Literacy in Irish Primary Schools (DLIPS) project are presented to show how surface, deep, and implicit structures of curriculum are enacted within an inquiry perspective. The Inquiry Cycle and the Practice Profile of Inquiry offer a means for educators to foster inquiry-based learning while making the best use of new digital media and tools.

Keywords: Inquiry Cycle, Practice Profile, digital literacy, new media, signature pedagogy, inquiry-based learning, primary school

The appropriate use of digital media in the classroom affords an enticing alternative to traditional pedagogy namely, the practice of inquiry. As a result there is a need for a useful framework to integrate our understanding of the practice of inquiry together with a conception of digital literacy for school contexts. We propose such a framework based on the Inquiry Cycle (Bruce and Bishop, 2002) and consider the practice of inquiry itself as a signature pedagogy especially in primary school classrooms. Drawing on previous research (Casey, et al., 2009) we advocate the use of the Inquiry Cycle as a lens through which classroom pedagogy can be both analyzed and effected. The approach facilitates a comparison of practice of inquiry with traditional pedagogy; it articulates aspects of inquiry which otherwise may be difficult to observe; and it enables the exposition of Shulman's surface, deep, and implicit dimensions of signature pedagogy.

There is little doubt that classrooms, workplaces and homes are being transformed by the impact of technology. As a consequence, digital literacy, once considered an optional skill set, is now an essential competence for active participation in the modern world. In classrooms, teachers are faced with the challenge of preparing our children for the future—a future they did

not anticipate. As they grapple with the panoply of digital devices, computers and the Internet, they face the challenge of finding or developing appropriate pedagogies to integrate technology and learning.

This is not an easy task. Pushed one way, they risk over emphasizing technical functionality to the neglect of their intended curriculum; pushed another, students mis-learn the world as an abstract, objectified version of reality. How then can we find the pedagogical 'sweet spot' – the optimum strategy for teaching and learning in a technologically mediated world? The solution lies in a re-examination of learning: a shift from traditional pedagogy to the practice of inquiry and, arising from this, a new conceptualization of the meaning of digital literacy and its relevance for education.

Traditional Pedagogy

Traditional pedagogy assumes three stages of learning: The learner first develops basic skills appropriate to the domain; second, acquires content relevant to addressing problems in the domain; and third, learns how to integrate that knowledge, become creative, and connect the learning to practical work. The stages are not usually defined so sharply and they may be enacted recursively or with widely varying degrees of emphasis. However, their general sensibility makes them seem self evident to many educators and parents, and the pattern repeats across many learning situations. For example, primary education is typically associated with learning the basic skills of reading and mathematics; secondary education tends to emphasize more learning content in science or social studies; tertiary, or on-the-job, education is where the learner pulls the knowledge together and applies it to real-world problems.

While acknowledging the value of these stages, and their seeming necessity, it is important to note that a rigid adherence to them is unlikely to lead to learning that is robust, generative, and able to serve the learner well in future endeavors. The three stages are based on the learning as preparation for life metaphor, which Dewey (1938) critiques so effectively in Experience and Education. When the learner has little grasp of the eventual use of a skill or bit of knowledge, it is very hard to be motivated. Even with motivation it is difficult to acquire that skill or knowledge, much less to retain it for the future. And even when the learner succeeds, he or she is left with the huge problem of pulling up that learning in the appropriate context and applying it correctly.

In fact, a case could be made for those who like the stages, that they should be applied in reverse order. Attempt a complex and dynamic problem without preparation and you are sure to understand the value of knowing more. This is why many teacher educators report a vast difference between preservice and inservice education (e.g., Hong, et al., 2008, Li, 2002). In the former case, future teachers are expected to learn many skills and concepts with only a vague sense of how those might be used. In the latter case, teachers with experience know well the challenges of teaching and become enthusiastic, even demanding, learners: "How do I manage groups in the classroom?" "How do I help the one slow learner without boring the rest of the class?" "What can I do about a parent helper who is not really helpful?" As Windschitl (2002) argues, teachers need to negotiate such dilemmas, not just solve simple, well-structured problems. It is only after they attempt to apply pedagogical skills and knowledge that they can fully appreciate and incorporate them.

Practice of Inquiry

As we think of pedagogies for a digital age, we have an opportunity to reconsider the basic models of teaching and learning. One starting point is the interests of the learner, as categorized by John Dewey: "the interest in conversation, communication; in inquiry, or finding out things; in making things, or construction; and in artistic expression." He called these "the natural resources, the uninvested capital, upon which depends the active growth of the child" (Dewey, 1956, pp. 47-48). Dewey stated similar ideas in a process form in his stages of reflective action (Dewey, 1910) and in his definition of inquiry. The latter uses the idea of *situation* to provide a descriptive account of how we survive in the world: "Inquiry is 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, 1938/1991, p. 108).

