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Incorporating Internet resources into classroom practice: pedagogical perspectives and strategies of secondary-school subject teachers

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Abstract

Drawing on evidence from lesson observations, teacher interviews and project reports, this paper examines the pedagogical perspectives and strategies of teachers working to incorporate use of Internet resources and associated ICT tools into humanities, social studies and science lessons in English secondary schools. The eight teachers were participants in small-scale, school-based projects in which they investigated self-devised, technology-integrated pedagogical strategies in their own classrooms. Each of the five projects proved to have important distinctive features. This paper provides an overview of project characteristics, followed by a within-project analysis of key pedagogical concepts and concerns. The salient ideas and issues emerging from a cross-project analysis are then summarised in terms of the following themes: Organising lessons around teacher-supported pupil activity; Enhancing lesson resources through use of Internet material; Structuring and supporting pupil access to Internet resources; Instrumenting use of ICT tools to support subject learning; Building and capitalising on pupils' sense of capability and agency; Supporting and shaping pupil activity through informal teaching; Managing lesson relocation, room configuration and technical malfunction.

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1. Introduction

This paper examines the pedagogical perspectives and strategies of teachers working to incorporate use of Internet/Web¹ resources and associated ICT (information and communication technology) tools into humanities, social studies and science lessons in English secondary schools. Primarily through analysis of their accounts of this work, the study seeks to identify ideas and issues salient for teachers venturing into this emerging area of technology-integrated teaching and learning.

2. Use of Internet resources and ICT tools in secondary schools

According to government surveys, by the year 2002 the proportion of English secondary schools linked to the Internet exceeded 99%, and the number of terminals with Internet access grew nearly sixfold between 1999 and 2002 (from an average of 27.0 per school to 153.6: DfES, 2002, p. 8). The most recent national surveys based on school inspections have drawn attention to increasing classroom use of Internet resources in the curricular subjects featured in the projects to be examined here. In Geography, “Pupils often use information available on the Internet... especially to enhance coursework” (OfStEd, 2003a, p. 6). In History, “Research on the Internet has yielded a vast potential source of improved resources, both text and visual, including unprecedented access to archive material” (OfStEd, 2003b, p. 5). And in Science, “Access to the Internet is being increasingly used to supplement textbooks by providing a rich source of information and illustration”, while “A small but growing number of science teachers produce their own on-screen worksheets with hot-links to relevant sites, activated according to pupils’ needs” (OfStEd, 2003c, p. 8).

The recent Impact2 study examined the influence of networked technologies on the education of school-age pupils in England (Harrison et al., 2003, p. 103), finding that while the Internet had not become a regular feature of school life, it was widely recognised as having educational potential on account of the attractiveness, currency and variety of resources it made available. However, there was less clarity about how this potential might be realised in classroom teaching and learning. Observations of lessons where pupils themselves sought material on the Internet suggested that few had been taught how to search effectively and critically. Where teachers did promote a more structured approach to Internet research by pupils, they introduced processes such as considered use of keywords, identification of promising sources, and evaluation of resources retrieved. In other lessons, teachers chose not to involve pupils in searching, directing them to sites preselected as providing suitable information. Alternatively, pupils might be referred to portals which enabled them to access, browse and search a smaller range of deliberately assembled material.

Much of the wider research on classroom use of ICT tools and Internet resources has taken place in the United States. Drawing on a major national survey, Becker (1999, p. 13) examined

¹ Our informants tended to talk in general terms of the Internet rather than discriminating more finely between the Internet and the World Wide Web.

how teacher attitude towards Internet resources and their classroom use was related to school phase, curricular subject and pedagogical orientation. Examining teachers' ratings of the educational value of the Internet and of the extent of its classroom use for student research, Becker found these to be markedly higher amongst high-school teachers of science, social studies and humanities than any other group.

Proponents of technology integration have often associated it with pedagogical change towards 'constructivist' models (Cognition & Technology Group at Vanderbilt, 1996; Schwartz, Weir, & Cole, 1989). Cuban (1989, 1993) has been sceptical, arguing that schooling is shaped by pervasive cultural beliefs about what teaching is, how learning occurs, and what knowledge is proper in schools; and that the central structures and processes of schooling remain relatively well adapted to the continuing expectation that schools lead large numbers of students through a set curriculum with limited resources. Cuban suggests that, in secondary schools in particular, external tests, graded classes, self-contained classrooms, departmental organisation and disciplinary training all encourage teachers to behave as academic specialists whose primary concern is covering a specified curriculum over a set period.

Using national survey findings to examine Cuban's claims, Becker (2000) conceded that computers have not transformed the classroom practice of most teachers, particularly teachers of secondary academic subjects, but concluded that technology has enabled some to put into practice a more constructivist pedagogy attuned to their teaching philosophy. Equally, in a study of teachers in high schools viewed as relatively successful in integrating technology into their daily instruction, Cuban, Kirkpatrick, and Peck (2001) found that the inconvenience and unreliability of new technologies under school conditions constituted important barriers to their use. And when these technologies were used, this was largely in ways adapted to familiar forms of teacher-centred instruction, with only a minority of teachers modifying their lessons and classrooms in substantial ways to encourage greater independence and initiative on the part of students, and to draw on sources of information beyond teacher and textbook.

Some complexities of using Web resources to support inquiry-based learning are illustrated by a study of the implementation of a middle-school science module (Wallace, Kupperman, Krajcik, & Soloway, 2000). While students found Web technologies easy to use, they tended to reduce what the researchers had envisaged as relatively open tasks – offering opportunities for personal engagement and intellectual challenge – to much simpler ones of finding an obvious answer or a good website. Such reactions reflected students' normal expectations of classwork, often sustained by the forms of support which the class teacher provided in response to their requests. Adopting a terminology current in library and information sciences, these students could be described as practising an immediate and restricted form of 'information gathering' – simply acquiring relevant material – rather than undertaking a more iterative and expansive process of 'information seeking' – extending from recognising an information need to finding and using information to meet that need. Accordingly, the researchers suggested that the development of pedagogical strategies suited to classroom use of online resources be recognised as an important priority for future work.

It is this line of enquiry which is pursued in the study to be reported here, by analysing the pedagogical strategies developed by experienced classroom teachers.

3. Context, design and method of the study

This study was designed as a collective (Stake, 1994) or multiple (Yin, 1998) case study of differing instances of a pedagogical phenomenon; a phenomenon loosely conceived as the incorporation of Internet resources and associated ICT tools into classroom practice. The intent of the study was instrumental (Stake, 1994), concerned with building a grounded theory (Strauss & Corbin, 1994) of the phenomenon. An important consideration, however, was that this instrumental intent could be realised at two levels: one of analytic generalisation, primarily across cases (Yin, 1998) and another of naturalistic particularisation, primarily through individual cases (Stake, 1994). In particular, the design and reporting of the study has taken account of the distinctive contribution that reports of case research can make to extending the experience of their audience. This is a quality highly valued by practitioners and policy makers; it necessitates modes of analysis and reporting chosen to achieve both valid generalisation and effective particularisation (Stake, 1994). Because of the relative novelty of the phenomenon under investigation, the study was necessarily exploratory in approach, and descriptive rather than explanatory in aim (Yin, 1998). It drew on well-established techniques for the study of pedagogy (Richardson, 2001; Wittrock, 1986).

The cases examined in this study are small-scale, school-based projects which arose from a programme in which teachers investigated a range of self-devised, technology-integrated pedagogical strategies in their own classrooms.² Although the projects all built to some degree on classroom approaches already employed by the teachers, they typically involved significant development of the use of computer-based tools and resources within these approaches. The voluntary participants came from schools involved in a research partnership with the University of Cambridge, and this particular programme had been initiated to address an area of mutual interest and priority identified across the partnership. While teachers and schools involved in these projects had an unusual commitment to research and development, their experience has a wider significance in illuminating pedagogical concepts and concerns associated with particular forms of technology integration.³ This paper focuses on all five projects which centred on the use of Internet resources.

Teachers participating in the programme worked on their project singly or with a colleague from the same department. Participants met in larger cross-project groups on six occasions over the course of the 2000/2001 school year. The main function of these meetings was to support the planning and reporting of projects through discussion in cognate groups and advice from the university team associated with the programme (to which we belonged). During the period when classroom work associated with the projects was taking place, each participant was visited in school by a member of the university team at a mutually convenient time. One element of the visit was a standard sequence of lesson observation and ensuing teacher interview, intended to con-

² The projects were supported by Best Practice Research Scholarships awarded by the national Department for Education.

³ A study of pedagogic strategies across the full programme has examined projects from the theoretical standpoint of guided participation (Hennessy, Deaney, & Ruthven, 2003).

tribute both to the project in progress and to subsequent analysis by the university team. After the close of the school year, teachers prepared project reports, in the particular format required by the funding agency, for final submission by the end of 2001.

Accordingly, lesson observations and teacher interviews conducted by ourselves, and initial plans and project reports prepared by the teachers, all provided evidence about the pedagogical concepts and concerns framing the teachers' incorporation of Internet resources and ICT tools into their classroom practice. The observation records and interview transcripts provided the most extensive and detailed insights, and so have served as the principal sources of evidence for the study. Other pressures on teachers limited the scale and scope of their initial plans and final reports; in particular, these were uneven in their treatment of pedagogical matters, and less detailed than the interview accounts. Where possible, however, they have been used to triangulate and elaborate findings.

Analysis was conducted in two phases. An initial analysis established basic characteristics of projects and lessons. The main analysis focused on the pedagogical thinking of participating teachers, and had two co-ordinated dimensions, corresponding to the levels of naturalistic particularisation through individual cases, and analytic generalisation across cases. This main analysis was carried out through an iterative process involving two forms of interplay. The more basic interplay was between available data and emergent ideas, through a process of constant comparison (Strauss & Corbin, 1994) in which prominent themes were sought within and across projects. The more overarching interplay was between within-project and cross-project analysis, through the writing in parallel of project profiles – to convey a more naturalistic and holistic sense of key concerns and concepts within particular projects – and topic summaries – to identify and isolate salient issues and ideas running across projects.

Our adoption of the project as the principal unit of analysis and reporting was carefully considered. Each of the projects proved sufficiently coherent and distinctive to make this a parsimonious level for reporting without sacrificing fidelity. The accounts that teachers provided in interviews ranged well beyond the particular lesson to the project as a whole. Projects had a clear substance: there were outline plans and final reports; and, where a project involved two teachers, they worked closely together, developing shared ideas and making joint submissions. Nevertheless, our analysis was alert to any important divergences between teacher accounts or lesson observations within joint projects, and these have been noted in reporting. Equally, important elements of teachers' accounts were grounded in the activity of specific lessons and the concerns of specific projects, and this too is reflected in our reporting.

