Brunel UNIVERSITY WEST LONDON

ICT tools for future teachers

Summary Report

prepared for Becta by

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Summary Report

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1. Background and methods

1.1 The National Context

The national background and context which led to the commissioning of this report is that whilst the use of ICT tools for educational purposes in schools and colleges is increasing, there is considerable variation in practice.

A series of Becta reports which provide further background on progress in embedding ICT tools in professional practice include the Becta *Harnessing Technology Review* and survey (2008), the *Curriculum Online evaluation* (Kitchen et al 2006), and the Learning and Skills Network report '*Measuring e-maturity in Further Education*'. Full references are provided in Annex 1.

1.2 The purpose of this report and the focus of the research

The purpose of this report is to provide Becta with research-based advice to support effective ICT use by teachers now and in the future.

The research underpinning this report was focused on five questions:

- What in the views of practitioners, are the characteristics of effective technology-based tools and resources and how do they help teachers do their work well?
- What are the characteristics of effective non-technology based tools and resources and how to they help teachers do their work well?
- Where do practitioners go to find out about and access new tools for learning and teaching?
- What are the key challenges faced by practitioners in doing their job well?
- The future – what ICT tools would help? What digital solutions are needed? If these solutions do not exist, could they be created? What would their characteristics be, and how and when would they be used?

Detailed Supplementary Reports one to five which are attached to this Summary Report provide considerable detail with respect to each of these questions. This detail is likely to be particularly relevant to government agencies making decisions about the deployment of resources to support change, teachers and school managers wishing to transform practice in their schools, local authority and university staff responsible for the training of teachers and to software developers for whom there is quite specific advice about the design of educational software appropriate for 21st Century classrooms.

1.3 The methods used

Each of the questions was explored from the perspective of four aspects of the organization of the school/college - subject teaching, accountability processes, communications within and beyond the school and the effective use of time and space.[1]

A brief summary of the methods used for data collection and analysis is as follows. A detailed report is available on request.

The data underpinning this report were gathered between March and July 2009 in several stages.

Initially 45 teachers from the nine government regions with expertise as senior managers and as classroom teachers in primary, secondary, special educational needs and FE as well as in local authorities and universities were worked together in focus groups over two days.

Those attending were selected following an invitation via professional networks for nominations. Selection was made to get a balance across school types and roles and the ICT work being undertaken in their schools or institutions. Working as co-researchers and using mind mapping techniques they provided very detailed responses to the research questions. The conversations in the focus groups were recorded additionally by a team member in each focus group. A grounded approach was then used to establish the key themes which provide the structure for the Supplementary Reports with data grouped progressively to create these themes as the work of the focus groups developed.

To counter potential bias in the findings from what was a largely expert group, the findings were then tested through group and individual interviews with another fourteen teachers nominated by six institutions from the primary, secondary and FE sectors. International experts in ICT in Education from the US and Australia were also asked to comment on the draft findings. Both groups asked to scrutinize and challenge the initial findings in the light of their experience. In addition, a review of discussions on popular online forums where ICT tools are discussed was undertaken to identify what issues were preoccupying the teachers who use these forums (see Annex 3).

Many of the teachers' ideas are used verbatim in the supplementary reports. This detail is provided as it was considered that synthesising the sections more would result in a loss of fine-grained information which could provide a useful foundation for change in teaching practice and in the process of producing high quality educational software.

This Summary Report omits this fine grained detail and focuses particularly on findings which are within the remit of Becta as a national agency.

[1] These ways of looking at the functions of a school are used by the 21st Century Learning Alliance see www.21stcenturylearningalliance.com.

1.4 Main findings and recommendations

The Becta Harnessing Technology Strategy (2008) expresses the expectation that schools will make use of the pedagogical benefits of ICT tools. This research found that there is widespread awareness of ICT tools as used now in everyday life and understanding that ICT could enable teachers to do their jobs well as well as improve the functioning of the institution.

Major barriers to improving the use of ICT tools and resources in school are:

- knowledge about the ways various technologies can be used to enhance teaching, learning and assessment is very patchy with deep knowledge scattered across the education system and therefore hard to access, and;
- there is huge variation in the quality and reliability of the technical infrastructure which teachers have to rely on to integrate ICT tools into daily practice.

The recommendations which follow identify barriers to effective use of ICT tools together with actions which could improve the knowledge base in the education system.

Five major recommendations which are probably within the specific remit of Becta as a national lead organization have emerged from the research findings. These are discussed below and a summary is provided in Table 1.1.

Recommendation 1: Curriculum

Teachers identified a number of characteristics of effective technology-based tools which it would be appropriate for Becta to draw to the attention of developers (Supplementary Report 1). ICT tools do not seem to be tested fully with users and it is proposed that an industry standard for user testing be established. In addition, marketing information should include information about the pedagogical approaches supported by the tools. Tools in their content, design and technical aspects should support deep learning and not be based just on an information transmission model. An interesting comparison can be drawn with the characteristics of effective non-technology based tools (Supplementary Report 2) and this also may be useful for industry colleagues.

The time taken for the adoption of tools for which there is a clear benefit can be very short. However, the lack of detailed examples and evidence of pedagogical impact and application is inhibiting adoption of ICT tools. It is quite likely that this material exists but has not found its way to the individual teachers to whom it is relevant. Any such exemplars need to be convincing for school leaders and teachers who are not early adopters of ICT tools. Unless information of this type targeted at particular curriculum applications is readily available and promoted, change in the use of ICT tools from the current position will be slow.

There is also an increasing number of free tools. Purchasing models are changing from stand alone packages to annual subscriptions with regular updates downloadable in the school. Industry will need to demonstrate extra added value of the tools they charge for: interoperability, adaptability and pedagogical application are key characteristics of effective tools.

There is an argument for the provision of online environments to support knowledge sharing between educators who are innovators and early adopters and industry who are developers. Current networks such as the Becta forums do not support this form of collaboration. See Recommendation four below.

Recommendation 1: Curriculum

That new working practices should be developed between software developers, teachers, and researchers to:

- *ensure software for the education market is founded explicitly on a full range of effective teaching and learning approaches [2] not just drill and practice*
- *exploit the potential of ICT tools and resources to support creative pupil-led learning*
- *develop industry standard models for user testing of software (design and pedagogical applications) so that on release the tools are accompanied by sound information about pedagogical application and potential impact*
- *establish standards for the pedagogical labelling of ICT products*
- *publish exemplar case studies showing how products can be fully used to enhance learning.*

Recommendation 2: Assessment Practices

Statutory curriculum and assessment requirements are currently 'the elephant in the room' in discussions about embedding ICT tools in practice and ICT tools for the future. The development of personalised learning pedagogy and the embedding of ICT tools in practice are hindered by the assessment system. To support changes in practice, examples are needed of effective practice with respect to multi-modal assessments, just in time assessment including online, and the use of e-portfolios.

Recommendation 2: Assessment Practices

That Becta work with leading schools, examination boards and relevant government agencies to:

- *develop and disseminate future practice in assessment which recognises e-portfolios and multi-modal assessments*
- *develop forms of assessment, taken when the pupil is ready, recognizing the benefits of this approach for inclusion and personalized learning. In addition, identifying realistic practice for teachers of large classes in some subject areas in managing individual pupil progression.*

2 For example, aspects of pedagogy teachers may consider when using ICT tools include forms of learning supported, links with particular curricula, grouping and timing issues, appropriate forms of assessment for learning.

Recommendation 3: Developing organisational and individual capacity

Decisions about the adoption of major ICT tools such as learning platforms are taken at the local authority or Senior Management Team (SMT) level. The extent of SMT engagement with staff in the decision making and the level of SMT understanding of the pedagogical benefits of the technology both have a significant effect on the adoption and embedding of the innovation. Becta, the NCSL and other education partners have an ongoing role in ensuring SMTs understand the pedagogical applications of the technologies being adopted and that they are aware of effective ways of engaging staff in the change process. In addition, teachers spend considerable effort collecting and inputting assessment data for which it appears little use is made.

The adoption of new ways of working with ICT Tools takes time – time to play, time to test ideas, time to embed change. It is recommended that there be widespread sustained provision of CPD designed to maximise impact.

A cycle for effective CPD and embedding change might be something like this: specialist input to develop skills and pedagogy and to experiment with the software (1 day training out of school); implementation and evaluation (4 weeks in-school work); further skills development and pedagogy review after four weeks (1/2 day training out of school); followed if appropriate by another cycle of implementation (4 weeks in-school work) and then review (1/2 day training out of school). This could be linked with CPD points and M level credits assessed using multi-modal methods. CPD points are a common approach used in other sectors to ensure staff take advantage of opportunities to stay up to date.[3] A CPD model which includes structured interventions within an action research cycle has been shown to be effective in changing practice. This CPD model could be implemented through arrangement between major developers and suppliers and FE/HE institutions/training schools.

Recommendation 3: Developing organisational and individual capacity

That Becta, the National College of School Leadership and other relevant bodies work together to:

- *brief school senior management teams (SMTs) about*
  - *the pedagogical benefits of ICT,*
  - *the need to avoid expensive mistakes by involving internal and external experts in senior management decisions about whole school ICT tools and strategies*
  - *the effective use of assessment data to help learning and in change management strategies within the organization*

[3] A quick search on Google shows just how prevalent the expectation is that professionals will undertake CPD to a certain level of points annually, as a condition of continuance of professional registration.

- *ensure that when new ICT tools are proposed for schools e.g. learning platforms[4], the forms of CPD provided focus on pedagogical application of the tools and are spread over a period of time to allow for introduction to the tools, testing in the teacher's context and follow up.*
  Groups of developers might find it effective to combine efforts to subsidise CPD in their ICT tools across LA/HEI school networks. Online networking could be used to support knowledge exchange about effective practice and such forms of CPD and online collaboration could be recognized within the proposed 'licence to teach' CPD points scheme.
- *provide case studies of effective use of learning platforms across all sectors as there appears to be significant lack of understanding about how to use the learning platform to support the whole work of the school.*
- *provide remedial support and interventions for schools where the lack of reliability of the learning platform and/or lack of understanding of how to use the learning platform has damaged staff confidence in this way of working.*

Recommendation 4: National infrastructure to support knowledge sharing

Isolation of subject experts: Primary, secondary and FE subject specialists reported isolation from peers in other institutions and requested online networking support to enable knowledge sharing and collaboration between themselves, examination boards and university staff. This was such a strong theme to emerge from the focus groups that time was taken to review current provision and practice. Examples of online networking for professional groups, from other countries and other sectors in the UK were examined for relevance. Teachers see clear benefits for the education sector in provision of a 'Face book' type environment for education linking people in public or private networks, listing events, providing a 'project finder' tool and linked with 'back streaming' tools. Current learning platforms used in school and regions do not provide this form of networking and functionality does not allow easy connection with experts across the UK. Networks such as Becta's ICTRN do not seem to have mechanisms for the summarising and accumulation of knowledge so that similar questions may be asked over and over. Regional and LA learning platforms are providing some connectivity between professionals which is valued but there do not seem to be many interconnections between Las and regions. The education sector in the UK is behind other UK sectors in access to online communities workspaces constructed to meet professional needs.

4 The term 'learning platform' describes a broad range of ICT systems used to deliver and support learning. These systems can be accessed by learners and others involved in the learning process either from school/college or remotely. A learning platform can be made up of a range of resources that work together to provide communication, assessment, content delivery, tracking and learning management. The term learning platform broadly encompasses functionalities associated with tools such as virtual learning environments (VLEs), managed learning environments (MLEs) intranets and extranets.