Inspired by these sources and the fundamental idea that learning begins with the curiosity of the learner, we 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 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). Thus, reflection on solving a problem may lead to reformulating the problem or posing a new question. Similarly, action in the world is closely tied to dialogue with others.

The *inquiry cycle* presents aspects of inquiry that need support in a successful learning environment. As such, it serves as a *boundary object* (Star & Griesmer, 1989), allowing us to

relate theory with ordinary practices or to look across modes and contexts of learning. The cycle can thus be used to inform and guide educational experiences for learners. It is important to note that it is merely suggestive, neither the sole, complete, nor rigid characterization of inquiry-based learning. In actuality, 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. Despite these complexities, the cycle highlights aspects of an otherwise opaque process.

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. The indeterminate situation Dewey refers to is part of that experience, including an individual's participation in a community. It is not something that can be delivered from "outside" this participation. An example of this comes from an early study of learning with computers. Researchers found that students became most engaged when there was a bug in the computer learning software. They had a genuine interest in exploring the behavior of the bug, which led to deep inquiry about programming. The researchers noted the "enormous pedagogical difference between answering someone else's question and formulating your own" (Olds, Schwartz, & Willie, 1980, p. 40).

But it is important to caution that inquiry does not always start with a well-articulated question. In fact, questions themselves arise from reflection and action in the world, including dialogue with others. Elspeth Huxley (1959, p. 272) states this well:

The best way to find things out …is not to ask questions at all. If you fire off a question,
it is like firing of a gun – bang it goes, and everything takes flight and runs for shelter.
But if you sit quite still and pretend not to be looking, all the little facts will come and
peck round your feet, situations will venture forth from thickets, and intentions will creep
out and sun themselves on a stone; and if you are very patient you will see and
understand a great deal more than a man with a gun does.

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. Because experience includes interactions with others, there is also a moral dimension to inquiry. Similarly, physical, emotional, aesthetic, and practical dimensions are inherent in inquiry, and are not merely enhancements or add-ons.

Through investigation, we turn curiosity into action. Learners gather information, study, craft an experiment, observe, or interview. The learner may recast the question, refine a line of query, or plunge down a new path that the original question did not, or could not, anticipate. The information-gathering stage becomes a self-motivated process that is owned by the engaged learner.

Create picks up the "controlled or directed transformation" part of Dewey's definition of inquiry. This term reminds us 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. As information begins to coalesce, the learner makes connections. The ability at this stage to synthesize meaning is the creative spark that forms new knowledge. The learner

now undertakes the creative task of shaping significant new thoughts, ideas, and theories extending his/her prior experience.

Discuss highlights an implicit part of Dewey's definition. Although inquiry has a personal aspect it is also part of our participation in social arrangements and community. The discuss aspect in the Inquiry Cycle 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 to others. Shared knowledge is a community-building process, and the meaning of their investigation begins to take on greater relevance in the context of the learner's society. Learners compare notes, share experiences, and discuss conclusions, through multiple media, including now 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 (later articulated in the work of Schön, 1987, and others) 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. Reflection is taking the time to look back at initial questions, the research path, and the conclusions made. The learner steps back, takes inventory, makes observations, and new decisions. Has a solution been found? Do new questions come into light? What might those questions be? And so it begins again; thus the circle of inquiry.

We can now use the cycle to compare inquiry-based learning to traditional pedagogy, as shown in Table 1.The term 'traditional pedagogy' could be interpreted to imply that 'process inquiry' represents a modern, up-to-date counterpart. This is not the case; the intellectual

foundations for conceptualizing learning as the practice of inquiry can be found in the writings of

Aristotle, Plato, Confucius, Rousseau and many others. Its clearest articulation, as presented

here, arises from the work of Dewey. Contesting views on the nature of learning and the quest

for effective pedagogical approaches has a long tradition (see Plato's *Meno* for an early example

of the content versus experience debate). Evidence of the traditional–skills and content–approach

can be found in many current schools' policy and curricula documents.

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Insert Table 1 about here

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There is also evidence that the current emphasis on high-stakes testing leads

predominantly to fragmentation and narrowing of subject area knowledge and increased use of

teacher-centered pedagogies (Au, 2007). What happens in schools is heavily influenced by

historical, social and economic factors, pedagogy is seldom considered in isolation. In recent

years a new factor has entered the equation; this is the world of digital media and as a result we

may be seeing an opening of new opportunities for old ideas on learning—the ideal of pedagogy

based on the practice of inquiry in the school classroom may now be within our grasp.