In the sections that follow, we first provide an overview of project and lesson characteristics (Section 4). We then present the project profiles (Section 5), directly evidenced with quotations, and organised in terms of the themes emerging from within-project analysis of key concepts and concerns. These profiles also interweave attention to ideas and issues identified in the cross-project analysis. This material is then drawn together to offer topic summaries highlighting the themes emerging from the cross-project analysis of salient ideas and issues (Section 6), and referring back to evidence presented in the more detailed project profiles. Finally, these themes are synthesised to form a simple theoretical system (Section 7). This sequence allows the reader to gain a stronger sense of the context and character of the projects under study, before proceeding to a more abstracted overview. Some readers, however, may prefer to read the more compact topic summaries (Section 6) prior to the project profiles (Section 5).

4. Overview of project and lesson characteristics

Basic information about the projects is summarised in Table 1.

Three of the projects [A, B, C] were conducted by pairs of teachers who collaborated in planning and reporting their work; the remaining two projects [D, E] were carried out by individual teachers.

The participating classes came predominantly from Years 8 to 10. In most of the projects [B, C, D, E] each teacher worked with a particular class over an extended period; however, one project [A] involved work with a range of classes in short sequences of lessons. One project [E] was unusual in focusing on a ‘bottom set’ of academically disadvantaged pupils, while the other projects at Community College involved academically selective ‘top sets’ [B] and a subject taken primarily by academically successful pupils [D].

In most of the projects [A, B, C, E] pupils worked on set tasks common to the whole class; in one project [D], however, pupils carried out independent research on a self-chosen topic. In two projects [A, B] pupils typically accessed resources preselected by the teacher; in the others [C, D, E] pupils themselves often searched for relevant resources within the lesson.

Contextual information about the observed lessons is summarised in Table 2.

Table 1

Overview of the teacher projects: School, subject, class(es) and teacher(s) involved; typical mode and scale of pupil use of Internet/Web resources

Project	School ^a	Subject	Class(es) ^b /teacher(s)	Pupil use of Internet/Web resources in lessons	
				Typical mode of use	Scale of use
A	Media College	Science	Y9–Y13 various sets/OT & VM	Access preselected resources for common lesson task via online worksheet	Sequence of 2–3 lessons
B	Community College	History	Y9 top sets/AY & OL	Access preselected resources for common lesson task via intranet portal	Regular lessons for around 2 months
C	Technology College	Geography	Y8–Y9 middle sets/FC & DR	Use search-engine to find resources relevant to common lesson task	Regular lessons for around 3 months
D	Community College	Classics	Y10 only set/LL	Use search-engine to find resources relevant to personal coursework topic	Regular lessons for around 1 month
E	Community College	Geography	Y9 bottom set/DD	Use search-engine to find resources relevant to common lesson task	Periodic sequences of lessons over several months

^a Most English secondary schools are organised by age cohort, ranging from Year 7 (age 11/12) to Year 13 (age 17/18). For each subject, the age cohort is typically divided into several classes or ‘sets’, sometimes of ‘mixed ability’ but more often grouping pupils of similar ‘ability’ in the subject.

^b These pseudonyms reflect the official designations of the schools involved.

Table 2

Context of observed lessons: Teacher, location, pupils present, terminals available, pupil organisation, and significant technical problems

Lesson	Class	Location	Pupils present	Terminals available	Pupil organisation	Significant technical problems
A-OT	Y9 middle set	Computer suite	22	12	All work in pairs	None
A-VM	Y12 AS set	Computer suite	14	12	Most work in pairs; a few individually	Unreliable Internet access on most machines
B-AY	Y9 top set	Library/ resource centre	29	19	Most work in pairs; a few individually	None
B-OL	Y9 top set	Computer suite	30	16	Most work in pairs; a few individually	None
C-FC	Y9 middle set	Computer suite	18	16	Most work individually; 6 girls work in pairs	Intranet material unavailable
C-DR	Y8 middle set	Computer suite	26	16	Most work in pairs; a few individually	None
D-LL ^a	Y10 GCSE set	Library/ resource centre	14	19	All work individually	Word-processing and printing unavailable
E-DD	Y9 bottom set	Classroom; then library/ res'ce centre	11	19	Most work individually; 3 girls work as group	Internet unavailable; CD-ROM access delayed

^a An earlier cycle of lesson observation and teacher interview was also carried out with LL, not involving use of Internet resources and ICT tools. Further reference is made in reporting this project.

In all the projects, making use of ICT facilities involved relocating lessons from the normal timetabled classroom to a suitably equipped room booked in advance. This not only called for additional planning by the teacher, but disrupted working norms and procedures to some degree, something of particular concern to teachers of classes containing pupils who could be hard to manage [A-OT, E-DD⁴].

In the computer suites at all three schools, terminals were ranged around the perimeter of the room so that users faced the walls. At Community College, most of the lessons took place in the library/resource centre where terminals were laid out along long tables. We observed, and teachers commented on, difficulties such layouts created in gaining the attention of the class as a whole. When classes were large, this was exacerbated by cramped conditions and difficulties in turning seats around. In only one of the rooms was there a public form of computer display, an electronic

⁴ We refer to observed lessons using the coding system <project>–<teacher>. Basic information about projects and teachers is summarised in Table 1, and about observed lessons in Tables 2 and 3.

whiteboard recently installed in the computer suite at Community College, which the teacher who sometimes used this room considered “very important... in getting the class to focus” [B-OL/Int⁵].

The general preference amongst teachers appeared to be for each pupil to work individually at a terminal, but this proved impossible in some projects. In those projects where there were sufficient machines available for pupils to be able to work individually [D, E], that is what happened with the single exception of a trio of girls who chose – and were permitted – to work together [E]. In the other projects, teachers talked of considering and rejecting using a more distant room because “there still wouldn’t have been enough computers for each individual” [A-OT/Int]; of “want[ing] initially everyone working individually but that didn’t happen because of the computers” [B-AY/Int]; and of how “pupils have to do most of their work in pairs” because of the limited number of machines [C/Rep]. Nevertheless, whether pupils were working at a terminal individually or in pairs, teachers also recognised advantages of peer support, particularly on technical matters.

A general concern for teachers was the potential malfunctioning of computer facilities. Significant failures of school networks disrupted four of the eight lessons observed.⁶ Teachers had clearly become accustomed to such difficulties, and anticipated them occurring:

This is the problem time and time again, that people aren’t happy using ICT because they can’t rely on it working properly. So you’ve always got to have something up your sleeve, something as a backup, in case everything goes totally wrong. [A-VM/Int]

Likewise, after lessons which had gone smoothly, teachers volunteered comments on there being “no problems with the technology” compared to the “technical hitches” encountered in earlier lessons [B-AY/Int]:

If you’d been in the last lesson, it was a different story. If you’ve got four computers which aren’t working, that’s eight people out...That presents real problems. [B-OL/Int]

Teachers reported that experience had taught them to actively plan for such eventualities by having alternative resources to fall back on:

Having back-up plans... is perhaps more important in this kind of Internet IT work than in normal teaching. So, having the resource sheet to use just in case, taking books to the lesson just in case... I didn’t do that at the start, but I soon learnt... It doesn’t take long for the system to crash and you’re stuck for a lesson [C-DR/Int]

In all of the schools, the wider curriculum had already provided pupils with some basic familiarisation with the main ICT tools used in the projects: web-browsers and word-processors. Equally, levels of home access to computers and of experience in using these tools were high amongst pupils in most classes. In general, then, projects were able to assume that pupils already had at least a basic technical proficiency. In three of the projects [A, B, D], pupils were encouraged to make use of other ICT facilities – notably e-mail, publishing and presentation tools – or indeed

⁵ We indicate the provenance of quotations using the coding system <project>–<teacher>/ followed by the source *Obs*(ervation) or *Int*(erview), or <project>/Rep, indicating the source as the (common) project *Rep*(ort).

⁶ This should not be interpreted as chance misfortune in a small sample. Across the programme as a whole, significant technical problems occurred in 10 of 18 lessons observed.

of pen(cil) and paper, as they saw fit and felt able. In the other two projects, there was a more direct concern with aspects of pupils' technical proficiency. In project C, pupils were required to make intensive use of a rather wider range of ICT tools. In project E, involving less academically successful pupils, the attention given to technical proficiency reflected the findings of a survey, conducted as part of the project, which had shown that such pupils tended to "have less access to computers and the Internet at home... so they may be less confident and competent when using them at school" [E/Rep].

The structure and content of the observed lessons are summarised in Table 3.

The majority of lesson time was spent in pupil seatwork on assigned tasks. The typical lesson fell clearly into three phases. In the opening phase, typically of the order of 10–20 minutes, the teacher settled and organised the class as its members arrived before introducing the task to be undertaken, sometimes also reviewing relevant ideas from previous work, and on one occasion [C-DR] demonstrating an ICT technique required. In the seatwork phase, pupils worked on the assigned task, monitored and supported by the teacher who would occasionally address brief comments and instructions to the class as a whole. In the closing phase, typically lasting rather less than 5 minutes, the lesson was concluded. On three occasions the teacher made brief comments on pupils' work, and on two occasions there was a more extended plenary discussion. One lesson [A-OT] differed from this general pattern only in as much as it involved two cycles of the opening then seatwork phases; the first cycle using a textbook to provide an overview of the topic, the second then using specified Web resources to provide information in greater depth. In another lesson [B-AY], what has been recorded as the closing phase alternated between periods of plenary discussion and periods during which pupils adapted their own written work in response to this discussion and the teacher's summarisation. Even in this lesson, then, the majority of lesson time was given over to seatwork.

5. Key pedagogical concepts and concerns within projects

We now provide profiles characterising each project in terms of the key pedagogical concepts and concerns which framed teachers' incorporation of Internet resources and ICT tools into classroom practice. The subheadings of each profile indicate the major themes of the project.

5.1. *Project A: Using online resources in supported study of science topics*

Whereas other projects involved sustained work with a single class over several weeks, the focus in this project was on short sequences of Science lessons, often repeated with several classes. The approach emphasised the use of Internet resources and electronic documents as online analogues of the familiar textbook and worksheet.

Both observed lessons formed the opening sessions of a unit, and both employed online worksheets to structure students' use of textbook and Internet material. In one [A-OT], the topic was change in accepted astronomical models of the universe; in the other [A-VM], rainforests and deserts as examples of biological ecosystems.