Currently opportunities are being lost for cross-national collaborations on current major initiatives such as the ICT Training for Teachers and the Masters for Teaching and Learning as well as other CPD work e.g. that commissioned by the TDA and undertaken by teachers. Generally cheap and cheerful approaches using 'free' online tools whilst providing some experimental opportunities are causing frustration because of: hidden costs; the lack of interoperability; lack of functionality; limitations on customisation; lack of access through firewalls; concern over embedded advertising; ownership and access to information and so on. The teachers expressed very strong views that national Web 2 infrastructure is needed as is provided for other sectors.

Recommendation 4: National infrastructure to support knowledge sharing
That Becta work with other relevant bodies work to develop a national infrastructure to support knowledge sharing across the sector which would include:

- *a list of educational networks and expertise in the sector being brought together, promoted and maintained to facilitate teachers' ability to find colleagues with similar interests and the expertise needed to develop practice.*

- *a learning platform open to all teachers with tools to support knowledge sharing. Teachers are aware of the functionality of Face book type software and this infrastructure was wanted universally by respondents regardless of sector or quality of provision in the school and local authority. Current 'free tools' do not meet the need for a national infrastructure. Note: to promote professional openness such an environment would need to be managed by professional organisations rather than a central government organisation. As schools, local authorities and HEIs do not have the remit to provide a national service promoting exchange of innovative practice nationally a lead in this area has to come from an organization with a national remit.*

Recommendation 5: Change management strategies used by Becta

It is critical that Becta adopts change management strategies which are proven to be effective in bringing about whole sector change. The data suggest that when major new technologies are introduced the speed of adoption would accelerate if time was taken to test out and develop pedagogical applications with innovators and early adopters before roll-out across the sector. A clear relationship with assessment would also accelerate the motivation to change.

Adopting this model would mean that new ICT tools such as such as learning platforms would not be introduced to all schools until case studies and exemplars outlining the pedagogic justification for use – for different age groups , subjects and contexts- together with CPD were available.

Recommendation 5: Change management strategies used by Becta

That Becta reviews the model used for introducing ICT developments across the education system to ensure any changes and innovations proposed are always accompanied by exemplars of practical application drawing on effective practice in leading schools.

Summary

Table 1.1 summarises the five key recommendations from the research which were discussed above. Detailed advice underpinning each recommendation can be found in the Supplementary Reports which follow.

Table 1.1 Recommendations

Recommendation 1: Curriculum

That new working practices should be developed between software developers, teachers, and researchers to:

- *ensure software for the education market is founded explicitly on a full range of effective teaching and learning approaches [5] not just drill and practice*
- *exploit the potential of ICT tools and resources to support creative pupil-led learning*
- *develop industry standard models for user testing of software (design and pedagogical applications) so that on release the tools are accompanied by sound information about pedagogical application and potential impact*
- *establish standards for the pedagogical labelling of ICT products*
- *publish exemplar case studies showing how products can be fully used to enhance learning.*

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5 For example, aspects of pedagogy teachers may consider when using ICT tools include forms of learning supported, links with particular curricula, grouping and timing issues, appropriate forms of assessment for learning.

- *develop and disseminate future practice in assessment which recognises e-portfolios and multi-modal assessments*
- *develop forms of assessment, taken when the pupil is ready, recognizing the benefits of this approach for inclusion and personalized learning. In addition, identifying realistic practice for teachers of large classes in some subject areas in managing individual pupil progression.*

Recommendation 3: Developing organisational and individual capacity

That Becta, the National College of School Leadership and other relevant bodies work together to:

- *brief school senior management teams (SMTs) about*
    - *the pedagogical benefits of ICT,*
    - *the need to avoid expensive mistakes by involving internal and external experts in senior management decisions about whole school ICT tools and strategies*
    - *the effective use of assessment data to help learning and in change management strategies within the organization*
- *ensure that when new ICT tools are proposed for schools e.g. learning platforms[6], the forms of CPD provided focus on pedagogical application of the tools and are spread over a period of time to allow for introduction to the tools, testing in the teacher's context and follow up.*
  Groups of developers might find it effective to combine efforts to subsidise CPD in their ICT tools across LA/HEI school networks. Online networking could be used to support knowledge exchange about effective practice and such forms of CPD and online collaboration could be recognized within the proposed 'licence to teach' CPD points scheme.
- *provide case studies of effective use of learning platforms across all sectors as there appears to be significant lack of understanding about how to use the learning platform to support the whole work of the school.*
- *provide remedial support and interventions for schools where the lack of reliability of the learning platform and/or lack of understanding of how to use the learning platform has damaged staff confidence in this way of working.*

6 The term 'learning platform' describes a broad range of ICT systems used to deliver and support learning. These systems can be accessed by learners and others involved in the learning process either from school/college or remotely. A learning platform can be made up of a range of resources that work together to provide communication, assessment, content delivery, tracking and learning management. The term learning platform broadly encompasses functionalities associated with tools such as virtual learning environments (VLEs), managed learning environments (MLEs) intranets and extranets.

Recommendation 4: National infrastructure to support knowledge sharing

That Becta work with other relevant bodies work to develop a national infrastructure to support knowledge sharing across the sector which would include:

- a list of educational networks and expertise in the sector being brought together, promoted and maintained to facilitate teachers' ability to find colleagues with similar interests and the expertise needed to develop practice.
- a learning platform open to all teachers with tools to support knowledge sharing. Teachers are aware of the functionality of Face book type software and this infrastructure was wanted universally by respondents regardless of sector or quality of provision in the school and local authority. Current 'free tools' do not meet the need for a national infrastructure. To promote professional openness such an environment would need to be managed by professional organisations rather than a central government organisation. As schools, local authorities and HEIs do not have the remit to provide a national service promoting exchange of innovative practice nationally a lead in this area has to come from an organization with a national remit.

Recommendation 5: Change management strategies used by Becta

That Becta considers the model used for introducing ICT developments across the education system to ensure any changes and innovations proposed are always accompanied by exemplars of practical application drawing on effective practice in leading schools.

Key challenges faced by practitioners in doing their jobs well were similar across the primary, secondary and FE sectors but there were some interesting exceptions which are listed in Table 1.2.

Table 1.2 Points of difference between primary, secondary and FE institutions

- **E-communications between staff and the wider community:** whilst practice varied considerably, some teachers felt strongly that in small primary schools because face to face communication between staff and the wider community is highly valued it is not likely to be replaced by electronic communication. However other primary teachers were already finding the learning platform helpful in facilitating communication with parents. In FE and secondary schools e-communication was seen as advantageous with systems such as the automatic call system when pupils/students are absent being highly rated as is the provision of parental access to their child's records online.

- **learning platform use:** FE staff seem to have been using learning platforms for a longer time than school staff and use is more deeply linked with pedagogy. Some primary staff are questioning the value of a learning platform for the primary school and secondary staff are very concerned about the time taken to produce resources for the learning platform as well as intellectual property. These are very real concerns and there is a danger that staff are effectively doing the job once done by text book writers without the remuneration or the time to do an excellent job.

The Supplementary Reports which follow provide a detailed commentary structured around the questions which formed the focus for this research.

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ICT tools for future teachers

Supplementary Reports

ICT Tools for Future Teachers

Supplementary Reports

The teachers providing data for the ICT Tools for Future provided considerable detail about how teachers are using and want to use ICT tools in their daily practice. The following Supplementary Reports are provided for those who wish to access this level of detail.

The ideas provided in Supplementary Reports 1, 2 and 3 are particularly relevant to developers of ICT tools and digital resources.

The ideas provided in Supplementary Reports 4 and 5 are particularly relevant to school management, regional broadband consortia and those designing Schools for the Future.

All of the reports are relevant to ICT teachers, teachers wish to develop their use of ICT tools and resources and those training teachers.

These five supplementary reports are focused on the five questions posed for the research:

Supplementary Report 1. What are the characteristics of effective technology–based tools and digital resources?

Supplementary Report 2. What are the characteristics of effective non–technology–based tools and non-digital resources?

Supplementary Report 3: Where do practitioners go to find out about and access new tools and resources?

Supplementary Report 4. What are the key challenges faced by practitioners in doing their job well?

Supplementary Report 5. The future - what ICT tools would help?

Each report considers the question with respect to four major aspects of the work within schools

1. Curriculum – subject teaching
2. Curriculum – administration, accountability and monitoring
3. Communications between people within and outside the school
4. The use of time and space

Contents

Supplementary Report 1.

Characteristics of effective technology–based tools and digital resources

Teachers worked in phase-specific focus groups to discuss the questions: what are the characteristics of effective technology-based tools and digital resources and how do they help teachers do their jobs well. The discussions were focused around the following four dimensions of the operation of schools/colleges:

1.1 Curriculum - subject teaching
1.2 Curriculum – administration, accountability and monitoring
1.3. Communications between people within and outside the school/college
1.4 Use of Time and Space

For the most part, issues faced in primary schools/colleges and by primary teachers were similar to those in FE and in secondary schools/colleges. Where statements do not apply across the three sectors, mention is made of the sector for which the comment is relevant.

1.1 Curriculum - subject teaching

The Becta Harnessing Technology report (2008) identifies key pedagogic uses of ICT tools and resources as being to:

- gather information
- analyse information
- support creativity
- solve problems
- individualise learning
- work with others.

To this list, teachers added three new categories. One relates to the learning of the individual i.e.

- to support higher order thinking.

The other two highlight the influence that digital technologies are having on how teachers interact with pupils/students and on modes of learning where pupils/students collaborate together inside and beyond schools/colleges:

- to change power relationships in learning contexts
- to enable the learner to make connections within and beyond the school/college.

Table 1.1 Summarises the characteristics of effective technology-based tools and digital resources for subject teaching. Ideas are grouped around three characteristics: pedagogical, design and technical. Some characteristics may appear to conflict because their application will depend on the age of the learner, the skill of the subject teacher and the subject matter of the package.

Table 1.1 The characteristics of effective technology-based tools and digital resources for subject teaching

Characteristic	Effective technology-based tools and digital resources are those which:
pedagogical characteristics	• have tasks which are realistic and authentic e.g. tasks use credible circumstances and are related to local environments where possible
	• avoid replicating electronically activities that are better achieved non-digitally like reading books
	• are designed for teachers by teachers where appropriate
	• provide extra learning power for conventional tasks e.g. through additional links to activities and resources
	• are adaptable for different purposes including SEN
	• are open-ended, creative, flexible, engaging
	• allow teachers and users to control the pace and direction of learning
design characteristics	• have explicit pedagogical models underpinning their design
	• are intuitive, easy to use, modify and update and easy to return to sometime later i.e.' save' facilities are available
	• support a quick start but also allow for growth
	• protect work held on the school learning platform so this cannot be wiped including by the service provider
	• have updates which are quickly and easily accessible
	• have a sensible licensing or subscription model
	• are flexibly structured
	• provide a single clear focus
	• demonstrate value for money and added value wherever possible
	• include additional follow up activities and resources
	• allow student authors to own their work in the school learning platform
technical characteristics	• are multi-platform
	• are economic on band width
	• are safe and secure
	• provide a good rapid response back up service
	• integrate with and are compatible with other systems including home systems and are interoperable with other tools
	• put technical quality and robustness first before price

The further education (FE) group made detailed comments about the importance of pedagogy with particular reference to the design of materials and tools on learning platforms to enable the role of the learner to change with maturity. This might be because in further education learners are expected to be more autonomous than is the case in primary and secondary schools.

FE colleagues described two kinds of use of online learning environments: virtual learning environments (or learning platforms) and personal learning environments:

- Virtual Learning Environments (learning platforms) are class- teacher- institution-focused (push) and use a delivery model: resources are structured and organised
- Personal Learning Environments are person-focused (pull) and use a personalised learning model: the learner is free to select, choose, control resources and learning experiences.