Digital Literacy

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

(Bruce, 2003). This is why we need to understand digital literacy and how it connects to learning

and teaching. We require a specific understanding of what *digital literacy* means in school settings. We propose that digital literacy should be framed in terms of pedagogy, specifically, the practice of inquiry as outlined above.

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 school. Firstly, digital technology has and continues to shape the life experiences of young people (Hull & Zacher, 2004; Lankshear & Knobel, 2008; Coiro, Knobel, Lankshear, & Leu, 2008). 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. Their

Pedagogical Content Knowledge, or PCK (Shulman, 1986, 1987) had to grow to accommodate the new pedagogical tools. This sphere of influence is elaborated in Mishra and Koehler's (2006) extension of Shulman's framework to Technological, Pedagogical and Content Knowledge, or TPACK. 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.

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 digital literacy has therefore also to do with 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.

Our research on digital literacy practices in Irish primary schools led to the following definition: "Digital literacy 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). The definition suggests ways in which digital media enhance the practice of inquiry. Digital media can enable the Inquiry Cycle by offering new entry points such as taking pictures for investigating or facilitating discussion through on-line connection. Digital

media can also sustain inquiry through expansion; as in when new questions arise from reflection facilitated by reviewing creative outputs such as a photo story or web site. Furthermore, digital media can enrich the practice of inquiry 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.

Signature Pedagogies

Shulman (2005) defines signature pedagogies as applied to professional education as recurrent practices intended to facilitate novices to think, perform and acquire the values of a profession. He provides examples such as the hospital round system in medical instruction and the specialist approach taken in law school classes to nurture the development of legal argument. Although signature pedagogies may be found in any area of education they are especially associated with professional development. In these areas, education for understanding alone is not sufficient; what is required is education for the ability to successfully practice in the profession. This means that students are 'formed' to think, act and adopt the ethical stance of their more accomplished counterparts. Student performance is at the heart of signature pedagogies—in a way they can be seen as supportive contexts that mirror expected authentic practice.

Competence, interpreted in its broadest sense to mean knowledge, application and values, grows by means of active participation in recurrent structured learning activities. Shulman argues that the structure of these practices has surface, deep and implicit dimensions. Surface structure is the observable framework—the questions, tasks and activities that are addressed. In contrast, the deep structure of pedagogy attends not just to the task in hand but the development of

associated thinking skills that need to be nurtured over time. Finally, implicit structures underpin the boundaries of a domain of practice and the associated values. They inform the student of the kinds of questions, tasks and activities that are legitimate for the profession. This awareness grows not just from what is included in the practice but also from what is left out.

Shulman's structural framework for signature pedagogy can be applied to other contexts beyond professional education (Gurung, Chick, & Haynie, 2009). It may also be useful for applications of technology in education. In particular, we suggest that surface, deep and implicit structures may be observed in pedagogical practice involving digital media in primary school classrooms.

It is important to note that "recurrent practices" within an educational context may be characteristic of signature pedagogy, but this does not imply that they are ideal with respect to the larger goals many might hold for that field. For example, some early introductions of computers in schools focused almost entirely on keyboarding skills, with little opportunity to apply those skills in meaningful contexts. Many students came to see keyboarding as the definition of the use of computers, and as expected lost interest in the area, while failing to engage with significant problem solving. There have been various attempts to equate "computers in the school" with particular programming languages, e.g., BASIC, LOGO, or C++. Other introductions have emphasized the use of the computer as a tool for practicing basic skills in other content areas. It could be argued that each of these schemas represent a possible signature for pedagogy across a large number of classrooms.

Note that it is not sufficient that a signature pedagogy be recurrent and have the structural dimensions, it must also embrace the 'implicit' values and boundary structures of the profession.

This is why the early surface approaches broke down; they lacked the implicit dimension of computer science.

One effort to make sense of the wide variety of uses of new technology and media in education is the taxonomy developed by Bruce and Levin (Bruce & Levin, 1997, 2003; Levin & Bruce, 2003). This is a learner-centered framework for analyzing or systematically developing powerful environments for learning. Rather than focusing on technology or media characteristics per se, it emphasizes the purposes of the learner. It can thus help us determine the most appropriate technologies for learning, given the educational goals and the available educational resources. It also offers a theoretical background for the empirical research we have done that helps us to define an effective signature pedagogy for digital media in education.