Table 3
Structure and content of observed lessons: Opening, seatwork, and closing phases

Lesson	Start time	Opening phase	Shift time	Seatwork phase/ Overarching task	Shift time	Closing phase	Finish time
A-OT	14:15	Opening procedures	14:20	Using text then Web resources provided, examine rationales for models of the universe	14:36	Closing procedures	15:15
	14:36	Ideas reviewed; Task introduced	14:43				
A-VM	11:25	Opening procedures; Prior ideas reviewed; Task introduced	11:47	Using resources provided, investigate a desert or rainforest as an example of a biome	13:05	Teacher elicits ideas, probing and summarising; Closing procedures	13:15
B-AY	10:55	Opening procedures; Prior work reviewed; Task introduced	11:03	Analysing available sources, explain the outcome of the battle of Vimy Ridge	11:22	Teacher elicits ideas, probing, summarising; Pupils adapt work; Closing procedures	11:40
B-OL	10:50	Opening procedures; Prior ideas reviewed; Task introduced	11:08	Examine specified paintings in terms of artists' interpretations of experience of war	11:38	Brief comments on ICT skills displayed and work done; Closing procedures	11:40
C-FC	09:55	Opening procedures; Prior ideas reviewed; Task introduced	10:05	Using resources provided, recommend renewable energy sources for an Italian ski resort	10:47	Closing procedures; Brief comments on quality of work done	10:50
C-DR	11:10	Opening procedures; Prior ideas reviewed; Task introduced; ICT technique shown	11:28	Using resources provided, devise a flood protection plan for an English village	12:06	Closing procedures; Brief comments on ideas developed	12:10
D-LL	08:02	Opening procedures; Prior work on searching flagged; Task restated	08:10	Search for material for coursework project on self-chosen aspect of Roman life	08:48	Brief negotiation about homework	08:50
E-DD	08:55	Opening procedures; Task introduced;	09:12 Room move 09:15	Search for material to create image, caption and message of postcards from Brazil	09:45	[Most pupils already packed up]; Closing procedures	09:45

5.1.1. Theme A1: Promoting more active student participation through assigning tasks

A major concern of both teachers was to promote the more active participation of students in lessons through assigning them tasks to work on. VM regretted the reluctance of her class to contribute to lessons:

They tend to be very quiet, they're not very forthcoming with their answers, and they need something to... get them involved in the lesson. There tend to be some quite passive, absorbers of information, but they don't want to actually get involved and give any information, and I'd like to see them actively participating. [A-VM/Int]

Similarly, OT reported that the topic for his lesson was one in which he had previously found it difficult to generate student interest and reflection. Lack of resources suitable for direct use by students had obliged him to adopt a more teacher-led approach. Moreover, this was his first lesson with the class for some time, scheduled for the last session of the school day:

This is a really dry topic... In the past when I've been talking about [it] you can see glazed eyes... And if I'd done a chalk and talk lesson, yes it would have been over and done with in a lesson, but the learning that would have gone on, they would have had a set of notes, but there would have been very little processing... And period five with this particular group needs something more than just me prancing around the room trying to make it as interesting as it can be. It needs to be much more active. And there really was no other alternative... before the Internet was available, I was unable to teach this in any other way. [A-OT/Int]

Nevertheless, some difficulties emerged in OT's lesson. He commented on how “the pace wasn't quite right” and “the first task needed to be a bit more punchy” [A-OT/Int]. While he was satisfied with the response of “the higher ability [students who] pretty much got on with it”, he had concerns about others. Within the lesson, he was most immediately exercised by “the loud ones, the ones who can't sit still”, who required his very active presence to direct their attention to the assigned task. This he saw as indicative of how, as computers had become mundane, they no longer served to capture the attention of students:

It's certainly a misconception that if you put [students] in front of computers they'll work... Our students are so used to using the computers now... it's not a novelty anymore, it's just run of the mill. So those students who do have an attention problem... need to be able to focus down, and in the end... [I] sat down with a few individuals... and by giving them those focused tasks they were able to, for at least five minutes, concentrate. [A-OT/Int]

Paired at a limited number of computers, with cramped access to the machines, OT also noted the “very quiet people who... just sit on the sidelines”. He envisaged getting these students to swap positions and take on responsibilities in the following lesson:

[They] sit away from the computer and let somebody else... get on with it. And they'll just sit there quite happily looking over the shoulder, and the amount of information that is going in is questionable... So I hope... that will be rectified when they swap over tasks and roles... next time. [A-OT/Int]

5.1.2. Theme A2: Structuring and supporting activity through online worksheets and informal teaching

The project report noted how worksheets could be “strategically used as a means of guiding the students”, assisting classroom “activities [to] be student-centred allowing individuals to work at their own rate” and “the teacher to take more of an advisory role” [A/Rep]. Equally, while teachers talked of being able to ‘stand back’ [OT] and of trying not to ‘interfere’ [VM], they also

valued the opportunity for closer and more personal interactions with students, typically to support and shape activity without overly controlling it:

I'm there making sure that they're happy with what they're doing, answering questions that they might have, and trying to point them in the right direction, rather than teaching from the front... It gives you the opportunity to go around and talk to every student individually and just show an interest in what they're doing. [A-VM/Int]

In both lessons, work on the assigned task was structured by an online worksheet. A small number of hyperlinks – usually annotated – guided students – and facilitated access – to relevant material. Such material was intended to function “just like an online text book... that we're... directing the students to” [A-VM/Int]. It was envisaged that some students might go beyond the preselected material and conduct their own Internet searches, but there was little of this:

[The] structure that I've given them... [is] focusing them onto specific points, and yet at the end gives them the opportunity to look elsewhere to do their own searches beyond those sites if they feel competent enough. The majority in this lesson were just concentrating on four or five sites that I'd particularly pointed out. [A-OT/Int]

Equally, teachers were aware of differing degrees to which students actively sifted the quite extensive material available so as to relate it directly to the questions posed by the worksheet:

I was pleased to some extent that they were just cutting and pasting... to get the key chunks of information so they can sift through that at a later date. The odd person printing out whole reams is inevitable... [The others] are being a little bit more choosy about what information they can try and extract. [A-OT/Int]

Use of a worksheet was seen as providing structure for the assigned task, freeing the teacher to play a more facilitative and less directive role through informal teaching:

[You] are going around just probing them and giving them stimuli but not giving them answers... And on the odd occasion you just chivvy them along and make sure they are on task, but no formal teaching. One of the things that the ICT does do, it allows you to just stand back and... to go round and engage individuals or small groups. The ICT itself does the teaching if you've got it structured correctly. [A-OT/Int]

However, reviewing the difficulties he encountered in his lesson, OT identified deficiencies in the newly prepared worksheet he was using. He felt that it had not provided sufficient structure and guidance for students, particularly in getting started on the task:

It was just too open-ended... It just needs to be more specific and more prescriptive about what they are going to do... My initial intention [was] just a quick introduction... and then go round and talk to the groups to make sure that they are clear about... what they are looking for... But obviously, inevitably, there are groups that get left till last, and they're floundering a bit more. [A-OT/Int]

5.1.3. Theme A3: Using preselected Internet material to enhance resources and complement textbooks

Teachers saw the Internet as providing a range of information from which they could preselect appropriate material to enhance the resources available for lesson tasks. The project report talked of “providing up to date information beyond that available in standard textbooks” and of presenting material through non-textual media in ways “relevant and motivational to a range of students with different preferred learning styles” [A/Rep]. For OT, it was the availability of information relevant to the topic of the lesson and appropriately pitched for the students which

had recommended use of the Internet to supplement the limited material available in textbooks:

The sites that I chose were reasonably well written and on the whole at the right target age... Very few text books have this kind of information in... It just doesn't appear in textbooks... partly because... this particular aspect is new to the... National Curriculum... This isn't a topic that needs to be up-to-date, it was just the fact that the information was there. [A-OT/Int]

Before her lesson, VM commented that “the Internet is extremely useful since information can be gathered from a wide range of sources with motivating activities” [A-VM/Obs]. She was particularly disappointed when the main resources she has envisaged students using – virtual tours of a rainforest and desert – proved unstable, due to a problem with the school network:

The tours were the main point of the lesson and they were really quite interesting. And so it did fall flat because the computers turned themselves off and didn't like you clicking from one thing on to the next. ... I don't think they got far enough into their tours... to be able to get to the bits that I really wanted, buttress roots and good adaptations and long root systems and all the rest of it. [A-VM/Int]

Both teachers wanted students to see Internet resources and textbooks as complementary. OT's lesson started with a task built around the double-page spread in a textbook:

One of the reasons for integrating the textbook work... is to emphasise the fact that the Internet isn't everything, that you can get information from books still, they aren't completely redundant. [A-OT/Int]

However, VM noted how, without direction, many of her students did not use their textbook in what she had described to them as ‘an Internet lesson’:

It did actually say on the worksheet, ‘Use the computer or the textbook’. But the majority of students, I had to actually go and say, ‘Why aren't you using your textbook?’ because they could have got through those first three questions very, very quickly if they'd thought to do that. But I'd said it was an Internet lesson and they thought, ‘Oh, we've got to find all this information from the Internet’. So I wanted to also raise their awareness that it isn't always the most appropriate source of information to use. [A-VM/Int]

5.1.4. Summary review

In this project, classes made relatively structured use of teacher-selected Internet resources in studying a single topic over a short period. Assigning tasks was seen as a way of promoting more active student participation in lessons. The use of worksheets – sometimes online – was viewed as playing an important part in structuring this activity, leaving the teacher free to play a supporting role and provide informal teaching. Preselected Internet material was seen as enhancing task resources and complementing textbooks.

Even where such material was considered to be functioning as ‘just another textbook’, it appeared that project lessons often involved working with a range of information sources rather than a single definitive one. This opened up possibilities of critical synthesis – not just selection – of material. The relatively short duration of these Science units and the tight timing of classroom activities militated against this issue being taken up within the project. Nevertheless, it was one that the teachers wished to address, reporting that it was explicit in a new component of the Science curriculum concerned with ‘Ideas and evidence in science’:

Unlike everything else in the National Curriculum... it isn't content driven. The main emphasis is on research, it's on analysing the information that they get, it's on evaluating sources that they use, and to that extent... it's just brand new to us in Science. We've never had a skill area like this before. So they need to be able to access... all sorts of different information sources, and the Internet is, in this particular case, one of the most useful. [A-OT/Int]

It is appropriate, then, to turn to another project, and to a subject in which – at least in England – the place of analysing and evaluating sources is better established.