So FE teachers conceived the learning platform as a tool that served and linked two learning phases:

- In **phase 1** the Virtual Learning Environment (learning platform) builds independent learning in the first phase of student use and generates familiarisation with the wider collaborative features of online learning
- In **phase 2** the Personal Learning Environment emerges out of the student's initial VLE experience and enables the student to draw together the resources and materials relevant to them.

To achieve this transition, FE teachers emphasised that the most important lesson for the student is 'learning how to learn' in the earliest stages of education.' *[Students] need to know what each tool does and how to use it*'. [ADD CALL OUT BOX] FE teachers also emphasised the changing role of the teacher: from the director of learning to the facilitator of learning. The teacher's role being not to teach subject content only but to teach pupils/students how to learn, to encourage lifelong learning and to support the learning process.

The introduction of a learning platform that promotes independence was recognised as a challenge to teachers who are still questioning the need to change their role from teacher to facilitator. Because this shift is uncomfortable for some they argued that teachers need tools to support that change in role. Therefore, both for teachers and learners the design for learning approach to the learning platform should emphasis less 'push' and more 'on demand' resources.

FE teachers wanted learning platforms designed for teachers as expert learners with provision for a continuum of learning and flexible pedagogy. They saw the platform as a framework to hang tools and resources from: a virtual learning kiosk where teachers know what to expect of the products available. In this learning environment teachers and learners needed to be able to recognise which tools will support their purposes. Teachers offered some useful tips for designers about how digital tools and resources are used in classrooms. In primary schools, they explained, lessons sometimes have a discrete ICT focused purpose, but, nevertheless, these lessons should lead into other subject-focused sessions, so that the skills and knowledge can be applied to contexts which are meaningful and the ICT is seen to have a purpose. They decided on this basis that generic software is therefore more useful.

As primary schools do not have the same levels of technical support as secondary schools/colleges have, tools must be easy to use. Teachers do not have time to read a manual. Software that was simple to use and had a strong pedagogical underpinning was highly praised by primary and secondary teachers who recommended developers reconsider the design principles that ensured leading software developed early on provided transformational tools.

There were complaints about Interactive Whiteboard (IWB) software suites that major on resources that promote mechanistic, behaviourist approaches e.g. testing knowledge instead of constructing knowledge.

This kind of testing approach has limited application and is over-represented in software available to schools. It has some value for checking on progress from time to time, but little value in concept development.

The teachers wanted IWB resources that have a sound pedagogical base and which can be used to develop thinking skills e.g. like the mind mapping tools that already exist and resources for sorting and classifying or for logging experiences in an immediate and representative way. The best IWB products were considered to be generic tools rather than those that provide specific one-off resources. In order to master specific one-off resources, a teacher has to carry around a lot of information about what might be used just once for a particular job – whereas tools that can be adapted to meet a range of needs are more likely to be used. Teachers in some subjects said there was little software available to support work in their specific subjects. *A request for exemplars which are explicit about pedagogic issues is a recurring theme throughout the data. Descriptions and case studies in which pedagogic approaches are implicit are not sufficient.*

Developments of LOGO-type control programming were praised because they have developed the original product so that the same program can be used without an interface to begin with but teachers can then move on to the control of external devices with the older pupils/students – hence they can be used with a range of age groups.

In terms of costs teachers prefer robustness to superficial cheapness e.g. low quality digital still cameras. Teachers become disenchanted when equipment breaks easily and cannot be repaired. However, designers needed to be alert to issues like telephone costs. One idea to be explored was that laptops for pupils/students loaded with all the textbooks might be cheaper than printed books if the copyright issues could be agreed.

Table 1.2 lists specific examples provided by teachers of how technology-based tools and digital resources help them to do their job well.

Table 1.2 How technology-based tools and digital resources help teachers to do specific <u>subject teaching</u> tasks well

Support for learning - *technology-based tools and digital resources:*		
help pupils/students to explore ethical and moral issues in a practical context through the need to deal with inappropriate sites	facilitate interactions between teachers and pupils/students as well as between pupils/students	help pupils gain a range of perspectives through monitoring multiple channels of communication
provide a range of learning routes	help with demonstrations	support planning via use of hyperlinks
provide opportunities to share learning, collaboratively edit and add to work	provide access to school/college systems from anywhere	offer innovative ways of communicating though music and sport
support communication and collaboration via cameras, podcasts, wikis	provide time to think and apply knowledge instead of taking notes because the lesson can be	help teachers to keep abreast of current specialisms like Assessing Pupils/students' Progress (QCA

	printed.	booklet)
provide a means of publishing samples of good work	provide quick recording of data from class discussion	support learning by backchannel chat around main activity
help very young children and children with writing difficulties to record and publish their work	provide opportunities for pupils/students to personalize their own learning	
Communications support - *technology-based tools and digital resources:*		
via video conferencing and other tools connect people, teachers, pupils/students across distances e.g. for global collaboration	help to involve parents via learning platforms in the home	provide access to a broad curriculum through links with pupils/students elsewhere and support anywhere anytime learning – pupils/students no longer limited to being in school/college
provide business sites for the community	provide professional presentation of resources	
Resource support - *technology-based tools and digital resources:*		
are often more up to date than a text book	provide information via the internet	improve time management and administration efficiency
Technical aspects - *technology-based tools and digital resources:*		
Tools can be used together in ways non-digital tools cannot		cut down on storage space

1.2 Curriculum – administration, accountability and monitoring

The data for this section were collected from cross–phase focus groups and so this part of the report is not divided by sector. In this area major concerns which were expressed by teachers included:

- the use of data should not supersede discussions between teachers and pupils/students about progress:

  'ticking boxes means a lot of qualitative information is now lost…formerly teachers would meet at the year's end to discuss the progress of individual pupils/students and rich information would be passed on. Now the focus is on data which ticks other people's boxes rather than meeting the needs of the teachers and more importantly the pupils'/ students'. A child must not be 'reduced to a set of targets'.

- software which just gives numerical data to schools/colleges does not help assessment for learning approaches [INSERT CALL OUT BOX]

- care needs to be taken to limit the volume of data collected to that which can be used.

Practitioners perceive that too much money is spent on developing and implementing tools for data gathering e.g. many companies with displays at the national BETT Exhibition 2009 focused on these issues. There is potential to collect endless amounts of data but to what end? Any data collected needs to be for a clear purpose and used. There needs to be more investment in identifying the pedagogical approaches that collection tools support.

Table 1.3 summarises the characteristics of effective technology-based tools and digital resources used to support administration, accountability and monitoring.

Table 1.3 Characteristics of effective technology–based tools for curriculum administration, accountability and monitoring

Characteristic	Tools should:
pedagogical characteristics	• support formative assessment and improving learning rather than focusing on summative outcomes i.e. the technology should support the processes of learning rather than just recording the outcomes of learning
	• not just focus on target–led approaches and measurable outcomes. Subject specific assessment tools should not be abstract but should include applications to the real world.
	• enable more generalised thinking and higher order skills development
	• ensure exchange of data with a variety of devices by: - linking with e–portfolios – enabling teachers to easily record and monitor pupils'/students' progress e.g. in recording evidence for the six areas of achievement at the foundation stage; enabling pupils/students to upload e–portfolio material - linking with PDAs which are used for recording pupil/student progress data e.g. observation data - providing hyperlinks between assessment evidence and grades - dealing with digital data e.g. videos
design characteristics	• support communication between stakeholders, by - being open to scrutiny by pupils/students, teachers, parents and management - supporting blogging to engage and interact with parents and pupils/students - being intuitive to use - being easily updatable by whole school/college workforce - sending alerts
	• be simple and strongly visual e.g. outliers on graphs should be highlighted, using a traffic light system when pupils/students are falling behind or achieving well to enable target setting and half–termly reporting
	• provide immediate access and updates, by - providing feedback to pupils/students and teachers on demand - identifying irregular attendance patterns and communicating this to teachers and parents - being updatable quickly by the whole school/college workforce in response to events

technical characteristics	• provide one tool with multiple functions, and for multiple purposes e.g. OFSTED, school/college, formative and summative needs. One teacher reported having to work with four different systems. • be comprehensive – provide management of all student data e.g. SEN, medical, child protection [INSERT CALL OUT BOX]
	• be web–based – access has to be web–based for parents and whole school/college workforce access
	• be robust – 'one crash and everyone loses faith' [INSERT CALL OUT BOX]
	• be secure – 'one loss of privacy and everyone loses faith' [INSERT CALL OUT BOX]
	• be flexible – with high standards of interoperability between commonly used packages e.g. homework information on the learning platforms should be linked with homework returns by email and alerts about homework missed
	• allow staff appropriate access - there are different levels of access depending on 'need to know' - teachers need easy access to pupil/student data useful for lesson planning.

Ways in which effective technology-based tools and digital resources help practitioners to do specific tasks well with respect to accountability and monitoring in the ways set out in Table 1.4.

Table 1.4 Ways technology–based tools and digital resources support practitioners in undertaking curriculum administration, accountability and monitoring well

Tasks supported by the tools	Ways tools support the undertaking of tasks
monitoring pupils/students' progress and their achievement against predictions	through progress tracking
personalising learning and planning for personalised learning through building on prior attainment	through – checking pupil/student's previous achievement and teacher comments – providing information across subjects for 1–2–1 progress meetings – traffic lights acting as a starting point for discussion with parents and pupils/students – more detailed information about pupils/students being available
collaboration through sharing knowledge	between primary and secondary with pupils/students with parents
time saving	everything in one place

facilitating pupil/student stakeholder voice	through anonymous feedback via online surveys and for use for monitoring quality of courses and programmes
independent learning	through online materials
assessment for learning	building on previous records
managing parents' expectations	through reference to evidence
capturing of data in different locations	using wi–fi and hand-helds inside and outside the school/college

There are however risks accompanying the use of these tools:

- previous reports on pupils/students may adversely influence current responses to pupils/students and current reports
- if reports are open then it is difficult to include criticisms
- market leaders in software do not need to innovate at the speed that schools/colleges would wish
- there are different approaches to levelling between primary and secondary schools/colleges and foundation and KS1 so data may look as if it is transferable but it is not always.

1.3. Communications between people within and outside the school/college

Teachers reported a variety of ways in which technology-based tools were used to facilitate communication both within the organisation, and between the organisation and the wider community with some primary schools less likely to use digital tools for communication than FE colleges and secondary schools/colleges. Examples of these ways of communicating are as follows:

- **collaboration within the organisation:** The use of email for staff bulletins was welcomed by some and not welcomed by others. Primary colleagues in particular rely more on face to face communication with the wider community and between staff members. *This is a recurring theme through the data.*
- **collaboration with the wider community:** undeveloped opportunities for ICT tools to support knowledge sharing and building between education colleagues and the wider communities their organisations serve were identified. *This was a recurring theme throughout the data and was strongly confirmed in the wider testing of the recommendations of this report with a sample of schools and colleges.* For example, teachers identified potential for new collaborations between networks and subject experts, schools/colleges and other services under the 'Every Child Matters' agenda. In the experience of the teachers, this was not happening effectively. 'Community Learning Partnerships' which provide a one-stop shop for parents were mentioned as not using digital technologies that could help in their work. Some emerging use of learning platforms for school/college collaboration was reported both in London boroughs and in rural areas but there was a request for case studies and exemplars particularly focused on pedagogic issues.