We propose that the appropriate use of digital media in the classroom affords an enticing alternative to traditional pedagogy namely, the practice of inquiry. Furthermore, we advocate the use of the Inquiry Cycle and Shulman's dimensional framework as theoretical perspectives or lenses through which classroom practices be observed and analyzed.

Insights from Field Observations in the DLIPS Research

In order to illustrate our position, we draw from an extensive study reported in Casey, et al. (2009). The authors, along with other researchers and teachers, conducted observational research on digital literacy in Irish primary schools (DLIPS). In a multi-school, multi-investigator, year-long study, we observed a wide variety of instantiations of digital literacy practices. Our field notes offer rich classroom examples to help illustrate our analysis and the argument for the Inquiry Cycle as a signature pedagogy.

The goal of DLIPS was to develop and validate a useful conceptual framework of digital literacy in primary school contexts. We sought a setting with the following characteristics: disadvantaged schools—not schools with a long tradition of technology practice; teachers who were at the early stages of use of digital tools but with just enough support for such practices to be within grasp. Eight class contexts were identified across four Irish primary schools that met the criteria. 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. They were not technology-savvy teachers—in many cases they were using the hardware and software for the first time. Teachers were asked to decide on the learning outcomes and to design appropriate learning activities for the pupils.

A team of six investigators worked in pairs to observe classroom activities and subsequent data analysis. Researchers devised the *Practice Profile of Inquiry* (Casey & Bruce, 2011; Casey, et al., 2009), based on the elements of the Inquiry Cycle with additional ratings for participation, print literacy and use of digital media. This was proposed as a tool to help teachers in planning projects and activities to optimize learning. As seen in Table 2 the Profile may be regarded as a matrix of questions encouraging the teacher to map anticipated activities (such as group work, use of digital media, use of texts and so on...) to elements of the Inquiry Cycle. In this way a constant emphasis on question situations is maintained and inquiry—framed as five constituent elements: ask, investigate, create, discuss and reflect—is enabled, sustained and enriched through the range of planned activities.

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We confine our discussion here to illustrating how surface, deep and implicit dimensions of pedagogy may be gleaned from observational data. To achieve this we present redacted research field notes from one of the case studies titled *How to Make a Banana Split*.

The 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 stated aim for the class was to produce an audiovisual slide show on how to make a banana split. It began with teacher and pupils discussing 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 pupils then photographed their work as they made the banana split. Pupils worked in groups and each had been assigned a role such as note taker, photographer and banana split maker. When complete, there was much fun in eating the finished banana splits. The class then used photo story software to make a slide show of the process. They had to order the photos, add text and transition effects to the images and add background music to the presentation. With teacher support, they discussed suitable background music for presentation and each group got to choose a piece. The boys made four movies and had a showcase in school of their work.

Surface Dimension. At the surface level we identify explicitly stated goals in terms of projects and digital outputs. It was notable that in the case above and other cases we observed how teachers used the production of a digital output (e.g., video, animation, slideshow) as a means of integrating a wide range of project related goals and activities. It was also noted that learning tasks involving digital and print literacies were observed side-by-side; as for example,

when the key words for the banana split recipe were introduced and written down by the class in advance of the activities.

The project work 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 class group reflection indicated that they felt they had learned new words and learned how to crop digital images and put them together in a sequence. The use of the digital camera and computer gave the project an added stimulus and the boys stated that they enjoyed the practical aspects of making the banana split and the use of the technology to capture their work and tell their story.

Deep Dimension. There is also a deep structural dimension to the pedagogy whereby the pupils were learning about the process and practice of inquiry. In designing the class activities the teacher was creating controlled conditions for inquiry. Left unsupported, pupils may not have the ability to draw upon, manage or direct all of their natural impulses toward the project goals. Often the teacher directed and guided 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 were learning the practice of inquiry. The functions of the teacher involved directing, modeling and often scaffolding the inquiry process.

Implicit Dimension. There was also an implicit dimension to the pedagogy. In deciding to use project work, to select as the explicit goal a digital output and to organize the activities as group work with an emphasis on meaningful participation for all members, the teacher is communicating important values and background assumptions to pedagogy.

Discussion

The practices we observed through DLIPS were described and evaluated using the Practice Profile of Inquiry. We found that the Profile offered a way to identify differences among classrooms and activities within classrooms, supplementing narrative accounts. At the same time, it did not reduce digital literacy to simply a technique to accomplish other curricular objectives. At the core of the approach was the use of the Inquiry Cycle as a framework for making sense of classroom inquiry practices.