5.2. *Project B: Using a virtual archive in developing skills of historical interpretation*

This project used Internet resources to enhance an existing unit of work in History. Over some 20 lessons, pupils engaged with archived documents and artefacts relating to the First World War, accumulating insights into the part played in historical enquiry by interpretation of diverse types of historical source. The unit culminated in pupils writing an essay exploring issues of interpreting evidence, involving reference to the full range of archival material they had encountered.

The observed lessons took place towards the end of the unit, shortly before an excursion in which the classes were to visit a battlefield from the war. In one lesson [B-AY], pupils analysed differing accounts of the battle in question using a range of sources with a set of written questions to guide them; while in the other [B-OL], pupils examined how artists had depicted the experience of war through close study of a small set of images.

5.2.1. *Theme B1: Providing structure and support for activity while preserving pupil agency*

An important concern in the project was to provide structure and support for lesson tasks while preserving the sense of agency which encouraged pupils to deepen their engagement with them. In response to dissatisfaction with some of the earlier lessons in the unit, the teachers had increased structure, both in posing tasks and in accessing materials. In particular, they had selected and adapted Internet resources to create a virtual archive on the school intranet:

The first lesson[s] that we did on the project... we left too much open... But this task today, it was certainly well structured, and they went from point to point, and generally... that's worked better... We've been quite selective in what we've put onto the site and... that's been really helpful. Today... the account of the battle is actually not that long... We adapted one or two things as well. We've taken things out that are... unnecessary... This is much tighter because the ICT stuff is set up much tighter. [B-AY/Int]

Nevertheless, suitably constrained research still had a part to play. While OL noted that in the observed lesson he had preselected a small set of images from the archive, he also referred to another occasion on which he had directed pupils to a particular site with a view to their browsing the available material to gain an appreciation of its variety:

I didn't really allow them any research [in the observed lesson]. I focused on... pictures and told them which ones, because it was important that they weren't spending too much time, for the purposes of... that lesson. But when we looked at... war propaganda posters, there's a site which simply doesn't exist in book form or any other form, where you've got posters from Canada, America, Britain, France, and being able to research that [was] fantastic. [B-OL/Int]

OL emphasised finding a balance between providing sufficient structure for activity and preserving a degree of student agency. In relation to the observed lesson:

Getting a balance between directing and giving them quite a clear focus, but then allowing them the freedom to communicate that in pretty much whichever way they wanted to. I think they enjoy their freedom or autonomy and that was an important strategy in the success as well. [B-OL/Int]

He gave pupils the flexibility to choose an appropriate mode and level of ICT use:

The freedom with which to present the materials very much gave pupils who felt perhaps less confident at ICT the chance to do something they felt comfortable with, and those who wanted to show off and do slide shows or whatever could do that. [B-OL/Int]

At the same time, he described encouraging the diffusion of enterprising uses of ICT:

Up till last lesson, most pupils were using *Word*, but one chose to break away and use *PowerPoint*, and... I made quite a fuss about that... ‘Hey everyone, look what [named pupil]’s doing’. This was the next lesson and... nearly everyone was [using *PowerPoint*], and I think that had been quite infectious... So I think celebrating successes like that... can influence others. I think this interdependency is important. [B-OL/Int]

OL also commented on how pupils “were able to dictate to some extent the pace” and drew attention to how “a lot of the time they were free to discuss, at whichever level”. However, he also noted his own “important” contribution in “going around... and feeding them ideas, asking questions and trying to move them on” [B-OL/Int]. AY, in turn, described his role in terms of “checking understanding, giving instructions about what to do, supporting kids who are struggling,... jogging one or two people along and also, of course, having to deal with one or two technical hitches” [B-AY/Int].

Overall, the project teachers perceived themselves as “far less didactic in [their] approach” within project lessons, reporting corroboration from pupils [B/Rep]. They pointed to how discussion of on-screen work contributed to this shift:

We both found it was easier to intervene as there was already ongoing dialogue between pupils. Having work on the screen enabled both pupils and ourselves to view and discuss the work collaboratively. This contrasts with our previous classroom experience with these groups where it is often difficult to do this. [B/Rep]

Likewise, they reported that the extensive range of resources created situations in which teacher and pupils could engage with an unfamiliar source on more equal terms:

On a number of occasions pupils discovered sources which we had not seen. This happens rarely when students do not have access to [such a] range of information... and led to the teacher and pupil unravelling the sources together. [B/Rep]

The project report concluded that the approach which had been developed “enables pupils to be independent learners”, permits “teachers [to] spend more time with individuals”, and “fosters a more collaborative approach between pupils and teachers” [B/Rep].

5.2.2. Theme B2: Enlarging evidence and experience through authentic resources and non-textual media

An important aim of the unit was that pupils should develop their appreciation of the way in which historical analyses of events draw on evidence open to interpretation, and on accounts written from different perspectives. Material from the Internet was considered to have greatly enhanced the unit, for example in the form of the differing accounts of the battle offered on

websites maintained by groups from different countries, and by the official visitor centre at the battlefield itself:

We base our trip around the Vimy Ridge site, but if you go looking for information in textbooks about the Battle of Vimy Ridge, you won't find any... So you can do fieldwork there... which is good, but of course fieldwork needs backing up... with other sources and so we wouldn't have been able to do it. [B-AY/Int]

The project had assembled material, varied in form and provenance, offering differing representations and interpretations of the battle and the war:

We've got on there pictures, written accounts of the battle, we've got biographical information, we've got letters, we've got diaries, and we've got posters. We've got all sorts. [B-AY/Int]

Alongside the battlefield visit, the use of non-textual media and authentic resources was seen as promoting multisensory and empathetic understanding:

We've got the... ability for kids to use their eyes... to get a feel of the environment that the soldiers were fighting in, so the field trip is really adding something to this... We've used film as well and I think all those things, they're alerting the different senses what it was all about. Perhaps we're getting a more... total picture. [B-AY/Int]

In AY's lesson, the impending visit was used to impart a sense of import and urgency to the analysis taking place, as pupils researched the battle at Vimy Ridge:

On Friday we're going to Vimy Ridge, so we're still trying to get this notion of how far this is a Canadian victory, because we've got other information which tells us it wasn't just... British soldiers were involved in playing a very important part, the French soldiers as well... and we've already done a little bit of work on that. Also, we've just located some information about one of the guys who's responsible for quite a few of the sites that we've looked at. We've got some biographical information on him, so how reliable is he as a source? [B-AY/Int]

Likewise in OL's lesson, where pupils examined the portrayal of war in a virtual exhibition of paintings, care was taken to create a sense of authentic contact with a wider world:

The sense that this was an exhibition that they were visiting, a virtual exhibition, not just some pictures I'd chosen from a book, but something which was connected with the UN, which I mentioned at the beginning of the lesson, I think that was important, to put those pictures into context. It kind of brought the reality of outside into the classroom. [B-OL/Int]

5.2.3. Theme B3: Enhancing discussion and argumentation through ICT-supported handling of evidence

The teachers saw pupil discussion and argumentation as playing a key part in successful learning. They pointed to a number of ICT-supported approaches which had enhanced these processes. AY saw benefit in 'using the computer like a notepad' to annotate materials:

One of the things that we've found is that you can almost use the computer like a notepad; whereas when kids are working with ... a written document, then we don't let them scrawl all over it because we need to use it again and it costs money. The thinking behind that kind of activity is to get them... looking at the screen, marking things on, and generally generate some discussion amongst themselves... I do think this idea of working on screen does develop their thinking because there's been a lot more discussion generated... and I think discussion does bring increased understanding and improved learning. [B-AY/Int]

Likewise, OL suggested that enlarging electronic images assisted attention to detail, while physically (re)positioning them as pupils were drafting their reports stimulated discussion:

The ability to manipulate the pictures was important... simply enlarging it, whereas if it appeared in a textbook, or if I'd provided it, it would have been one size, and they wouldn't be able to hone in on details, so that was important... The actual copying and pasting the picture, placing it, all helps with the discussion. [B-OL/Int]

Using the virtual archive and ICT tools also influenced the quality of analysis and argument in the final assignment. Working individually, pupils had been able “to support their findings in a more sophisticated way, by the ease of incorporating evidence into their work”. Equally, “sorting through the data, classifying and supporting arguments with evidence, were all facilitated through the use of ICT”. In particular, “creating tables helped pupils to classify their ideas and allowed them to manipulate what they had found out more easily” [B/Rep].

In addition, OL noted that containing the reading and writing demands of tasks played an important part in establishing an emphasis on thoughtful selection and discriminating use of material, suggesting that this had proved motivating to pupils:

There wasn't a huge amount to read... And there wasn't a huge amount of word-processing either... It was really more the discussion and the thought which went into it, and them being selective about what they typed. There's a shift now... in the way that the pupils see the subject, from content and writing lots, to putting more time into thinking and being more selective. So a lot more copying and pasting selectively which I think has... helped to motivate them. [B-OL/Int]

Equally, these teachers saw interaction between paired pupils as making an important contribution. Although AY reported having been pushed towards pairing pupils because of limited computer availability, he was pleased with the outcome:

There aren't too many problems with kids working together. They've been on task. Even where there's a particular pair... who seem to be very much at each other's throats, there's some kind of synthesis there which has actually produced some very good work. [B-AY/Int]

Consonant with his concern for ‘interdependency’, OL attributed the collaboration which he observed between pupils to the established culture of his classroom:

It was actually very democratic the way the children were working together, even although usually one person was doing the typing, the other person was very much engaged. There wasn't much evidence of free riders, people just sitting back and letting the other person do the work. But that's because of the culture which has been built up over the year and a half that I've had them. [B-OL/Int]

5.2.4. *Summary review*

A particular concern of this project was with providing structure and support for activity while preserving pupil agency. Lessons made use of a virtual archive in a distinctively cumulative way, intending pupils to build up knowledge and understanding of the collection over a sustained period. Teacher-preselected authentic resources from the Internet, and the use of non-textual media, were seen as broadening the evidence and enlarging the experience available to pupils. Again rather distinctively, a number of ICT-supported techniques for handling this evidence were seen as enhancing pupil discussion and argumentation.

While the teachers “strongly recommend[ed] this approach to teachers across the curriculum” [B/Rep], account needs to be taken of the prominent part accorded to enquiry and interpretation in the History curriculum (and also of the unusually high academic standing and motivation of the classes involved). In terms of broad approach, like Project A, this project pursued forms of

structured and supported activity continuous with established pedagogical approaches and classroom resources. In particular, both projects eschewed direct Internet searching by pupils in favour of a more immediate use of teacher-selected material.