As well as these ways the technology-based tools support communication, a number of barriers to communicating with technology–based tools were identified:

- schools/colleges in competition with others do not want to share resources with other schools/colleges which may be competing for pupils/students. Local authorities have tried setting up cluster–based networks and have found this a problem
- the availability and interoperability of learning platforms and tools depends on local authorities and regional broadband consortia
- ethics:

    - learning platforms are being introduced slowly and care needs to be taken with the launch with parents. Parents have concerns e.g. about pupils/students' photos appearing online even in their profile in a password protected section. *Ethical use, access, storage, protocols with respect to student information is a recurring theme throughout the data. Existing advice may need revision or at least, circulating to all teachers.*
    - there is anxiety about public/private personas e.g. teachers having social networking accounts which can be accessed by parents and pupils/students and the need for positive representation of the individuals, and the organisation.
- home access: Parents without internet or mobile phones are excluded from these forms of communication. There are issues with culture and skills as well as physical access.
- professional networking on line is not part of the primary culture for many current teachers.
- joint projects with other countries depend on the technological infrastructure there. Even in Europe, schools/colleges ICT provision is poor and in developing countries it is unreliable.
- access to relevant professional networks: the forums relevant to individual teachers are scattered in too many different places making it hard for teachers to keep up with relevant discussions. *This is a recurring theme throughout the data and links with comments about ways of improving formal and informal CPD opportunities. A centralised network finding service linked with RSS feeds might be a solution to consider. This solution would avoid eliminating the essential differences between web spaces that appeal to different sets of teachers.*
- policies are not written by experts.

Tables 1.5 and 1.6 list the characteristics of effective technology-based tools and how they are used for communication as well as how they aid communication.

Table 1.5 Characteristics of effective digital tools and resources used for <u>communication</u>

Characteristic	**Example**
pedagogical characteristics	effectiveness of any tools depends largely on the people who use the tools
	tools should facilitate collaboration between teachers and pupils/students for joint projects and support for inter–school/college and inter–country projects such as wikis, professional networking e.g. E–Pals and British Council
	online courses should expect and stimulate collaboration
design characteristics	tools need to be flexible and able to be adapted for different uses e.g. tools should be able to be added to learning platforms
	tools should be easy to use, cheap, free, accessible to all, receptive to different formats such as Skype, mobile phones, w-fi hotspots, social networking, videoconferencing
	hardware needs to be intuitive
technical characteristics	tools need to be fit for purpose e.g. supporting asynchronous and synchronous communication
	time saving and efficiencies need to be apparent e.g. group call enables parents to receive messages on their mobiles; a service alerting parents to events provides clear added value
	tools should support wireless networking/cloud computing

Table 1.6 How technology-based tools and digital resources help <u>communication</u> within and beyond the institution more effectively

How ICT tools help	Example
communication with peers in other schools/colleges and school/college staff	• use of outlook calendar instead of bulletins, sharing calendars is helpful for school/college trips • email is the best tool we have (but some staff do not look at email). Twittering helps (just-in-time learning) • finding schools/colleges for projects e.g. through E–Pals for curriculum projects forums and discussion groups, are good but there are too many in different places • email to LA staff and other schools/colleges can save time if not over used
teaching and whole class and group learning - personalising learning	• PDAs and small notebooks used for individual group work • mobile phones and voting technology • easy to find, accessible, user friendly, immediate, targeted communications, use of video clips (small size is important) scaffolding learning • IWBs and visualisers have changed the ways teachers are teaching. Pupils/students are more likely to share and comment on each other's work and the quality of their evaluations is better • showcasing pupils/students' work through plasma screens and through the web site is motivating pupils/students • live video streaming e.g. showing live artists working • integrating digital photos into reports of visits or school/college guides is motivating pupils/students to write and work together • discussion can be held on line and then revisited and reflected upon whereas a class discussion might not be remembered
administration	• all pupils'/students' education plans are on the system and staff update these online – this is time consuming
CPD – formal and informal - saves time	• video clips *(NB There was a big vote for this*) for demonstrators, mini–clips • able to share resources via the learning platform by placing handouts and documents about the use of ICT on the VLE • access to courses and 'how to' resources

1.4 Use of Time and Space

In general, to make more effective use of time and space, key requirements are for suitable devices and connectivity.

In terms of hardware primary teachers thought the most flexible approach might be to have enough classroom laptops for a group to work together as well a suite for whole class time-tabled sessions. This would impact on practice by allowing ICT to be embedded in everyday teaching (which mirrors real life), but also allow for more intensive follow-up or the teaching of discrete skills in ICT suite-based lessons.

Table 1.7 summarises the characteristics of effective technology-based tools and digital resources used to maximise use of time and space.

Table 1.7 Characteristics of effective technology–based tools maximising use of time and space

Characteristic	Effective tools:
pedagogical characteristics	• support for personalisation so that pupils/students are able to follow their personal interests in the way they access and use resources.
	• support for collaboration between pupils/students e.g. through wikis and blogging
	• provide anywhere, anytime learning via remote access to learning platforms (but schools/colleges provide safe places for pupils/students so offsite learning may be unsupervised
	• are asynchronous – so that online learning potentially provides a platform for deeper learning with pupils/students able to revisit material
	• give pupils/students access to other countries e.g. Google earth and web cams
	• allow parents to be easily involved
design characteristics	• give anywhere anytime access
	• provide flexibility within online courses
	• are demonstrably timesaving so it is apparent to staff why they should be used
	• tools help with mundane activities
	• provide learning platforms which are as attractive and whizzy as free social networking sites
	• make it easier to create course materials on line through flexibility for customisation.
technical characteristics	• use wireless networking
	• are accessible anywhere, anytime
	• Support RSS integration to create personal learning environments.

The teachers made the point that whilst ICT tools can support more effective learning and different forms of learning, time to explore possibilities is critical through supported and sustained CPD. *This was a recurring theme throughout the data.* The effective use of tools needs confident and competent teachers as well as pupils/students, and an environment where teachers can learn from colleagues and pupils/students about specific software.

Table 1.8 How effective digital tools and resources help practitioners use <u>time and space</u> well

How ICT tools help	Effective tools and resources:
support for learning	• support anywhere, anytime access: Pupils/students can continue working outside the school/college on tasks which they have started in school/college. However, pupils/students working at home may miss out on social interaction
	• encourage learning outside school/college which can have a knock on effect to the wider community
	• enable events to be recorded so those not there can access them
	• develop the traditional model of distance learning
	• support personalisation which is particularly useful for pupils/students who are disaffected.
	• Provide wikis and blogging so that pupils'/students' collaboration can be sustained

	beyond the time and place and the engagement of individuals can be traced potentially providing evidence of sustained shared thinking. Discussion can be more important in assembling skills and capabilities
	• enable students in small institutions to access broad curriculum delivered elsewhere via synchronous and asynchronous tutorial software
	• support mini–laptops in the classroom so they can be used naturally to support work on a needs basis. Restricting access to ICT on a timetable – the suite, the laptop trolley – means the resources are used less flexibility and less naturally
	• enable materials for supply teachers to be pre-recorded e.g. introduction to lessons
	• support 'webquests' – gathering information not just from the web but also from the locality using GPS
	• connect pupils/students across the world in ways which encourage learning.

Supplementary Report 2

Characteristics of effective non-digital tools and resources

Teachers worked in phase-specific focus groups to discuss the questions: what are the characteristics of effective non-digital tools and resources and how do they help teachers do their jobs well. The discussions were focused around the following four dimensions of the operation of schools/colleges which provide the structure for this report:

2.1 Curriculum - subject teaching
2.2 Curriculum – administration, accountability and monitoring
2.3. Communications between people within and outside the school/college
2.4 Use of Time and Space

2.1 Curriculum - subject teaching

Characteristics of non-digital tools and resources that had helped the teachers do their jobs well over the years are listed in Table 2.1.

Table 2.1 Characteristics of effective non-digital tools and resources[7]

Characteristic	Effective non-digital tools and resource facilitate teaching and learning through:
pedagogical characteristics	• face to face events e.g. speaker's visits immerse learners in real world interactive scenarios
	• text books e.g. especially those linked to course developers and assessors. Textbooks have a role in helping learners understand generic, stable concepts but often need digital backup
	• kinaesthetic learning e.g. physical manipulation of objects reinforces practice and • enhances activities like music and sport
	• pupil/student ownership e.g. reading for young children and SEN
	• control of information e.g. pupils/ students are protected from inappropriate materials
	• visual learning e.g. books with quality illustrations and colour are engaging
	• sharply focused pupil/student work
	• inclusivity e.g. access is available at home for all pupils/ students; materials cater for different pupils'/students' needs

[7] There is no significance in the order of items in the list

design characteristics	• ease of use e.g. flexible; easy to distribute on paper, to take home, to amend and easy to use in the school/college grounds or on field trips
	• immediacy as materials are to hand
	• reliable e.g. no need for electricity
	• there is charm in using 'old-fashioned' resources
	• the personal quality to non -digital artefacts
	• affordability
technical characteristics	• dovetailing with learning platforms and other ICT resources
	• flexibility
	• reusability
	• durability

The teachers also discussed the specific ways that non-digital tools help teachers to do specific tasks well. Table 2.2 lists specific examples which were put forward. The ideas in Table 2.1 are also relevant to this question.

Table 2.2 How non-digital tools and resources help teachers to do specific tasks well

How non-digital tools help	**Examples**
support for learning	free hand doodling post-it data gathering flash cards for engagement kinaesthetic learning – role play, story telling group work e.g. developing mindmaps on flipcharts; groups exchanging ideas so that pupils/students teach each other text books are developed for a specific audience and are pitched at right level for learners
assessment	instant assessment for learning with mini whiteboards marking any place, any time with a pen/pencil for summative assessment marking with a pen/pencil with the pupil/student alongside for formative assessment
planning	ease of planning

When the teachers compared digital with non-digital tools and resources they commented on the greater teaching power they now have with digital tools and resources at their finger tips. They pointed out that whilst there are some experiences that cannot be replaced by technology like handwriting, music and sport, even these activities and learning experiences can be both supported and enhanced by the use of technology for example, video to demonstrate and analyse performance.

Non-digital tools and resources clearly had many advantages but there were concerns that although, on the one hand, some digital products are just electronic books, on the other hand current books are often not well enough designed to take pupils'/students' thinking forward.

2.2 Curriculum – administration, accountability and monitoring

Increasingly non-technology-based resources are being supplanted by technology-based systems because of the sheer volume of assessment information being generated. However digital systems are not always appropriate:

- staggered pages in mark books are hard to replicate electronically and paper-based registers are still necessary where MIS systems do not support online registration
- some school/college systems are not robust enough to protect data from complete loss and unauthorised access
- some forms of assessment are quicker on paper and easier to work with e.g. Individual Learning Plans
- hard copy is better for longer pieces of work but, of course, not for work involving non-text media.
- there will always be a place for immediate face to face feedback to young people on their work and for group meetings and chat which facilitates informal communication.

2.3. Communications between people within and outside the school/college

Communication with Parents

The teachers reported that are few communication channels which do not rely on technology. Some primary schools/colleges reported a preference for face to face communication with parents. Others had well developed e-communication systems. However sensitivity of the information and parity of access to technology mean that schools/colleges cannot replace all non-technology means of communication with technological means.

Communication with Pupils/students

For some pupils/students technology is a barrier and paper based methods work better for them.

Teacher to Teacher communication outside the school/college/college

Because of the isolated nature of specialists in schools/colleges and colleges, opportunities to meet and network with colleagues with similar responsibilities are valued and need to be supported through appropriate provision. This was a recurring theme throughout the data. Opportunities for online CPD are underdeveloped, however, online discussions, blogs etc can never fully replace face to face contact.

Effective ways of working without technology include:

- pastoral care and CPD from outside the school/college/college including support from expert practitioners

- coaching triads
- CPD that involves other schools/colleges
- briefings are better face to face than in email
- pigeon holes should be used for some form of communication rather than email. One teacher reported that in the time taken to reply with one email, a teacher can deal with 10 pieces of information on paper.
- 'coffee machine conversations' are difficult to replicate online (although focus group members using Twitter say this fulfils this purpose)
- 'off the record' chats are important- more emotive issues are best dealt with face to face; anonymous suggestions can be collected e.g. in a box
- 'issues groups' can create ideas and recommendations
- open door policies are good for open discussion of issues
- learning styles and preferences must be taken into account.