Viewed in terms of Shulman's signature pedagogy (2005), we could see the Inquiry Cycle reflected in surface, deep, and implicit structures. These are shown in Table 3. for example (row 4) many of the classroom teachers found that group work supported the digital literacy activities. At a surface level, one could observe and describe group work to achieve an explicit task, such as creating a diorama for a digital video. But there was a deep structure of learning how to collaborate. The task per se was not the final end. Moreover, this practice, involving both teacher and students, had the implicit structure for all participants of conceiving learning as a social activity and valuing the perspectives and contributions of others.

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Note that the Inquiry Cycle as signature pedagogy appears quite different from the examples that Shulman and others have identified in professional education. For example, clinical education in medicine has a specificity to the discipline of medicine, which involves

attending to patients, making rounds, comparing lab results to patient histories and observations. Clinical practice in the law looks very different, with attention to precedents, legal versus fact-based reasoning, and so on. Although each of these domains requires deep inquiry, there are strong constraints that shape educational practice differently based on the social, cultural, and legal definitions of the work involved.

For primary education, where learners have a world of opportunities ahead, the signature pedagogy cannot be as sharply defined. Instead, it needs to be a set of practices and conceptions that support more open-ended inquiry. We have argued here for inquiry itself as the signature pedagogy for general education, and the Inquiry Cycle as a way to manage it in the classroom.

Conclusion

The most productive way to support digital literacy is unlikely to come from empirical results alone, or from theoretical analysis removed from practice. Instead, as in the best sense of inquiry, it needs to grow out of reflective action—an experimental way of knowing that attends to what students and teachers actually do, but seeks to understand that in terms of deeper conceptions of learning.

Analysis of a wide range of uses of computers in primary education shows the value of a learner-centered pedagogy. Such a pedagogy is oriented to developing powerful environments in which learners can use new media for ends that make sense in their lives. We have also reported in detail on actual primary classrooms that employ such a pedagogy. This work suggests both the theoretical soundness and the practical viability of the Inquiry Cycle as a signature pedagogy for primary education enriched through digital media.

There are of course many additional questions. Our research focused on Irish primary schools. How generalizable are these results across other national settings? Although the schools we studied were categorized as disadvantaged, that designation was relative to the Irish context. How might this approach fare in developing countries?

Also, the schools we studied did not have a long tradition of technology practice. How might classrooms with different experiences work with an Inquiry Cycle approach? The results are not obvious. For example, a school with a longer tradition may have developed a very different signature pedagogy that would stand in the way of an inquiry approach. Alternatively, it might enable the students to attain levels of engagement far beyond what we encountered.

Another major open question concerns how far the Inquiry Cycle approach can apply across the general education curriculum. The fact that our results are not tied to a particular subject are, but rather to general primary learning, offers hope that it could be used in different subject areas. Moreover, in other research we have see the successful use of an inquiry approach in secondary, tertiary, workplace, and informal learning. However, understanding exactly how it can best be applied requires more detailed examination of particular learning contexts.

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Table 1

Traditional Pedagogy versus Practice of Inquiry

	Traditional Pedagogy	Practice of Inquiry
Ask	Content delivery, skills development; implicit question	A priori questions leading to content mastery
Investigate	Pre-set methods and materials	Authentic materials; multiple sources & media
Create	Response modes defined by specific assignments, tests	Active, hands-on learning
Discuss	Teacher-driven	Collaboration, learning through talk & writing
Reflect	External evaluation	Making sense of the process; continuing learning

Table 2

The Practice Profile of Inquiry

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

Table 3

Structural Dimensions of the Inquiry Cycle and Digital Literacy

	Surface Structures	Deep Structures	Implicit Structures
Ask	The explicit task – create a digital output	Learning as inquiry – stimulating the 'ask' stance	Practice of inquiry as legitimate pedagogy
Investigate	Following a plan (e.g. a recipe), digital photography, video recording, exploring a topic	Arousing and harnessing curiosity	Using natural impulses for learning Learning to build your own knowledge
Create	Compiling, editing, arranging, adding sound, music etc.	Learning through activity and experience Making new things or new connections	Valuing the process rather than the outputs Stretching the boundaries for learning
Discuss	Group work to achieve the explicit task	Learning how to collaborate	Learning as a social activity Valuing other people's inputs
Reflect	Look back on class activities; review of digital outputs	Making sense of the process (within its own framework)	Making sense of the process (beyond the existing framework)
Digital literacy in the classroom	The ability to use technology as knowledge and skills	Technology as a means of participation in the practice of inquiry	How teacher and pupils regard and value digital technology