We now turn to a project which posited a sharp contrast between what it termed ‘traditional’ classroom methods and the ‘ICT’ or ‘Internet’ approach it sought to develop, with an important expression of this contrast being independent Internet searching by pupils.

5.3. Project C: Making intensive use of ICT in independent study of geography topics

This project used Internet resources in the Geography lessons of two classes over a complete school term. It made unusually intensive use of ICT tools as well as giving emphasis to Internet searching. Of all the projects, this was the only one where teachers developed serious reservations about their approach, anchored in the comparisons they made between project classes and similar classes following the same curriculum in a more customary way.

In a lesson [C-FC] observed half way through the term, pupils worked on a structured task leading to their recommending a source of renewable energy for a ski resort in the Italian Alps. This built on earlier lessons in which they had gathered information about a chosen Alpine ski resort, and investigated environmental issues in the Alps. The other observed lesson [C-DR] was the final one of the term; it aimed to synthesise ideas from previous lessons to inform a similar decision-making exercise: devising a flood protection plan for a British village.

5.3.1. Theme C1: Using ICT to increase pupil independence and enjoyment of classwork

With project as with comparison classes (often tackling the same task using paper-based resources), teachers sought to relate geographical knowledge to ‘real life situations’:

I think this activity is very useful because they actually put the geography they’ve learned or are learning into a proper situation... rather than just going through textbooks all the time... They enjoy using the computers, and they enjoy putting into this kind of situation. [C-DR/Int]

The opportunity for pupils to ‘use ICT for themselves’ in the project lessons was presented as providing welcome contrast to a textbook-based approach:

Their experience of using ICT for themselves... they see more value to it than the ones who’ve just had four lessons in the classroom with a textbook and have now got a fifth lesson in the classroom with a textbook... These kids like the change... they like using ICT, so it sparks them. [C-FC/Int]

Other contributory elements were seen as the changed ambience and approach, notably the more independent activity open to pupils:

They’re doing something different. They’re not sitting in a classroom facing the teacher and the teacher’s being didactic... They’re in a different sort of room, they’re using computers, and they’re allowed to work largely by themselves, unless they get stuck, and they like that method of learning. [C-FC/Int]

Using ICT as fully as possible was a prominent concern of one of the teachers, aspiring to eliminate paper-based materials and processes:

This is where I wanted to go when we started the project... to try and just use computers, to get away from paper, to get away from books. And I was quite pleased with the fact that I got the resource sheet onto the [shared disk

drive], and they could then cut something off the resource sheet, they could put that onto a *Paint* document, and then they could alter it, and then cut that and put it onto a *Word* document, and then do their changes... So the last lesson was utopia if you like. I finally reached it, [the] nirvana of IT work in geography, not having to use any books or anything. [C-DR/Int]

However, the teachers conveyed no sense of a particular medium shaping activity in more specific ways. Reviewing the final lesson of the term, DR talked of pupils in project and comparison classes as having “the same resource but in a different medium, on paper or on the screen” [C-DR/Int]. Beyond the classroom, however, working exclusively with ICT introduced a significant practical problem, noted by both teachers and reiterated in the project report: that pupils in the ICT-intensive classes were relatively ill-provided as regards access to materials for homework and revision:

The ‘non-ICT’ [class] will revise through their exercise books; the ‘ICT’ [class] are not printing out from the computers yet, so they’ve got no printouts, so they’ve nothing to hold in front of them... For [the] ‘ICT’ [class] to revise they have to go into the resource centre at lunchtime or... after school to access a computer... Only thing they can’t do, they can’t revise at home. [C-FC/Int]

To address this the teachers eventually produced handouts specifically for revision purposes.

5.3.2. *Theme C2: Sparking and supporting independent pupil activity*

Both teachers reported taking a lesser role in directing pupils to information and shaping their interpretation of it. FC contrasted his approaches in project and comparison classes:

In [the] ‘ICT’ [class] they know they can get the knowledge and fulfil their requirements from the World Wide Web. Whereas in the classroom I’m there and I’m explaining and I’m saying ‘This is explained in the text book, let’s have a look at this photograph, ... let’s look at that diagram’. [C-FC/Int]

Interviewed late in the project, and exercised by the poor performance of project classes on school tests, DR talked of their not having “been drip-fed quite as much as they should” [C-DR/Int], although he pointed to possible wider gains in their skills of reading and analysis:

During lesson time, the activities I do with the [comparison class] are very much focused towards the geography... whereas the IT group are having to read through a whole load of information... and try and pick out. So maybe they’ve developed new skills about reading and analysing information. [C-DR/Int]

FC emphasised helping pupils to ‘spark’ into independent activity in project lessons:

A lot of kids, they need an initial spark; once they’ve got that initial spark they’re up and running... [I’m] trying to work out what they’re thinking and then just trying to lead them along the path to reach the spark... Once they’ve got that spark, then they’re off and running. [C-FC/Int]

Accordingly, he expected most of his class to work independently at individual terminals, while he concentrated on the pupils ‘needing attention’, grouped at one side of the room:

Those who I know need more attention are grouped together, and... I spend most of my time on one side of the classroom, [with] occasionally five minutes on the other side just to make sure it’s all ticking over. [C-FC/Int]

As well as helping these pupils with ICT skills and geographical searches, FC assisted them to read material and make sense of it:

Some of it was interpreting words for them, or saying, “Well don’t worry about that particular page of a website, because maybe that’s a little too [complicated]”... and trying to pull ideas into their heads, or ideas out of their heads, where they weren’t getting ideas. [C-FC/Int]

Having pupils search for information was conceived as an important expression of their independent activity within the project, even if it ‘slowed down’ lessons:

In a normal classroom the information I want is there on page 15 and you go straight to it. Using the Internet it’s ‘Right, the information I want you to find out is [such and such]. Right, now let’s find it’. But they’ve got to physically find it and that slows it down. [But] if I... say, ‘Right, go straight to these websites’... then they’re losing out some of their ICT impact. [C-FC/Int]

As well as reducing the ‘ICT impact’, directing pupils to sites was seen as running against the ‘student-centred’ intentions of the project:

[If] you say ‘Right, everyone go onto this website, then go onto this page’... then that’s sort of defeating the object of student-centred learning and in terms of trying to find information, there’s no difference between using that and the text book. [C-DR/Int]

5.3.3. *Theme C3: Effecting subject learning through preselecting resources, focusing attention and sharpening strategies*

Nevertheless, pupils did not carry out Internet searches in either lesson observed. Recent pupil difficulties in finding appropriately pitched material had led FC to preselect a suitable site:

They have become very, very good at doing the searches now, using a search engine, and I trusted that skill alone to enable them to get to an appropriate site. The topic from the last lesson was such that however good their search skills are, it would only take them to a university site and I hadn’t realised that. So deliberately this lesson I went in and I found a site that was appropriate to their level, which they could understand and access easily. [C-FC/Int]

This ‘spoon-feeding’ was envisaged as a temporary ‘simplification’:

I’ll keep simplifying it for maybe another two or three lessons, but I want to get back to the stage where there’s less simplification, less spoon-feeding from myself in terms of websites and searches. [C-FC/Int]

FC also reported how reservations about the writing strategy adopted by some pupils had led him to intervene to promote more selection and (re)organisation of Internet material:

If any writing’s involved, they’ve adopted a strategy, which I don’t disapprove of, but I modify... Cutting [text from Internet sources], pasting it onto their *Word* document, and then going into that and changing it into their own words, or changing some of it. It’s a strategy which is almost copying from the Internet... but I don’t mind too much ... if they’re going into those words and changing them... [because] they must then be actively reading that sentence or that paragraph and actually understand it to be able to change it. [C-FC/Int]

In the later observed lesson, pupils were provided with prepared resources. DR placed more emphasis than his colleague on circulating round the room, attending to ongoing pupil activity:

I kind of like the idea of the kids doing all the work and me going round. It means that I can focus on the children a lot more. [C-DR/Int]

He was concerned that pupils' attention to ICT had been impeding their learning of geography:

[A] problem that I've been facing with this group over the past term, is [that] their IT skills have developed incredibly... [but] I think their geography has suffered... So it's something I keep on going on at them about. Half way through a lesson I'll say 'Remember your focus is on geography'. It's very easy to get wrapped up in a beautiful title or lots of pictures. [C-DR/Int]

Reviewing the observed lesson, he reported fulfilling roles as teacher both of ICT and of geography, as well as taskmaster "hounding them to get it done" [C-DR/Int]:

So one role was as an ICT teacher, showing them a new skill, making sure that there wasn't any problem with that... Another one of my roles was... trying to basically push their geography forward, so that was more the geography side of things. And then... chivvying them along. [C-DR/Int]

5.3.4. *Summary review*

What was distinctive about this project was its framing of key issues in terms of sharp contrasts: between teacher-led and student-centred lessons; and in terms of eliminating paper-based materials from project lessons. Using ICT was seen as a means of promoting pupil independence and enjoyment of classwork. Teachers envisaged 'sparking' pupils into independent activity on an assigned task and then offering support on request. In practice, responding to needs perceived in lessons, they introduced greater structure and support through preselecting Internet resources, focusing pupils' attention, and sharpening pupils' strategies.

While the evidence gathered by teachers indicated that the project had indeed been successful in terms of promoting pupil enjoyment of classwork, and that the quality of pupils' coursework had improved, the teachers became concerned that this had been at the expense of mastery of the core geographical content assessed in school tests. The project revealed a range of factors inhibiting pupils' learning of this core geographical content, notably displacement of attention to this content in favour of using ICT tools and framing Internet searches, and the unavailability of material to support homework and revision.

Such issues came to the fore in this project in part because the attention which it gave to gathering comparative evidence made it possible to systematically evaluate various aspects of pupil attitude and achievement (unlike those projects previously considered). On the other hand, this project gave little attention to the finer texture of teaching and learning. Its rather bald conclusion was that "traditional teaching methods (text book and teacher) are more effective for helping students understand the theory work, whereas the Internet can enhance the attainment and motivation of pupils when conducting project work" [C/Rep].

The particular interest of the next project to be considered is that it was the only one to focus specifically on independent project work by pupils.

5.4. *Project D: Using Internet resources in researching a Latin coursework topic*

This project examined the development of research skills by Latin students, each investigating a self-chosen aspect of Roman life for coursework, using the school library and the Internet as the major means of accessing material. The project aimed "to devise strategies to enable students to develop as independent, effective, efficient and discerning electronic information gatherers rather [than] remain as serendipitous and credulous surfer-browsers" [D/Rep].