2.4 Use of Time and Space

There will always be a need for physical spaces such as individual classrooms, offices and libraries but there is also a need for 'agile spaces' – big spaces for 'lectures' with teachers freed to support where appropriate with teaching approaches including the use of mobile devices. Schools need to be designed for blended learning.

With respect to the use of staff time, sometimes the use of technology requires greater commitment of time e.g. having to create online resources to support learning and teaching for blended learning requires more time and effort. Resources cannot be always reused as a key feature of personalisation is to match the resources to the needs of the learner.

Supplementary Report 3

Where do practitioners go to find out about and access new tools and resources

Teachers worked in phase-specific focus groups to discuss the questions:

3.1 how do teachers find out about new tools and resources?
3.2 what processes are employed in deciding on new tools and resources?
3.3 how long does it take to embed new tools and resources into practice?

This section is structured around the three questions posed and listed above.

In this report, where statements do not apply across the three sectors, mention is made of the sector for which the comment is relevant.

There is a noticeable shift in purchasing practice from teachers purchasing individual packages to suit their teaching to a central model of purchasing materials to use via the learning platform. This has implications for industry and for licensing arrangements and applies across sectors. The processes used to decide on new tools and resources were found to be similar regardless of whether the institution is a primary, secondary of FE institution.

3.1 How do teachers find out about new tools and resources?

Teachers use a very wide variety of sources to gain information about new tools and resources. These include in no particular order:

- **personal contacts** e.g. pupils/students, friends, colleagues, parents
- **professional contact**s e.g. peers, subject co-ordinators, in-school/college/college specialists (providing demonstrations), staff in other schools/colleges
- **professional networking** e.g. various professional associations
- **examination boards** especially for moderators
- **reviews** e.g. in magazines and specialist sections of newspapers e.g. the TES, Guardian

- **websites** e.g. TeacherNet, Teacher Training Resource Bank, Teachers' Resource Exchange (which teachers said needs a user-based rating system); Teachers TV (which teachers said needs short, sharp updates), professional associations.
- **exhibitions** e.g. BETT
- **local authorities** e.g. through advisory teachers and teachers' centres or virtual teachers' centres where ideas can be pooled and shared.
- **reputable software providers**
- **associated universities**
- **technician*s* who work across schools/colleges:** These are reported as becoming a conduit for the sharing of knowledge because they see what staff in other schools/colleges are doing and can judge what works. A suggestion was that they should be trained to understand pedagogy as well as technology[8]. In addition a cluster of schools/colleges could have a roaming e-learning technologist as well as a team of technicians.
- **well-designed CPD programmes** providing examples of pedagogical applications and giving time to play, test out and evaluate. Teachers said the best CPD programmes are not just about 'what' the product can do but also about 'how' a digital tool or resource can be used. This recommendation was made because staff will not always see the relevance or potential of a piece of kit or software unless it is linked to the curriculum. Decontextualised technical training was not considered useful unless it was accompanied by realistic and usable ideas for how a resource can be used in a real classroom with real teachers and real children. Inspirational examples from teachers themselves will often motivate teachers to use these tools in their classroom.

The teachers did appreciate some **intervention from external agencies** to avoid the reinventing of old ideas. Advisory teachers were particularly useful particularly for passing on information through their re-visiting of schools/colleges to support and then to provide follow-up ideas. Top-down regional advisory meetings that focus on policy were considered to be far less useful than opportunities for teachers to share their ideas. One view was that the coffee-time chat was often more productive than the formal input. Workshops should model for teachers, the constructivist learning contexts they are expected to provide for pupils/students.

FE staff and primary specialist staff find it particularly difficult to find networks of peers and experts who are working in the same areas.

Information management was raised as an issue with search tools for sources such as Becta, TTRB, TeacherNet not always retrieving the information necessary e.g. 'if you try to narrow your search by adding

[8] Author comment: There is an argument for university undergraduate IT degrees to include a module on school/college systems and pedagogy given the size of the education labour market for IT graduates.

more terms it defaults to widening the search (i.e. OR not AND)'. Changes in the Becta site caused concern: 'Why doesn't the Becta site do what it used to do? It does not tell us what it used to do. Now we're not sure where we go to find ICT focused information about teaching and learning.'

3.2 What are the processes by which decisions are made to adopt digital tools and resources

Depending on the tools, the LA, headteacher, SMT or the network manager may make decisions about the adoption of digital tools and resources. Best practice is that teachers are engaged in these decisions.

In order to adopt major new tools and resources the decision makers have to be convinced of the learning outcomes and that the investment is worthwhile. So an open-minded leadership team is essential if ICT use is to develop. Teachers indicated that sometimes, heads who are not well informed are easier to work with than those who are well informed because they hand over more responsibility to the ICT co-ordinator and 'trust' them. However, they appreciated the need for the head to be persuaded. Other staff also need to be convinced about the benefits for teaching and learning and brought into the selection process. Sometimes it was also appropriate to include governors and local authorities.

Effective in-school/college/college processes which support decision making include engaging staff in opportunities to trial and evaluate products, providing opportunities for demonstrations and knowledge transfer from expert users, as well as time to experiment and test out the software.

One group of teachers summarized the topics for evaluation questions they might use in the process of selection of resources. These are summarised in Table 3.1.

Table 3.1 Examples of evaluation questions teachers might use in choosing software

• evidence for the improvement of teaching and learning and that the technology makes the learning easier • compatibility and flexibility - can generic tools from other suppliers be added e.g. to the learning platform • access for parents, teachers, learners outside of school/college/institution context	• appropriateness • piloting opportunities • the availability of the resource e.g. 24/7 • storage capacity required

3.3 How long does it take to embed new tools and resources into practice?

The length of time for a system to be embedded depends on 'need to do basis' and on the type of tool and its immediacy i.e. the complexity and relevance. So adoption time could be one week or could be several years Examples of uses of tools which take no time to adopt include using SKYPE for an absent headteacher to talk to the children in the morning and swipe card technology.

Factors that were identified as helping embedding are listed in Table 3.2 in no particular order.

Table 3.2 Factors that help embedding digital tools and resources in practice

familiarity	pedagogical support	training including on the job training and informal peer training
sharing of good practice and open minds	school/college ethos	ways in which teachers can share what they are doing with others.
technical support	security sorted	pre-release issues sorted such as data protection
funding	compulsion	strong management including HT support
teachers seeing immediate benefits in supporting their everyday work e.g. IWBs.	use of pupil/student images	pragmatism and reduction of work load - the new technology helps people do essential jobs better.

New tools have to be SCORM compliant, interoperable, and standardised. Training has to allow teachers time to play. The best way to embed new tools into professional practice in the school/college is teachers seeing the tools in operation improving teaching and learning.

Technical support is also an important element in embedding tools alongside teachers' competence and confidence.

Learning platforms can potentially extend the teachers' range of pedagogic approaches seamlessly as long as the design is flexible and adaptable.

There are a number of factors hindering implementation with the key factor being the assessment system. If the ability to demonstrate ICT tool use as appropriate across subject areas was a required part of the assessment system then adoption and implementation would be accelerated.

Key factors hindering embedding of digital tools in practice are set out in Table 3.3.

Table 3.3 Major factors that hinder embedding digital tools and resources in practice

Factor	**Impact**
national assessment systems	There is a dilemma which teachers face in a high accountability system where it is directly measurable results which count. Pupils/ students may benefit considerably from extra-curricular activities but if these are not counted in a culture where that which is measurable is that which counts, then pupils/students are losers. There is too much emphasis on measurement of individual bits rather than the whole; and attainment over achievement. 'Surely ICT-based resources could be developed which allow more credit to be

	given to a range of outcomes which encourage pupils/students to explore, accumulate, reflect and demonstrate in a range of forms.
transferable skills aid adoption of new systems	The capacity to change tools depends on similarity to previous systems so schools/colleges can hit the ground running and so that pedagogical applications are known.
filtering systems	Filtering systems currently prevent access to educationally beneficial applications - "educate for responsibility rather than ban and block should be the philosophy". [ADD CALL OUT BOX] Filtering policies vary between local authorities and are reported as a major constraint in innovation. It seems that filtering systems are perceived as excessively rigorous and are causing teachers and pupils/students to work outside the system just to use applications which are now considered part of the toolkit of web users. *This was a recurring theme from the focus groups.* It may be worth reviewing practice in schools/ colleges, LAs and other countries to come to a transparent code of practice in UK which provides a base line for good practice together with a rationale for this. Some LAs restrict the use of equipment for personal use e.g. a laptop cannot be used at home for Facebook, hotmail or booking trips – even if these uses are school/college related. Some LAs block website access so that online resources such as games which might have an educational application can not be accessed.
lack of demonstrable pedagogical benefit	One of the primary groups for the research expressed concern about the value of learning platforms in the primary school/college and considered it will be a long time before they are accepted. There are concerns about maintenance and technical aspects of keeping them running - plus the skills needed for creating the tools. It was considered the money might be better spent elsewhere and the question:'where are the pedagogical claims backed by evidence?' was asked. Just because a technology exists does not mean it is going to be useful for schools/colleges of all types'. The value of learning platforms for secondary schools/colleges was acknowledged.

Less major factors that teachers identified as hindering embedding tools in practice are listed in Table 3.4 in no particular order.

Table 3.4 Other Factors that hinder embedding digital tools and resources in practice

Factor	How it is demonstrated
staff issues	staff attitudes: age of staff, people's preparedness to change
	availability of the skills needed to maximise the impact of the tools

	lack of time for teachers to become pedagogically confident
	lack of CPD: lack of support post implementation
	teacher pedagogic style: sometimes teachers resist the locus of power transferring from teachers to pupils/students. Some teachers find it difficult to understand that pupils/ students can discover knowledge for themselves as well as 'infecting' other pupils/ students with enthusiasm
technical issues including reliability	security e.g. the more mobile, the more likely it is to be stolen
	interoperability
	reliability - increased workload and duplication of effort because the technology cannot be trusted to work 100% of the time
	ability to download is not always available for free products - because of filters
	potential for subversion of the system e.g. pupils/ students swapping swipe cards around
	lack of teaching experience of those who write software
	compatibility of resources between schools/colleges, home and universities
school/college management issues	ethics e.g. issues over biometric data and security, the terms under which it is stored, civil liberties issues, future use of data issues e.g. fingerprint identification
	the lack of email culture in primary - pigeon holes are preferred means of contact
	accountability - loss of evidence trail and concerns over security and privacy: ensuring all parents have given permission for pupils/ students to be photographed and videoed. If there is one child in the classroom whose parents have not given permission then this restricts what technology can be used and how.
	health and safety
	soft management
	teachers need to have appropriate hardware and software and be used to using it e.g. electronic reporting requires this
	lack of joined up thinking in schools/colleges in different communities
	absence of professional culture of sharing
	cyber bullying
	cost
	being risk averse

Supplementary Report 4

What are the key challenges faced by practitioners in doing their job well

The teachers in the focus groups worked in their phase-specific groups to discuss the question: what are the key challenges faced by practitioners in doing their job well. The discussions were focused around the following four dimensions of the school/college:

4.1 Curriculum - subject teaching
4.2 Curriculum – administration, accountability and monitoring
4.3. Communications between people within and outside the school/college
4.4 Use of Time and Space

To some extent, in answering the question above, teachers were drawing out the major concerns they had expressed previously and which are reported in Supplementary Reports one to three. The recurring challenges are set out in Table 4.1:

Table 4.1 Key challenges faced by practitioners in doing their jobs well

The following challenges identified by teachers were recurring themes throughout the research
• lack of staff knowledge at all levels about how to use ICT tools to maximise learning i.e. pedagogical value including effective practice with particular groups in particular contexts • the need for industry to design interoperable and multi-purpose tools which are built on explicit pedagogical principles which promote deep learning • assessment: the barrier to adoption of new ways of working with ICT created by current assessment requirements which do not require the demonstration of ICT competence in subject areas • data collection: the collection of too much unused data on pupils/students coupled with security fears • CPD: -the lack of availability of time to experience with new ICT tools -lack of appropriate formal CPD - the value of informal CPD in keeping teachers up to date via knowledge sharing through networking with peers - the difficulty of finding the networks of colleagues working on similar issues • lack of pedagogical justification: national initiatives encouraging or requiring schools/colleges to adopt tools without convincing case studies demonstrating the benefits of adoption or the CPD required to

embed changes in practice e.g. interactive whiteboards, learning platforms.

- workload: the expectation that individual teachers will produce e-resources where previously text books would have been used i.e. increasing teacher workload.
- poor infrastructure: lack of industry standard ICT support providing high reliability and backups (note: The services teachers experience ranges from excellent to non-existent.

4.1 Curriculum - subject teaching

Teachers identified a tension in many schools/colleges between there being unrealistically high expectations of the technologies on the one hand, and, on the other hand, staff being unwilling to innovate because of the costs of upgrading equipment and learning new practices.

Primary teachers outlined three specific challenges that made their jobs problematic:

- the difficulty of engaging knowledgeable and competent staff in ICT
- the fact that formal assessment of pupils/students does not reward competence and understanding of digital technologies- both in the assessment of e-learning and in the assessment of subject areas
- purchasing decisions tended to dominate senior management discourse rather than discussions about pedagogy.

ICT co-ordinators in the group were particularly concerned that other teachers may not be aware of their professional accountability when using products like social networking tools with pupils/students but outside the school/college system. It is not usual for the use of social networking tools to be allowed on the school/college's IT systems.

The primary group warned about the time required for a change in professional culture with respect to the use of ICT tools. Ways of supporting increased use of ICT in the primary school/college which were suggested included:

- accepting the support of the pupils/students
- issuing software for home use that is compatible with school/college software
- backwards compatibility when new software is purchased
- some form of accreditation for adoption of new practice however minimal
- non-contact time for the ICT co-ordinators to enable them to support staff
- time allowances to allow members of staff think though changes in practice

- an intensive burst of activity from time to time when adopting new technologies rather than just 'drip feed'.

The secondary and further education participants focused on broad institutional issues around the challenge of managing significant change in practice. Ways of supporting change which were identified included:

- developing a long term ethos for the institution to avoid being influenced by short term trends
- the need for more pedagogic examples of learning platforms and social networking practice, particularly positive illustrations of learning
- encouraging more staff and other associates, including assistants and parents to contribute and collaborate to build up effective digital practice
- understanding the attitudes, the preoccupations and the fears of staff in order to create a culture of professionals who are open to the innovative use of technologies
- convincing resistant staff that digital technologies should not be used to replicate current teaching styles but to innovate
- finding time to demonstrate new products and mentor colleagues
- maintaining a work/life balance with an ICT responsibility
- solving significant technical problems associated with filtering and broadband/w-fi capacity
- differentiating between the advice of external groups such as suppliers and agencies who are promoting digital technologies, and balancing their conflicting advice.

A solution to the challenges of conflicting advice from external agencies was offered by the secondary group who suggested that instead of having to access multiple websites to find the information they need to do their work well, some 'condensation' of this material should be undertaken. In the meantime, these professionals turned to a variety of professional organizations or communities of practice with online forums for 'just in time' information and for informal validation of their decisions.

The difficulty of finding the networks and materials they wanted was a common theme for teachers in the five focus groups and for this reason, an additional session was added for the focus group participants to share knowledge about how teachers are accessing networks and materials they need. There was considerable concern about the difficulties of finding networks relevant to them, the lack of interconnection between what was found – both networks, materials and advice and the difficulty new entrants into the profession have with finding the professional networks relevant to them.

4.2 Curriculum – administration, accountability and monitoring

Three main challenges teachers face from the perspective of administration, accountability and monitoring were raised:

- the need to focus on **collecting and using data** to improve learning
- the impact of **league tables** on the choice of subject that pupils/students were able to make
- the **transition** issues from primary to secondary.

In terms of **data collection**, concern was expressed about the amount of time spent by teachers entering data that reduced the amount of time that should be spent on more important learning issues. A second concern was about the volume of data collected which was not used.

A concern about **league tables** influencing advice on pupils'/students' choices of subject was expressed. Pupils/students may be guided to take subjects in which it is perceived to be easier to get high grades. Opportunities to gain credit for existing accomplishments could be achieved with a more adaptable assessment system.

The third issue was the need to improve **transition** between primary and secondary school in terms of the data that is handed from the primary school/college to the secondary school/college. The concerns were around:

- data that do not provide the secondary school/college with enough information about the pupils/students themselves, where they are up to and what they need to do next
- the variability of data between different feeder schools/colleges
- the emphasis on accountability and league tables making feeder-schools/ secondary schools and colleges competitive rather than co-operative
- the problem for feeder schools/colleges to meet the variable data needs of different secondary schools/colleges
- the inordinate volume of data collected making it increasingly difficult to gain a meaningful overview as well as a useful picture of the individual child.

Factors that inhibited teachers from mastering adequately the knowledge and practice required from complex administration, accountability and monitoring tools included the following:

- coping with 24/7 access
- finding time to learn new processes and programs
- incompatibility with home systems

- appropriate levels of access
- the complexities of converting data.

Some key demands were professionally problematic. These were the need:

- to back up data, offsite storage of data – security issues/data protection
- to operate safely and remain within law
- to generate teacher awareness of issues of confidentiality, and privacy including issues around taking data offsite
- to discipline those members of staff who tended to 'do their own thing'.

The group were explicit about the complexities of decision-making about access to data. For example, although it is safe to work from home through the portal, teachers who leave the portal open whilst away from their desk or whilst at home potentially allow anyone to access confidential data. The same risk of misuse of data comes from the use of a pen drive to store confidential files.

The **solutions** mooted were:

- development of protocols/complex caveats around data security and have these agreed by the staff
- web-based means of keeping up-to-date with current legislation and acceptable practice
- advice on managing expectations
- development of more interoperable programs
- more access via portals to remove the need for staff to carry or port data.

In issues of administration, accountability and monitoring this mixed-phase group of practitioners thought that good practice could be achieved by ensuring that CPD met 'the need to know'. They suggested programmes led by subject specialists who were able to demonstrate through their approach good models for practice. Features of this CPD should be:

- time, appropriate training and support
- peer to peer support and professional networking
- departmental organisation of CPD
- appropriate materials and online content
- networking and sharing of resources
- on-going training to acknowledge, encourage and reward progress

- CPD giving time to experiment with new ICT tools and share ideas about applications with other teachers.

4.3. Communications between people within and outside the school/college

The three overall concerns amongst the primary teachers about pupils'/students' use of computers in both school and outside are:

- the digital divide
- the engagement of teachers
- issues related to learning platforms.

These three issues are discussed here in detail. In the first place there was concern that the **digital divide** is widening in the global society as a whole becoming more pronounced amongst the least advantaged. In some areas there are so many social problems associated with poverty that providing computers seems to be the wrong solution because some families, for example, do not have furniture. Other families do not have the required levels of fluency and literacy needed to access the internet that is still text-based in the main.

In addition digital differentiation is appearing between the groups in most deprived band of society. The fact that pupils in Pupil Referral Units get free computers is setting an unfortunate precedent because those who are on the borderline of poverty do not qualify. This group, just above destitution, constitute a growing underclass that is not connected to society or the internet. On the other hand, a majority of all pupils/students who do have computers at home only use them for information retrieval. Creative tasks, social networking and publication are not in their repertoire.

The wider social concern amongst these teachers is that increasingly the interactions between young people take place in web spaces. However, one participant commented in defence of this phenomenon:

> *What other social outlets are there in a world that is perceived as dangerous?*

Some teachers' engagement in this digital culture is also questioned. The main concern is the pedagogical climate that has been created by the 'tick box' approach to education so they do not see the advantages of networking. This appears to generate a mechanistic approach to computing amongst teachers that prevents exploration of creative computer uses. One cause might be the recent emphasis on teaching tools (e.g. IWBs) rather than learning with and through ICT. This emphasis has led to a distortion in the ways in which the resources are being used. There are pockets of effective practice – but considering the timescale and the history of IT in schools/colleges, the primary group were disturbed that many teachers are still focusing on short term and low level uses of ICT rather than more challenging applications.

This led to a discussion about the lack of information about pedagogical applications for learning platforms. Currently, the model of learning seems to be defined as low level information dissemination rather than offering creative opportunities for learning beyond the classroom.

Professional resistance in primary schools was compared to the situation in Higher and Further Education where learning platforms have been available for the last ten years but the spread is still patchy in terms of take-up. These teachers asked, therefore, whether after ten years the uptake will be similarly patchy in their sector. On the other hand they also observed that computers have been schools/colleges for over thirty years with an early emphasis on pedagogy yet so much of this early lead has not been exploited. These failures were seen to be issues of technical expertise, and the time required to acquire it as well as reliability, access and professional resistance.

In specific terms, the discussion in all the groups focused on the introduction of learning platforms firstly as a mode of connection people within the school/college. The barriers to uptake are:

- confusion in senior management teams about who should be in control of the platform: administration, senior management or curriculum specialists
- inappropriate interactions taking place on social networking sites including incidents of cyber-bullying
- pupils/students who arrive in the middle of sessions from countries or cultures where they do not have ICT resources and the same easy access to the internet
- a culture of secrecy within the staff.

The development of resources by staff for the learning platform was also criticised because:

- the creation of materials for supporting teaching can be disproportionately time consuming
- when resources are uploaded to the system there is a danger that some teachers will become ossified in their use of them
- a minority of teachers do not want to share their work with others.

For some teachers surfing the web is a significant barrier to the up-take of digital technologies. This group:

- resent the time it takes to find relevant materials in web based searches
- are disorientated by their lack of knowledge.

Another major issue is compliance. Schools who are considering linking to LA systems are inhibited by the knowledge that security may not be assured:

- an individual might use a memory stick to remove data from the system
- pupils/students bringing homework in on memory stick might introduce viruses and prohibited devices into school/college systems

- senior management are concerned about the risk of losing confidential data to mobile devices.

The further education group who had more experience in compliance and data protection with learning platforms over a longer period introduced some more sophisticated concerns:

- a lack of skilled facilitators deters learners in collaborative environments
- learning environments that are not appropriate for collaboration
- poor design of e-resources for CPD
- understanding of online pedagogy reflected in design.

Underlying these challenges was the acknowledgement that there was a need for better communication between the ICT manager and the rest of the staff. The CPD recommendations in this context were:

- establishing a management position predicated on improving inter-staff communication
- encouraging face-to-face sharing and support of reluctant management and teaching colleagues in a community of practice
- building respect between teams
- early discussion about pedagogy and assessment
- specific CPD in e-facilitation.

In order to improve the uptake of learning platforms, a special plea was made for a change in the role of ICT co-ordinators in primary schools/colleges who are on call all day, every day. Tasks include technical problems, replenishing stock, managing resources, keeping up to date and developing new practice often whilst teaching their own class.

4.4 Use of Time and Space

Some older buildings are difficult to network (even wirelessly) and do not accommodate IWB technology easily so the BSF programme was welcomed. Some specific challenges in widening the scope of the school/college beyond the physical space the building inhabits are:

- overloads on the digital systems
- bans on teachers using the computers for personal uses in school/college
- the impact on initiatives when the innovator leaves.