Two lessons were observed at the start of pupils' coursework. In the earlier lesson [D-LL'], the teacher restricted pupils to using book stock; in the later [D-LL], to using the Internet; with a view to their employing both media thenceforth.

5.4.1. Theme D1: Directing pupil activity towards finding facts and framing questions

In both lessons the teacher set pupils a very concrete objective, aimed at helping to get – and keep – pupils on task: that of finding five facts relevant to their project:

The reason I asked them to come up with five facts is because I've found during resource lessons before, they get a few books, prop them up, and then chat, because they're going to take the books out... So perhaps because... they're working in what could be seen as a social situation round a table with their mates, they want to defer that single working until they get home, and do the old chat bit, so that's why I wanted them to have five facts. [D-LL'/Int]

However, LL contrasted the 'Internet' lesson with the earlier 'library' lesson, relating the absence of socialising by pupils to the individual seating arrangements at separate terminals:

It's partly the disposition of the seats, but there was less socialisation [in the 'Internet' lesson]... Whereas before [in the 'library' lesson]... they were sitting... in social groupings and there was some socialisation going on. They had their books open and that was the background to a little bit of social [chat]. [D-LL/Int]

LL also commented on the attitude of pupils in the 'Internet' lesson. She related this not only to their working on a self-chosen topic, and to the change of environment (factors shared with the 'library' lesson), but to the pleasure that pupils took in using the Internet:

They knew they were having a lesson on the Internet... So they were disposed... They were doing what they'd already chosen to for their coursework... And they knew it was something different too. Different location... exclusive use of machines... So they were disposed to having an enjoyable lesson. [D-LL/Int]

The engagement of pupils in their coursework allowed LL's energies to be channelled into supporting their thinking:

My role was different... in that there were no classroom management problems at all. So there was nobody who was chatting, there was nobody who was passing notes or all their usual low-level displacement activities, which they would do in the normal classroom. There was none of that... They were all on task, so my role was different... checking and discussing their coursework, which is what I really should be doing.... It was much more them working and me just bombing about. [D-LL/Int]

LL's interventions were aimed at taking pupils beyond the immediate objective she had set of amassing facts, towards more critical engagement with material and more argumentative use of it, through formulating an appropriate organising question:

First of all I was... discussing the site with them, whether it was a worthwhile site. And also I was discussing the actual title of their coursework... But if they just have a title, a topic – food, gladiators, religion – it tends to be what I call a 'bung essay' in that they just bung down random facts, and they don't actually organise the facts towards an argument which is what they get marks for. And one of the best ways of making sure that they are getting the marks... is a question in their head, a kind of exam-type question: 'How did the Romans use food to confirm status'; something like that. And then they can marshal their facts and produce an argument: 'How did the Romans use pain within their punishment system'. So instead of just a list of all the horrible things they did to each other, you have to actually think about how they are using this thing. So I was actually discussing the kind of questions they could ask themselves. [D-LL/Int]

5.4.2. Theme D2: Establishing a dialectic between library and Internet resources

An important part of the critical perspective that LL was seeking to develop was appreciation of the relative qualities of library and Internet, and an according dialectic of use. LL contrasted the accessibility and acceptability of the highly filtered material in the school library with the diversity and unpredictability, vivacity and currency, but sometimes dubious validity, of Internet material. She pointed to the scope for pupils to triangulate the latter against the former:

[Library stock] has gone through a filtering process. It's designed for the age group..., it's produced by reputable educational publishers..., it goes through additional filtering by the librarian or the subject specialist, so it's had lots of layers of filtering... and therefore it's appropriate information for their level and for their needs at this stage. It's very useful... to have that as opposed to the freedom of the Internet, which is going to get them much more excited, and [give] interesting information and much more up-to-date information, but it isn't always reliable information because it hasn't gone through that filtering process. So if they've got that background, 'Oh I read in that book that etcetera. This one seems a bit odd to me from what I now know', then they become unsure. [D-LL/Int]

It was to bring out such ideas that LL restricted pupils to using library book stock in the earlier lesson and the Internet in the later, then asking them to brainstorm the difference:

I explained to them that... it's not [that] one's better than the other... They've just got to think of the advantages and disadvantages of using... the school library and the Internet... And they all, the boys, said 'Oh the Internet's obviously better'... 'Why is it better?' 'Because there's so much more information on it.' But slowly they began to get through to see the advantages and disadvantages of both... [and the need] to be much more... critical and discerning in their use of sites than they are with the book stock. [D-LL/Int]

Reviewing the 'Internet' lesson, LL commented not just on the amount of material found, but on some of its distinctive features, and on a degree of critical response by pupils:

They had achieved more than I hoped. And also there were some scepticisms about the sites that [they] were using. The girls said, 'I don't know if this is first century or not'. And they also had found quite unusual sites. For example, the girl who was doing decoration of Roman women and what they wear and their hairstyles and things, she'd actually found a catalogue of Roman artefacts for sale... It was brilliant because it had these lovely illustrations of rings and all these things you could buy. So she could certainly use that... It was a unique piece of information, which was specific to the Internet. [D-LL/Int]

LL was correspondingly alert to examples of pupils questioning and cross-checking information retrieved from the Internet:

And that's quite useful that one of the girls... found a site of Roman recipes. Well I don't know what date they were. They were called 'Roman recipes', but how did she know? How could any of us know? It looked a bit dicey to me. Actually that's what she was saying, 'Who thinks it's fun to make up Roman recipes?'. [D-LL/Int] And one of the people who was looking at human rights. She said, 'I'm not sure where this site's from'. So she was actually thinking about what were the problems of her site... The boys who had the information on Roman technology, they'd already found book sources which had information in about the disposition of an arch. So hopefully that confirmed for them the validity of that piece of information. [D-LL/Int]

The project reported that "the most focused lessons were where students used electronic and non-electronic sources in conjunction" [D/Rep], pointing to success in establishing a dialectic between library and Internet sources in the ensuing lesson where pupils were free to use either:

In the third lesson, pupils could choose any materials they wished. All, except one, began the lesson on the Internet – mostly using sites they had chosen previously. However, a significant number, while remaining logged on, supplemented or checked information using book stock – in many ways this produced the best lesson in terms of focused activity. [D/Rep]

5.4.3. *Theme D3: Developing and motivating use of library and Internet search techniques*

Reviewing both lessons, LL identified a need to deal more explicitly with search techniques. In the ‘library’ lesson, she noted that pupils tended to restrict their attention to a single classmark:

They weren’t using the library imaginatively enough... The catalogues were down, but they didn’t go to other parts of the library... because they think all of it’s going to be in one place... and therefore I had to go, ‘Go over here. Go over here’, because [relevant books] are scattered about depending on the dominant subject area... They hadn’t really caught on to using the library properly. [D-LL/Int]

Similarly, in the ‘Internet’ lesson, she noted a lack of attention to the framing of searches:

We did nothing on search techniques really; they just put up any old thing. They put in ‘Roman baths’ or whatever it was... [In the future] I think I would actually look at how they go about it because it’s a generic skill anyway, looking forward, thinking of search terms, thinking of alternative terms, thinking of broader terms, thinking of narrower terms, which I guess are just bog-standard search techniques. [D-LL/Int]

However, LL also pointed to factors subverting such approaches under the circumstances in which she and the pupils were working. First, the viability of simply browsing the book stock in a small school library reduced the incentive to employ more sophisticated search techniques:

In a couple of lessons you could have skimmed through... and come up with the books you want. So you don’t have to have those finely tuned search skills to go exactly where you want immediately, which you need to do if you’re working in a big library. Having said that, serendipity works well too. [D-LL/Int]

Similarly, a simple Internet search typically provided sufficient material for browsing:

But I suppose you could argue that there’s so much information on the Internet anyway, you don’t have to be quite so meticulous about search terms really because there’s oodles. [D-LL/Int]

While LL did proceed to introduce pupils to more systematic and analytic methods of searching, she reported a fundamental reluctance of many pupils to defer interaction with the computer in favour of a more premeditated search, and more broadly to cede the Internet as a personal domain:

After students had spent time away from the computers refining their search strategies, devising key search terms and thinking about criteria for judging the availability of web-sites, there was some improvement in the speed with which sites were selected, the relevance and reliability of those sites. Additionally, these thinking skill strategies sharpened the students’ understanding of their chosen topic... Although pupils were compliant in the lessons, pupil interviews indicated that, although they could see the rationale behind the initial search analysis, they found it an irritating deferral of their computer time... The subtext of... responses suggested that some pupils regard the Internet as their own private area of expertise and power and resented teacher intrusion or manipulation of what they regarded as their own discrete world. [D/Rep]

5.4.4. *Summary review*

This project had a distinctive focus on developing pupils’ research skills in carrying out coursework. At the start, directing pupils to find facts served not just as a basic strategy of research but as a means of classroom management; while assisting pupils to formulate an organising

question was intended to lead them towards more critical engagement with material and more argumentative use of it. Library and Internet resources were seen as having often complementary qualities, and the project aimed to establish a corresponding dialectic between them in which Internet material was validated against library sources. While the project saw development of search techniques as important, it identified some significant difficulties in motivating their use.

A distinctive feature of this project was the way in which it brought issues of relevance and validity to the fore. Whereas use of teacher-selected Internet material offers pupils information which –like that in textbooks and other conventional resources – has already been authoritatively sanctioned, through its approach to Internet research this project started to expose – albeit in relatively simple terms – epistemological issues which are typically bypassed in classrooms.

The projects reviewed so far all involved relatively academically successful pupils. The final project to be considered focused on a class different in this respect.

5.5. Project E: Mediating the study of geography by less academically successful pupils

This project focused on a class of academically disadvantaged pupils. It aimed to develop their skills in accessing Internet resources and using related ICT tools, and to employ these skills to support their learning of Geography.

At a relatively late stage of the project, we observed the first lesson [E-DD] of a geographical review of Brazil. In this lesson, pupils were to search the Internet for material which they could use to design and write a postcard from Brazil.

5.5.1. Theme E1: Managing potential difficulties associated with using ICT

An important concern of DD was managing potential difficulties associated with using ICT, which interacted in turn with the volatility of this particular class. Reviewing the observed lesson, he highlighted how the unpredictable mood of pupils influenced classroom ambience and collective motivation, and thus the prospects of pursuing a planned lesson:

The prime thing... with this particular group... is the mood, and that... manifests itself in things like noise levels. Now the noise level today was very, very low, which made communication easier. There were hardly any fights at all. It's so refreshing, not to have to be constantly pulling people apart... They were in a mood where I could jolly them along... [So] today, they as a class gave me their permission to teach them. And sometimes, as a class they will withdraw that permission. [E-DD/Int]

Against this background, DD had been alert to potential problems in moving from his own classroom to another location in order to make use of ICT facilities. Hence, he had “purposefully ma[d]e sure that they have the ICT lesson first thing in the morning” [E-DD/Int], and had chosen the library/resource centre rather than an alternative ICT suite because the former provided “more spacious and pleasant accommodation [with] plenty of computers... so [that] the group could spread out” noting that “this is important because it helps avoid the internecine arguments that are common in this group” [E-DD/Diary].

DD had started the lesson in his own room, where he customarily worked with the class. This was a means of establishing an atmosphere conducive to introducing the work planned, before moving to the library/resource centre to make use of computers:

That's something I always do with these groups. With the more able and experienced pupils, pupils where there aren't so many issues, I will generally arrange to meet them in the room that I've got booked. But when they get over there it's an informal space. When they are in here, it's my patch and I've just got more chance just to introduce the topic. So we have a little bit of lesson time to start with and then we go over... It just helps my authority a little because I'm in my space, and when we get across there it's not my domain and so it's more difficult to call them all to attention when they are not naturally people who give their attention. [E-DD/Int]

Before leaving for the library/resource centre, DD warned the class that “some unscrupulous people have taken the mouse-balls out of the mice”, later replenishing these from a supply he had brought with him [E-DD/Obs]. He had planned for the eventuality both of the Internet, and then his immediate fallback of the Encarta encyclopaedia, being inaccessible on the school network. Fortunately so, because this was the situation he encountered, although Encarta did subsequently become available:

I thought their behaviour, when they realised that we had technical problems, was little short of miraculous today... I'd got two or more strings to my bow in that Encarta is often a backup to work that we do, and the other back up is to go and get a book. And when I thought that Encarta wasn't going to load, I thought we'd have problems. [E-DD/Int]

DD described his role during this seatwork phase of the lesson primarily in terms of “having an overview of where different people are sitting to try and minimise conflict” and “making sure that those people who are weak are sitting quite close to somebody who can reach over and help them”, as well as “overcoming technical problems... [and] managing the task”, and “try[ing to] keep everybody going and giving... little... rewards” [E-DD/Int].

5.5.2. *Theme E2: Co-opting pupils to classwork through building their sense of ICT capability*

Co-opting pupils to classwork was a prime consideration for DD. Settling the class down at the start of the lesson, he held out the reward of using computers as an incentive to good behaviour:

At the beginning, the threat of not going over to the resource centre but staying in here with [me] droning on, was too much for them to bear... So it shows that it's a strong enough experience for them to be used as a carrot. [E-DD/Int]

Nevertheless, he reported that, apart from one pupil who was “very, very able technically” so that “it's nice for him to have a chance to shine” [E-DD/Int], there had been initial reluctance on the part of these pupils towards using ICT:

To start with, there was a great reluctance... ‘I can't do this. It never works. It always goes wrong. I never finish anything’. And as soon as they've started having successful lessons, then the reluctance has gone but I think it's a reluctance to do a lot of things which relates to all kinds of failures in some of their lives. [E-DD/Int]

DD was anxious to retain pupils' sense of capability with ICT; indeed this was a benefit of moving away from a classroom environment which he saw pupils as associating with failure:

They are at their best, that group, using ICT at the moment... When they're back in the classroom, no matter what one does to try and support... for a lot of them, they associate the classroom with failure. [E-DD/Int]

Hence, in planning this lesson after a long period away from the ICT room, DD had been concerned to ensure its success even if that meant repeating familiar work:

They didn't get there on the last Friday [before the vacation] because the network had gone down... They've had two weeks of Easter vacation. [Then] it was the first week back and I just wanted to get them settled. So they've had about a month away from the room, and I suppose my aims were really just to reintroduce them and to see whether they had remembered the things that I had been working on then. [E-DD/Int]

Thus the lesson had been expressly planned to avoid posing undue challenge to pupils, and this was then compounded by the unavailability of the Internet:

I don't think [the lesson] was particularly challenging... It was a very, very safe lesson, but it reassured me that they were remembering the basics and so I can take it on again. [E-DD/Int]

The project report highlighted some of the earlier difficulties of Internet searching that pupils had encountered, such as distraction by banners and hyperlinks, and problems in locating relevant material within a page:

Some pupils were immediately distracted by "banners" offering other services and they became hopelessly "lost"; others tried to choose a suitable website but were frustrated when they could not find the information they needed... However, strategies can be developed to help them to focus on the search for key words on the page, without being distracted by links and information which will not help them with their task. [E/Rep]

Another difficulty was the readability of text on some webpages:

Pupils identified the problem that text on web pages is often difficult to read for the following reasons: small text size, long sentences stretching across the screen, difficult vocabulary and the text being set against a strongly coloured or patterned background. Pupils reported that they found difficult sections of text easier to read when they cut and pasted the words onto a plain background and made the text larger and the width of text narrower using word processing software. [E/Rep]

Although creating a portal had been found successful in some ways, pupils could feel that this represented an excessive level of support:

The most successful strategy... was to create a "portal" page which included Internet links selected by the teacher... Pupils reported that they were pleased with their success when using this but several pupils agreed that they were not challenged by this high level of support. These pupils were then asked to type in the URL of the site themselves and they reported that this simple action made them feel they were doing more for themselves, although inaccurate typing caused occasional problems with this approach. [E/Rep]

5.5.3. *Theme E3: Marrying subject aims to human interest and personal agency*

An important theme in this project was one of marrying the pursuit of subject aims to the human interest and personal agency which engendered stronger pupil engagement with assigned tasks. Starting the lesson, DD had occasionally to call pupils to order, but they showed enthusiasm for the idea of producing postcards as he introduced it. Reviewing the lesson, he offered a rationale for the task; for the postcard 'as a useful device' around which subject knowledge could be developed:

With a postcard, you try to capture the essence of a place. One of the things I try to do as a geographer is to instil a sense of place. And so it's a useful device, which adapts itself extremely well to technology... And trying to get a sense of parts of Brazil, and then when we look at all of the postcards, the final fit of the jigsaw is that we get a sense of what a wonderfully diverse place it is. [E-DD/Int]

This had clearly been chosen as a task likely to have some resonance for the pupils. Similar considerations were in play when the teacher described how pupils responded to the human interest and accessible content of personal websites:

What they really love are little travel logs when somebody's been on holiday and they've got holiday snaps and little bits of diary, and they love those because there's a very, very human level. We did one on... somebody who'd been working in Africa for a while and it was very much day-to-day stuff, but... just the showers and the insects and things like that. And they absolutely loved that site and they kept on going back and wanting to go back to it. I mean it's just so well written because it's just written in a nice, chatty [style]. [E-DD/Int]

Regretting the inaccessibility of the Internet during the lesson, DD pointed not just to the greater variety of material that would have been available, but to the sense of personal agency in the face of unpredictability that the experience of 'fishing' the Internet offered pupils:

When they use Encarta, you get nice pictures but you don't get the reward of knowing. When I've talked to them, especially some of the boys, the nearest to their experience that I've been able to find [as] a parallel is fishing when they are using the Internet. For them, the Internet is fishing because you cast and you don't know what you are going to pull back and they get the same sort of excitement about getting a really good result as pulling in a nice fat fish. With Encarta, it's a bit like buying fish in a shop because it's all set out and you just choose the one that you want. And they quite enjoy the unknown. [E-DD/Int]

Equally, DD regretted that by not being called on to make decisions about what to investigate further, pupils had lost an opportunity to learn to temper human interest with task relevance:

The other thing they didn't get was choosing which site to go to... I've been working at... the idea that the most exciting looking sites are not necessarily ones which are really going to help you with your work. [E-DD/Int]

5.5.4. *Summary review*

The key concerns of this project reflected the particular demands of teaching academically disadvantaged pupils at a stage when they have come to see little prospect of success in their school career. On the one hand, the project viewed ICT as a potential means of co-opting pupils through offering a fresh arena, distinct from the conventional classroom, where it might be possible to give pupils a new sense of capability, and so better engage them in classwork. Equally, the capacity of Internet resources to introduce greater human interest, and of Internet searching to provide a sense of personal agency, were seen as similarly contributing to engaging pupils in classwork, as long as they could be successfully married to subject aims. On the other hand, making use of ICT introduced further complexities and uncertainties to be managed with an already volatile class. In particular, as the observed lesson illustrated, even where the teacher managed successfully to maintain lesson momentum and classroom order, these factors could give rise to a lesson which was reassuring to pupils but not sufficiently challenging to promote substantial new learning.

6. Salient ideas and issues across projects

We now draw together concepts and concerns from individual projects to identify ideas and issues which were salient across projects. The subheadings indicate the major themes emerging from the cross-project analysis.

6.1. Theme I: Organising lessons around teacher-supported, ICT-based, pupil activity

The majority of time in all the observed lessons was spent in teacher-supported, ICT-based seatwork activity by pupils. In one project [D], this was largely dictated by the agenda of carrying out individual coursework, but in others it was a deliberate choice in favour of a more ‘independent’ [A, B, C, E] or ‘student-centred’ [A, C] approach to a class topic. In these latter projects, worksheets – sometimes online – were often used to specify the assigned task and structure pupils’ work on it. Adopting this form of lesson organisation was seen as promoting more active student participation in lessons and engagement in thinking [A], as enabling pupils to put more time into thinking, which they enjoyed [B], as capitalising on pupils’ enjoyment of using computers to tackle realistic tasks [C], and as helping in managing volatile pupils and co-opting them to classwork [E]. Equally, this type of approach was described as permitting teachers to stand back and take more of an advisory role [A], as allowing them to become less didactic in their approach [B], as offering pupils a welcome contrast to teacher-led and textbook-based lessons [C], and as removing pupils from a conventional classroom setting which they associated with failure [E]. Likewise, the teacher conducting the project involving individual coursework [D] commented on the high level of pupil engagement which she attributed not only to a change of physical environment and to pupils working on a self-chosen topic, but to the pleasure that they took in seeking material on the Internet.