However, less visible but equally necessary is the wider need for teachers to re-think their approach to teaching and learning and focusing on learner choice. A key question in this situation was whether parents were willing to support learners' working from home. Radical suggestions were to:

- dispense with timetables and encourage teachers to facilitate pupils/students to learn as they wish, e.g. geography all day Monday, something else Tuesday. (Note – other teachers said these were unrealistic)

Solutions fell into four categories:

- physical space: building schools/colleges for pupils/students from 3-16 so that all can benefit from bounded finance and resources
- connectivity: the use of 3G connection (QIK) phones that can be used to film and connect wirelessly to computer
- security issues: adequate protection for equipment, pupils'/students' safety and sensitive data
- professional attitudes: the need for ICT 'champions'.

Supplementary Report 5

The future - what ICT tools would help?

Teachers worked in phase-specific focus groups to create a vision of ICT tools for future teachers through discussing the questions: what ICT tools would teachers to have to help them do their job well? What would be the characteristics of these new tools and how and when would they be used. The discussions were focused around the following four dimensions of the operation of schools and colleges:

5.1 Curriculum - subject teaching
5.2 Curriculum – administration, accountability and monitoring
5.3. Communications between people within and outside the school/college
5.4 Use of Time and Space

The ideas about ICT tools for Future Teachers from the primary, secondary and FE focus groups were very similar and so are combined for the purposes of this report where statements do not apply across the three sectors, mention is made of the sector for which the comment is relevant.

5.1 ICT tools for supporting curriculum work in subject areas

At present, the pervading viewpoint amongst developers seems to be that teachers only use ICT tools for whole class teaching or one-to-one interaction. Software designers need to consider the changing role of the teacher to 'facilitator rather than dictator'. Teachers wanted more emphasis in the future on tools which supported collaborative enquiry and working. The teachers predicted an increased take up of digital tools and resources in subject areas within the next ten years as members of the profession not born into a digital age retire.

Well-designed resources have the potential to reinforce the student–centred pedagogical models of the future. Teachers who experienced in the use of learning platforms proposed the application of a pedagogical model where ICT tools are used to:

- develop problem solving skills
- encourage independent thinking
- promote imagination and inquisitiveness
- support multimodal and multimedia assessment of independent projects
- encourage collaborative links with experts.

The teaching profession is showing a significant shift away from a focus on content and towards the process of learning with particular emphasis on teachers' roles as facilitating the learner. In this context the teachers identified three key areas for curriculum subject software development that did not relate to content:

- more **web-based suites** of programs for group teaching developed with teacher experts e.g. 'packages' covering subject areas
- more applications that would develop **personalised learning** without losing face to face elements of teaching where pupils/students engage in dialogues with teacher experts who have important, interesting and stimulating things to say about their subject
- a concentration on sophisticated **search** tools.

Web based curriculum suites; the design of software will be influenced by the tendency of institutions to move away from the purchase of packages to subscription-based web-stored curriculum resources. General advice to developers for future curriculum products centred on the need for more web-based suites of cross-curricula programs purchased by subscription where subjects are integrated into an overall curriculum vision and design paradigm. Teachers wanted more cross-discipline learning activities for all phases drawing on constructive learning experiences in the Foundation Stage. Continuity and progression in web-based suites of subject-specific software throughout the National Curriculum key stages could also be improved. Another request was that software should embed literacy through all subjects with an occasional discrete specific reference where relevant.

Personalised learning; the move towards personalised learning suggests that there should be increased use of different input devices, varied locations and web spaces for individual use. The growth of inclusive technology design i.e. designs which incorporate SEN needs, was welcomed. Specific mention was made of software that provides opportunities like vision enhancing techniques for those with poor sight like 'computer cubes': cookie-sized siftables with motion sensing like computerized tiles. Other inclusive approaches with learning potential are inclusion of neighbour detection, graphical display and wireless communication. In the most sophisticated environments all these features act in concert to form a single interface that enriches access to information and communication. The secondary group were particularly interested in the role of location sensitive devices in the future for both teachers and pupils/students. They would value more development work in the areas of data mining and location awareness around individual devices available to learners. However, devices that register who is in the room and where they are sitting should not be used for inappropriate surveillance that disturbs the trust between teachers and pupils/students. Automated minutes of class discussions and staff meetings were seen to have learning and administrative uses as well as more automated staff and curriculum timetabling. The integration of a wide range of ICT tools into software including virtual trips to museums, field trips and attending re-enactments of historical events were considered to be likely to greatly increase the power of the learner to direct their own learning.

Sophisticated search tools; the teachers requested a dedicated **search engine** for educational resources, that can be tailored by teachers or ICT co-ordinators to alert them to new tools and resources. Resources for education like folksonomies and website tagging tools which include user recommendations would enable teachers to find out what really works.

Characteristics of effective tools: Teachers wanted digital tool and resource designs that supported **flexibility** in curriculum and assessment. Some technical issues were raised that generated the following list of favoured characteristics: the opportunity to repurpose, support for discovery learning, autonomy devolved to the learner, meta-tagging by users, taxonomy support, elements that can be disaggregated, repositories of reusable objects, ubiquitous access and resources that were sustainable.

Some **specific characteristics** were explained at greater length:

- **access to learning platforms** anywhere anytime for anyone (cloud computing) was a key request with consideration given to mega bandwidth both at home and in school/college as well as mobile network coverage.

- many features of i**nteroperability** that the teachers wanted existed already in some software which accepts a range of different formats e.g. images and videos. One request was to extend PC interoperability to be similar to the Apple Mac so that, for example, music written in one PC package could be dropped into a PC presentation package without having to reformat. Another idea was to make SIMS interoperable with learning platforms e.g. via Moodle widgets.

- an accepted set of **cross-platform standards** would require software tools and icons to be similar no matter which piece of educational software was being used. This would reduce the learning curve for teachers. As a result the skills (and hence confidence) acquired in one area could then be applied to another.

- more uniformity over **licensing arrangements** was requested to assist coordinators who currently have to manage full site licences, licences per machine and separate network versions.

- whilst acknowledging **copyright issues**, the teachers pointed out that the more **readily available and accessible** software is, the more likely it will be used e.g. being able to download the IWB software at home without having to enter complex serial numbers would help.

Solutions were offered to ameliorate the demands on the profession as expectations of their use of and knowledge about ICT tools (i.e. their digital literacy) rise:

- **Learning technologists**: most institutions now have technical support through single or cluster-based technicians. However in order to ensure the widespread assimilation of learning platforms in the future, the support of learning technologists will be essential to help produce online learning materials for use by parents and pupils/students. Although some 'off the shelf' resources may be helpful, the value depends on whether they can be tailored to the needs of the pupils/students and the teachers. From this point of view the tools must be labour-saving rather than requiring additional time and effort from the teacher.

- **Formal CPD**: a preference was expressed for work-based learning that focused, not only on using the technical aspects of a resource, but also the pedagogical implications of its use. Software developers might consider at the outset what types of learning and teaching resources will support. Informal support for primary ICT co-ordinators was requested in the recognition that their role is onerous because of the continually changing, whole-school/college, technical and pedagogical environment.

- **Informal CPD:** information for teachers about cross-curricular and subject association support was considered important in promoting knowledge about future directions. Another source

of potential progress was the informed parent who could drive ICT use and innovation. In support of their own careers some form of qualification might be appreciated by parents in recognition of their efforts in support.

5.2 ICT tools for supporting the curriculum with respect to accountability and assessment

Statutory curriculum and assessment requirements are currently 'the elephant in the room' in discussions about digital solutions to **assessment** and **accountability**. These teachers complained that present teaching styles and assessment practices are designed to restrict rather than inspire pupils'/students' responses. Developers' attention to **assessment issues** might help to change attitudes in this area from an emphasis on cohort data to data that traces the achievements of individuals from a range of multimodal perspectives. The design of measurement tools should reflect the needs of the whole child including their social development like their ability to be collaborative and co-operative, not just those areas that yield quantitative data. Designers should work with teachers on assessment modes that credit what the pupils/students are capable of doing rather than forcing them to provide evidence of learning in formats which are not appropriate for the needs and interests of the learners. E-portfolios were seen to have significant potential as the designs of e-portfolios improve.

In this context, the teachers requested future development in assessment that focused more **on individual needs**. There was a growing preference amongst the teachers for diagnostic/analytical tools rather than software that only permits the presentation and manipulation of cohort data. This trend to personalisation might be reinforced if developers liaised more with pupils/students and parents about what they want from education because some schools/colleges are becoming too introspective: the tendency of institutions is to see pupils/students as data rather than as individuals. Further reinforcement of the trend towards personalisation could be achieved by backing up parents' meetings with online systems for two-way **communication with parents**. As well as providing a means of presenting data these systems, with pupil/student access, should be means of the pupils/students demonstrating their capabilities. In this context, the design of **assessment tools** in any learning platform should consider the value of e-portfolios, both open and varied, that promote inclusive **multimodal forms of assessment,** not just skills and knowledge. Online assessment should be available when the pupils/students are ready. Recording their achievements in an e-portfolio might include the use of automated tools that generate automatic emails to pupils/students who have not completed targets by deadlines, copied to tutors, parents and so on. **Formative assessment** tools that respond to learner activity and take account of learner voices are also important. Digitising a paper-based system like Assessment of Pupil Progress (APP) might be worth considering.

Some **management systems** already support customisation and allow schools/colleges to design the look and feel of the front page of their online management information system i.e. their own front-ends. Moving in the same direction, specifications for similar management systems of the future include open Application Program Interfaces (APIs) so that schools/colleges can create their own systems. Teachers should be empowered to structure data reports that are useful for them so that schools/colleges can take advantage of deeper professional insights. These systems should work on any kind of integrated device, fixed or mobile. Sufficient storage area per teacher was vital. A development that the teachers expected to see more of in the future were applications like the Mentis verifier and Swift that display **holistic management thinking**. These empowering professional online school/college improvement systems

support self-evaluation, the Self Evaluation Framework, school/college development plans and performance management - all in one. Swift, for example, connects information and documents across these modules to aid school/college improvement and cut out duplicated work.

In the area of **accountability** teachers wanted ICT Tools that would educate in the processes of effective filtering rather than just provide an insensitive blocking process. The teachers favoured a future in which developers delegated personal and social responsibility rather than undertaking policing. Codes of conduct for modification and ownership by the users were considered to be an important route for future resources. Intuitive systems should communicate with other tools within and beyond the school/college.

The teachers identified a clash between the impetus to innovate and the need to be professionally accountable. The solution was more understanding of the **management of innovation** within schools/colleges. Widely available examples linked to information about building institution-centred codes of conduct would help teachers, managers and LAs to integrate new technologies into the school/college system such as mobile phones and social networking for learners. These would help all stakeholders learn how to manage the development of learner-focused and authored resources that make effective use of these devices and opportunities. Learners and teachers are using social networking sites but this use is currently outside the formal school/college system.

Specific recommendations that might help to allay LA and Regional Broadband Consortia concerns about the risks of emerging technologies included:

- an 'education mark' awarded to website providers so schools/colleges can access them through the firewall
- more discussion between schools/colleges, LAs and Regional Broadband Consortia about the acceptability of the practices of innovative teachers who might be using the full range of publicly available ICT tools for educational purposes.

In the future assessment systems overall should be technically:

- secure
- accurate
- reliable
- portable
- affordable
- accessible
- cross-platform
- interoperable.

Other characteristics of effective assessment systems that were detailed again indicate changes in the vision of the learner and the communities they come from. Assessment software should

- be usable across multiple contexts (home, school/college, other areas and international)
- take account of the learner's voice
- allow for lifelong learning achievements
- facilitate transition between phases, and;

- be supported by professional networks managed by the profession in collaboration with the examination boards and university teachers to facilitate sharing of good practice.

Key points that emerge from these discussions on assessment and accountability are that a series of case studies are needed to build:

- confidence in deploying new forms of multi–modal assessment
- understanding of the value of student–led curriculums
- a case against a one-size fits all approach to learning
- management competence in overseeing institution-focused management software designed for teachers to engage in collaborative system improvement.

Overall, **well-designed CPD** was seen as a vital means of progressing change. Joined-up training, for example, was requested in the full range of well-designed assessment and accountability resources in which the information gathered on pupils/students from a range of different sources can be used to find out more about the needs of the child as a whole. CPD programmes should not just be available online as this can result in professional isolation.

5.3 ICT tools for supporting communications between people within and outside the institution

Many of these practitioners were already seeing the future for education in existing social practice that demonstrates a richer range of communication with universal access in different formats and media that would include everyone in the local and the wider community. The advice about the design of future learning platforms concentrated on reducing the distinctions between people inside school/college, the wider community and internationally. Building in the opportunity to communicate in different modes of communication was also requested: one to one, one to many, many to one, many to many.

Schools/colleges already innovating with learner-choice have to confront significant issues of responsibility and trust in developing communications that involve people within and outside the institution. For example the piloting of video used for performance review and mentoring has raised ethical issues and the need for a Code of Conduct. Learners themselves need to know in which lessons this will happen and how the information will be used. The use of web-cams is already controversial. Where a class web-cam is set up teachers have also noticed that pupils/students are more reluctant to contribute or to volunteer when they thought their parents might be watching. However, although privacy and security issues need to be addressed in schools/colleges, practitioners acknowledged the potential value for learning of new tools and resources that are current in the market place such as:

- handheld and laptop devices including fine-grained content and wi-fi connections
- MP3 and MP4 devices linked to learning platforms
- podcasting (voice), vodcasting (video) and video conferencing
- email
- ichat (synchronous typed chat), backchannels (messaging), SMS and voice communication

Pedagogical developments in the use of mobile phones were praised - pupils/students are already using them as cameras for taking before and after pictures in science and as calculators and timers. The teachers suggested that the range of multitasking e-activities that pupils/students indulge in socially should be encouraged in classroom. However, teachers need more support in pedagogical applications of these resources and in teaching pupils/students how to mine information, assess its reliability, evaluate it and apply it with commonsense. The applications that pupils/students commonly use out of school/college which have pedagogical applications include:

- **Multiuser, networked, 3-D virtual gaming**, like Second Life, a contested area where holographic projection is expected to be the next stage. The question is raised about whether schools/colleges are influencing behaviour in these public virtual environments by promoting walled spaces. The practitioners said, 'Trust the teaching profession to make the decisions, not the Academy or the parents who are often too keen to preserve traditional avenues for learning.'

- The feasibility of **mentoring and tutoring online** particularly subject specific arrangements. Teachers foresaw opportunities for virtual tutoring via the learning platform linked to artificial intelligence. Pupils/students might also gain from being engaged in the technical tutoring of teachers and learners - one 12yr old has already posted a video on YouTube that explains how to use the iPhone.

- The barriers to the uptake of **learning platforms** were considered to be social and professional rather than technical. Teachers themselves do not yet have much experience of social networking. The primary teachers, in particular, were not convinced about electronic communication within the same small primary school/college because it is easier to for teachers to talk to each other. In one school/college, for example, where memos are sent out as emails some teachers may not get around to opening them for a month.

- **Social networking for teachers** was suggested. Teachers should be encouraged to contact each other beyond school/college for professional knowledge. Free social networking tools already exist. Whereas subject groups currently meet in face to face conferences it might be useful to collaborate between meetings as well as obtaining information live as when professionals are meeting. Different kinds of collective learning behaviour are emerging in professional networks. Connecting networks to allow cross-collaboration would be helpful.

One solution to teachers' hesitation in changing pedagogic approaches to use ICT tools would be formal and informal CPD designed to promote social/professional networking that encourages collaborative learning between professionals. Teachers could have access to knowledgeable advisers, experts and peers during this learning episode for knowledge exchange/sharing practice. Teachers should be experiencing joint projects and just in time learning themselves using these new media. This requires some kind of professional networking tool that provides ways that teachers with the same interests can locate each other. The digital requirement is for tools that make available resources, ideas and tools easy for teachers to find. It would be a tool that enables professionals to find "people who know" and shared projects. Built into this network could be connections with those who will provide voluntary support to benefit local communities and institutions. Collaboration might also be possible with industry and local partnerships but

requirements for CRB safety checks can prevent such volunteer activities. Perhaps a less rigorous check may need to be devised like a database of 'safe' people in industry who can be looked upon as a pooled resource. Lack of inter-operability and access to Regional Broadband Consortia and learning platforms limits learning.

In summary, **solutions** to the challenges of people to people communication in future learning were:

- maximising collaboration tools
- providing CPD through networking and access to experts and establish sustainable models to support the efforts of cross-curricula and subject associations? (Current networks depend on considerable volunteer effort – are these sustainable? What other models exist?)
- creating CPD giving time for play and space to develop pedagogy for new ICT tools e.g. LA roadshows
- avoiding the CPD cascade model – 'Chinese whispers do not work'
- increasing the use of online and video conferences and new ways of working described as 'unconferences'
- creating a collaborative environment with e–facilitators that is open and international. Review the current provision for professional networking online and face to face. How can fragmentation be overcome? How can links between networks be made? The exclusivity of some current networks was recognised
- develop more people to people connections and e-twinning opportunities.

There are ethical issues to be resolved as teachers work more online sharing knowledge and resources and there is a need to develop a common code of conduct for such work. Any sites supporting professional networking will normally have terms and conditions with protocols for codes of conduct which include:

- how can listeners in the e-forums be identified
- what ethical code do contributors subscribe to
- who owns the ideas and the content posted by teachers.

5.4 ICT tools for supporting effective use of time and space

Characteristics of design relating to the use of time and space

The future was expected to embrace the concept of the 24 hour school/college – open to communities, parents, pupils/students. The pervading access to tools will create 'communities of knowledge.' The teachers indicated a range of future applications that will need to be debated such as pupils/students taking responsibility for populating the databases, using the swipe cards, seeking help from identified peers, radio frequency identification (RFID) tags, GPS location-aware software embedded in pupil/student

handhelds, clothing etc – again learner involvement and responsibility is a key issue. The teachers' main message was, 'educate rather than ban'.

A key consideration was about how digital tools will enable a more personalised learning approach inside and outside the institution. Each learner and teacher were expected to have one digital tool that provided freedom from current constraints of only operating in classrooms and learning cubicles. One suggestion for an input device was a camera phone or PDA for teachers with cameras and Excel already used for both pupil/student assessment and threshold administration.

Open workspaces or 'productivity corners' were prophesied for digital tasks like printing; walls might be used as touch screens; wireless connectivity would be provided, inside and out. An example was given of rooms such as one in Emirates Stadium which is designed with white slanted walls that can be written on and used as a desk. This kind of stimulating learning environment, both physical and virtual, was considered to be vital for the future of effective learning.

The all-encompassing learning platforms that will support these new approaches will require a physical environment that is fit for purpose. Classroom designs need to be flexible to support different pedagogical approaches. In this context architects, developers and installers need to work with school/college staff, pupils/students and parents in careful consideration of a range of topics:

- positioning of power sockets in the floor and connections for network access – as these can affect pedagogical decisions
- how and when teachers will need to use digital tools and resources with pupils/students for activities like IWB use, groups using a laptop or listening units, learners using laptops with limited battery life
- checking ambient window light when IWBs and laptop screens need to be visible.
- encouragement of 24 hour open access areas for the whole community
- allowing for learning outside the classroom
- the effect of more use of portable equipment e.g. wireless data loggers, PDAs and recording equipment flexibility.
- the impact of more mobile equipment needing good battery life
- electronic tagging equipment to reduce the likelihood of devices being stolen
- health and safety issues like avoiding exposure to LCD projector beam for long periods of time by back projection or steeply angled projection.
- reliability of electronic storage as opposed to paper storage in terms of space saving.

Specific benefits related to **time** issues include:

- administrative gains for teachers: auto–recording of meeting minutes and automatic registering of pupil/student attendance
- 'just in time' learning: flexibility of schooling for 14+ students allowing 14–16 in employment and 16+ return to formal schooling.

Specific benefits relating to **space** include:

- electronic storage regarded as permanent for school/college records
- new technical configurations like 'thin clients' rather than desktop PC
- robust multimedia server-based activity rather than on local machines
- individual devices reducing the need for computer rooms
- LAs and government devolving autonomy of tool choices to pupils/students and teachers
- tools that are adaptable for different pedagogical uses.

These scenarios present a range of challenges for the profession that pertain to the management of change in schools/colleges and in communities. Issues teachers will need to resolve are:

- School leadership
    - how can professional leadership and management teams become familiar with technology issues?
    - what is the best way to work within a school/college climate that discourages change?
    - how can digital evangelists be encouraged?
    - how can the social system be reconfigured to support an 'open school/college' model?
    - who needs to consider the privacy issues raised by the implementation of new technologies in open schools/colleges?
- CPD
    - what value is there in transdisciplinary training for professionals rather than a focus on specialisms?
- Families
    - is there a need to educate the families as well as the child?
    - what kinds of support systems do families require in an open school/college system?
    - how to work with parents who are not motivated to have their children learning at home and who are influenced by issues of culture, ethnicity, social status?

In conclusion, the teachers asked that 'professionals should not just think about schools for the future, but remember the young people in these institutions! Teaching and learning is not just about a building.' Overemphasis on surveillance rather than creativity was a danger in the design of the building as much as the design of the curriculum.

The teachers estimated that currently only a small percentage of the teaching profession understand how the future might unfold with respect to teaching and learning. As a result they suggested that understanding might be spread through work-based CPD programs focused on managing change and changing practice backed up by exchanging examples of practice through a national collaborative network of professional networks.

Annex 1: References

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Annex 2: Questions put to focus groups

The following questions were put to the focus groups:

Q1) What, in the views of practitioners, are the characteristics of effective technology-based tools and digital resources? You may wish to specify for whom and in what circumstances.

Q2) What, in the views of practitioners, are the characteristics of effective non-digital tools and resources?

Q3) How do these tools and resources (from Q1 and Q2) help practitioners to do specific tasks well? (For example supporting personalised learning delivering excellent teaching, reporting and communicating effectively with learners and families, supporting and assessing student learning).

Q4) Where do practitioners go to access tools for learning and teaching?

Q5) What are the key challenges faced by practitioners? Are there specific processes relating to these challenges? Are there currently digital solutions to these challenges, and if so:

Q5a) What are their characteristics?

Q5b) Where and when are they used, during which processes?

Q5c) If these solutions do not exist, could they be created? What would their characteristics be, and how and when would they be used?"

Annex 3: Tools under discussion on the main forums used by teachers – recorded during February and March 2009 – from an analysis by John Cuthell.

Professional groupings and communities of practice can form a key resource for disseminating best practice and supporting classroom practitioners. Themes from debates in three of these – MirandaNet, Naace, the ICT Research Network– are listed below. For some teachers this interchange is a major source of information and advice. Regular themes over the period February to March 2009 have been:

creativity
critical thinking skills
e-portfolios
e-Safety
exposure to ICT and screen time
Google Docs
handheld devices
keyboarding
ICT in BSF
internet safety
internet search techniques
IWB use – or not
learning platforms/VLEs
Maths & Science resources for Gifted and Talented,
MirandaMod unconferences,
mobile learning
open source software in schools/colleges,
primary curriculum review
research evidence on the uses of IWBs,
safer internet use
social networks
touch typing
the role of ICT
using Second Life for teaching and learning
uses of Twitter, Microblogging and IM
video games and computer games for learning
visual learning
What are your kids learning while you're not looking?
What computer should I buy?
wireless networking
YouTube and its variants