6.2. Theme II: Enhancing lesson resources through use of Internet material

A theme running across projects was the way in which the use of Internet material enhanced lesson resources. In terms of supplementing conventional textbook and library resources, it provided educational material lacking in available textbooks [A] and much wider coverage of topics than the limited range of texts available in the school library [D]. It gave access to a wealth of authentic sources and materials which could serve educational purposes, helping to establish a sense of contact between the school classroom and a wider world: through, for example, accessing rival virtual museums of a First World War battle [B], civic and tourist websites for Alpine ski resorts [C], an online auction featuring Roman artefacts [D], and the web-diary of an American expatriate in the African bush [E]. In some cases, too, the interactive or dynamic way in which information was presented and the use of non-textual media were seen as promoting a more multisensory understanding: notably virtual tours of a rainforest and desert [A], and a virtual exhibition of war paintings [B]. The authenticity and vivacity of such resources were seen as helping to stimulate pupil interest and engagement in lessons. Nevertheless, all of the projects also had to contend with the issue that much Internet material was ill-matched to pupils’ capabilities or to educational purposes.

6.3. Theme III: Structuring and supporting pupil access to Internet resources

While some projects placed more of a premium on pupils themselves searching for Internet resources than did others, all preselected material for lessons at least occasionally [C, D, E] while some did so systematically [A, B]. One project [A] made particular use of online worksheets with hyperlinks to guide students to preselected sites and also to facilitate their access to them. In other projects intranet portals fulfilled a similar function regularly [B] or occasionally [C, E]. Preselection of material sometimes served simply to direct pupils to a single source analogous to

material in a textbook, but on other occasions it was designed to assist pupils in seeking relevant material by limiting them to a more extensive but tightly constrained set of resources [A, B]. These were viewed as ways of bypassing potentially time-consuming, frustrating and unproductive processes, notably conducting open Internet searches, but even typing website addresses into a browser. Where open searching took place, worksheets could give advice on types of search terms that might profitably be used [E], and ‘good’ sites found by pupils could be publicised to the whole class and added to a portal for future reference [C]. In some projects [C, D, E] a deliberate investment was made in helping pupils to develop more effective search strategies, and one project [D] brought issues of validation to the fore. At the same time, however, two projects [D, E] noted pupil resistance to overly structured and supported approaches to accessing Internet resources, linked to the issue of pupil agency.

6.4. Theme IV: Instrumenting use of ICT tools to support subject learning

Accessing Internet material in electronic form permitted it to be further treated using other ICT tools. Two projects in particular drew attention to specific ways in which such tools could be used to examine this material in greater depth, so enhancing subject learning. One project [B] reported that these tools permitted or facilitated techniques for handling evidence and forming arguments: notably marking and annotating source material, enlarging electronic images to examine detail, and tabulating and (re)organising source material to formulate and refine arguments. Likewise, another project [D] reported that more systematic development of pupils’ online search strategies – for example through devising key search terms and thinking about criteria for judging websites – not only led to more relevant and reliable material being accessed quickly but sharpened pupils’ understanding of their coursework topic. Equally, one project [E] highlighted the importance of developing techniques – such as searching for keywords and improving text readability – to overcome obstacles that less academically successful pupils experienced in retrieving information from cluttered and confusing webpages accessed directly by them. More generally, while use of ICT tools facilitated the direct copying of material – particularly text – into pupils’ own documents, most projects [A, B, C, D] reported seeking to develop an approach, both more critical and more supportive of learning, in which pupils thoughtfully selected and redrafted relevant material.

6.5. Theme V: Building and capitalising on pupils’ sense of capability and agency

In all projects, teachers noted how working with ICT gave pupils opportunities to express and take pleasure in their capability. They were also aware that some needed encouragement, support, and often a degree of flexibility if they were to make confident and personally satisfying use of ICT. Contrasting approaches were evident in two projects. In one [B], involving academically successful pupils, a teacher reported ‘celebrating successes’ as a way of encouraging innovative use of ICT and diffusing it across the class. In another [E], involving academically disadvantaged pupils, the teacher described painstakingly building and carefully sustaining pupils’ confidence in using ICT, so that they might experience a sense of capability seen as lacking under ordinary classroom circumstances. More generally, both these projects emphasised the value of opportunities for pupils to exercise a degree of control over their work and responsibility for it, creating a sense of personal agency. More widely indeed, this was implied by the references that all projects

made to pupil ‘independence’. This could involve allowing pupils to choose what tools to use in writing up tasks, to decide how intensively to examine particular sources, and to work at their own pace [B]. Similarly, the thrill of ‘fishing’ in the uncharted waters of the Internet was seen as more rewarding than the predictable extraction of material from a CD-ROM encyclopaedia [E]. Opportunity to exercise personal agency was particularly high in the project centred on self-chosen coursework [D], and the teacher viewed this as contributing to pupils’ high level of engagement in their work.

6.6. Theme VI: Supporting and shaping pupil activity through informal teaching

Across all the projects, pupil activity on assigned tasks was seen as facilitated through informal teaching. Although some teachers talked of “lik[ing] the idea of the kids doing all the work” [C], or suggested that “once they’ve got that initial spark they’re up and running” [C], or posited an ideal situation in which “the ICT itself does the teaching if you’ve got it structured correctly” [A], in practice they sought to support and shape pupil activity during seatwork in a range of ways. They referred to dealing with technical hitches [B], helping with technical skills [C], and troubleshooting technical difficulties [E]. They talked of supporting pupils who are struggling [B], pointing students in the right direction [A], and of trying to move them on [B], trying to keep everyone going [E], and trying to push the subject forward [C]. They reported showing an interest in what pupils were doing [A] and giving them little rewards [E], making sure that pupils were on task [A] and jollyng, jogging or chivvying them along [A, B, C, E]. Finally, they described themselves as checking understanding [B] and helping pupils to understand [C], as probing and stimulating pupils and focusing them onto specific points [A], as feeding pupils ideas and asking them questions [B] and pulling ideas into and out of their heads [C], and as checking and discussing pupils’ ideas [D].

6.7. Theme VII: Managing lesson relocation, room configuration and technical malfunction

In all of the projects, teachers were obliged to relocate lessons from the normal timetabled classroom to a suitably equipped room in order to make use of ICT facilities. The resultant disruption to established working procedures was of particular concern to teachers of classes containing pupils who could be hard to manage [C, E]. Typically, the inflexible layout of ICT rooms and the absence of any public form of computer display made it difficult to gain and hold the attention of the class as a whole, and cramped conditions sometimes inhibited effective pairwork by pupils. A general concern was the malfunctioning of computer facilities, something to which teachers had become sufficiently accustomed to feel obliged to anticipate them by having alternative resources to fall back on. In one observed lesson [E], a combination of these factors transformed what the teacher had anticipated being a ‘safe’ lesson with a less academically accomplished class into one he judged unchallenging.

7. Conclusion

The projects examined in this study closely reflect the types of Internet use alluded to in the recent inspection reports and research studies reviewed at the start. While the schools involved

were relatively successful and the participating teachers had an unusual commitment, their experience has a wider significance in illuminating key ideas and issues associated with this form of technology integration. In particular, the themes sketched in the preceding sections fill out what little is currently known about the concepts and concerns framing teachers' current use of Internet resources and ICT tools in humanities, social studies and science lessons in English secondary schools, and the broader ideas and issues which these define.

Returning to the popular association of technology integration with pedagogical change, these projects – and the themes emerging from them – provide evidence more of modifications to the texture of classroom teaching and learning than of any radical refashioning. Indeed, it was the project [C] which took a highly dichotomous view of such matters that was judged unsuccessful by the teachers involved, an outcome arguably reflecting the lesser attention to pedagogical processes in this project. On the other hand, where projects were conceived as reworking established practice, changes were not without significance, often in ways unanticipated by teachers. For example, while one project set out to achieve a more informal teaching style [A], for another this was less preconceived as an outcome [B]. Two projects aspired to emphasise the development of pupils' argumentative skills [B, D], but many of the specific strategies contributing to this goal emerged only through practical action, and were crafted through adaptation within and between lessons.

It is clear that the themes of *Organising lessons around teacher-supported, ICT-based, pupil activity* and its counterpart of *Supporting and shaping pupil activity through informal teaching* capture a pedagogical orientation to the use of Internet resources and ICT tools shared by all the projects examined. This orientation is reinforced by the possibilities identified under *Enhancing lesson resources through use of Internet material* and *Building and capitalising on pupils' sense of capability and agency*. It was teachers' commitment to this orientation which led them to tolerate the travails identified under *Managing lesson relocation, room configuration and technical malfunction*. In particular, what motivated teachers was the contribution that Internet resources and ICT tools could make to lessons organised around substantial pupil activity on assigned tasks. As one case [B-OL] illustrates, while the availability of an electronic whiteboard was seen as valuable during the opening and closing phases of such a lesson, its overall organisation was no different.

Perhaps the most intriguing issues to emerge from this study are those associated with the themes which focus on the part played by ICT tools in mediating key intellectual processes. Various approaches are identified under *Structuring and supporting pupil access to Internet resources*, some of which seek to minimise search activity and marginalise its part in teaching and learning. But if the process of searching, including the discussion between pupils and the interaction with teachers which potentially surround it, can serve a developmental function not just an immediate practical one, deepening understanding of subject matter and its epistemological dimension as well as locating contributory information, then the contribution of search activity assumes a wider significance. In effect, this is one aspect of the idea that technical activity has a potential to contribute to intellectual development which is represented under the theme *Instrumenting use of ICT tools to support subject learning*.

At the time when these projects were carried out, viable Internet access within lessons was a relatively recent possibility in the participating schools, in line with the national trends summarised earlier. Indeed, teachers reported that most pupils had much more extensive experience of Internet use through home access. Consequently, as one project [D] noted, many pupils had es-

established a personalised style of Internet use which could be at odds with developing a more systematic approach. Equally, pupils had often had limited prior opportunity within school to learn how to use the Internet “to obtain information well matched to purpose by selecting appropriate sources, using and refining search methods and questioning the plausibility and value of the information found” (DfEE, 1999, p. 20), as specified in the curriculum order for ICT⁷.

Perhaps more fundamentally, however, while the problems of knowledge, of competing claims and alternative formulations, may receive passing recognition in curriculum orders, schooling largely seeks to factor out the complexities that such issues introduce. Even in terms of the old technology of print, it is sufficient to note that – of the analogues to which teachers appealed – the textbook and the worksheet remain more central to the practice of schooling than the library or the archive. Nevertheless, there do seem to be particular curricular niches which lend themselves more readily to development of critical use of the Internet. From the cases examined here, one would point to the potential of coursework projects in this respect, and of more consciously interpretative subjects in which the evaluation and synthesis of sources occupy a central place.

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⁷ This extract comes from the 1999 ICT curriculum order which came into force for the school year in which the projects were conducted. It is similar to the specification in the previous 1995 curriculum order for IT, applicable in the years during which the pupils involved had received most of their curricular entitlement in this area.

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