


Education Departments' Superhighways Initiative

Group D: Home–School Links

Final Report

Lancaster University Evaluation Group

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Evaluation methods

1. The evaluation reported throughout this group has been based upon evidence collected in a range of ways from a number of sources:

    - direct observations during site and school visits
    - discussions and interviews with project managers, school managers, teachers, pupils and parents
    - documentary evidence and materials provided by project managers and schools
    - analysis of ranges of pupil work
    - data collection from monitoring systems within some projects
    - data collection from questionnaires widely distributed to teachers, pupils and parents.

    It should be noted that, where evidence is given from questionnaire returns, the number responding (for example 13 out of 23) indicates the number of positive responses from the total number of returned questionnaires. Blank responses are not included.

Evaluation team

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Section 3

Cross-Project Observations and Recommendations

OVERVIEW

Implications for the professional development and training of teachers and others

1. In developments involving uses and applications of communication technologies, adequate professional development and training of teachers and others is vital. The provision of communication technologies to schools could be in danger of falling into the same or similar pitfalls to those that befell the earliest introduction of computers into schools in the early 1980s. At that time, the computer technology was neither supported by sufficient software nor by sufficient support personnel, and computer use was initially extremely limited as a result.

2. Many different individuals are involved in successful projects of this nature. Whilst there are certain contextual or background requirements that ensure successful developments, the implications for professional development and training are particular; they are both wide and deep. It is notable that all projects that have been evaluated in this group, where there have been successful outcomes demonstrated, have involved many staff, and have created demands and needs for different staff in different areas.

3. The future of communication technology use and practice in schools will imply potential changes for all professionals who are involved in education or schools in any way: for those responsible for architecture and building of new and modified schools and classrooms; for governors who consider strategic decisions for future developments; for parents who wish to support their children in particular or positive ways via communication technologies; for managers and senior management in making decisions with regard to delivery; for those with financial responsibilities; for those with responsibilities for advice and guidance on curriculum matters; for those with responsibilities for inspection; and for all those who teach, in each of their respective subject or phase areas.

4. Appropriate levels and types of support and training will be required in all schools for projects of these types. Indeed, past experiences would suggest that more support and training will be required for those who are not amongst the few in the lead, as they may not be able to depend upon the same high levels of willingness and involvement, and kudos, as ‘trailblazing’ schools. Indeed, this evaluation has shown that some schools, who might perceive themselves as being on the fringe of projects, may particularly feel concern at a lack of training and support. In such cases, support may well be needed as a significant boost to morale and kudos if a direct project development involvement is absent. The effectiveness of uses of Information and Communication Technologies (ICT) will undoubtedly depend upon appropriate professional development targeted at particular groups and which addresses key needs and issues. The four groups likely to need particular professional development are:

- managers
- co-ordinators
- teachers
- those involved in providing INSET.

5. Particular development and training will, in part, arise from the nature of the information becoming available via communication technologies. The use of communication technologies is leading to opportunities for pupils to handle newly found knowledge that is not recognisable by teachers as 'corporate knowledge' of the school. The operational and conceptual handling of such new 'non-corporate knowledge' implies staff development needs at all levels of teaching and learning, including that for school, library, classroom and curriculum management.

6. Not only will the information need to be appropriately handled, but also the shifts in the perceived ownership of information. Some teachers are reporting that resources such as magazines, available in school libraries, normally but previously not used, are used more when Internet access is available. While this could be due to a side-effect of the novelty of the medium, some pupils appear to gain significant motivation from their finding 'new information'. This increased ownership of information appears to arise when pupils are able to explore and identify material that is considered to be outside the corporate knowledge base of the institution. For teachers and schools in the future, such enjoyment and motivation could well provide barriers or problems or both. Internet facilities enable pupils to add elements of corporate knowledge to an institution. While in the past institutions have been used to providing the corporate knowledge that pupils are presented with, the future use of such resources will mean that the management of developing an evolving corporate knowledge will need to be addressed.

Future development of initial teacher training and continuing professional development

7. Appropriate forms of staff development both for pre-service and in-service teachers will be required if the use of resources via communication technologies are to be implemented in classroom practice. Staff development will be required in terms of:

- appropriate training in the operation of the technologies
- appropriate training in the pedagogic use and application of the resources
- appropriate time and opportunity to try out new developments within the classroom.

8. There will be a clear need for professional development in the areas of pedagogy and of pedagogic interaction, to support teachers in the development of successful ways to handle the integration of these 'new' resources, rather than handling them by substitution for others. This is particularly pertinent since the material currently available on the Internet falls into three main categories, and these are not clearly differentiated for ease of access by users: business and marketing material; academic material (usually higher-education related); and social material (sometimes of a chat-type, sometimes project related, and sometimes with specific topic or subject content). It may well be that the non-primary and secondary educational origins of the content of much material currently available may lead teachers initially to question whether the value of Internet resources is potentially useful. It is sometimes felt, paradoxically, by some teachers that there is an excess of material available. It requires skills to be developed in recognising routes and selecting

useful material, even before finding ways to successfully integrate material into appropriate pedagogical situations.

9. Integrated approaches rather than 'bolt-on' ones need to be developed. Evidence from this evaluation suggests that teachers who perceive communication technology resources as additional data to be considered alongside and with other data, so that it is compared, contrasted, analysed and an understanding developed of how such data are represented alongside others, have enabled attainment and achievement for pupils to be developed and enhanced. Where resources are used in 'divorced' or 'bolt-on' ways, gains are less, or just not identifiable.

10. Ways of using resources will need to be recognised and balanced. Teachers who are 'users' of resources are concerned with how to balance a 'browsing' use against 'focused' use; 'browsing' is considered by teachers to be an activity that has to be limited, unless it is within the pupil's 'own time', including homework time.

11. Ways to manage pupil access will need to be devised. There are needs for teachers to develop a range of alternative ways in which to provide access for pupils to data offered via the Internet. Rather than using the Internet on screen, it is possible for teachers, for example, to download material for use, as an alternative to always accessing material directly on-line.

    In terms of the professional development needs for teachers, key issues can be categorised into four areas: preparing for use in lessons, classroom management issues, pedagogical considerations, and external liaison and links.

12. Key issues for teachers in preparing for use in lessons will be:

    - the need to prioritise time for review of materials prior to use
    - the need to evaluate the relevance and use of resources
    - considering the language level of resources
    - identifying crucial features and phrases in resources used
    - identifying real and up-to-date data
    - downloading resources in advance, where necessary or appropriate
    - considering how to support empowerment of pupils.

13. Key issues for classroom management will be:

    - understanding the implications of being able to work in a variety of different working locations, for the pupil as well as the teacher
    - understanding the implications of being able to work at a variety of different times, again for the pupil as well as the teacher
    - considering appropriate ways to structure a lesson or activity
    - considering the ways to support working groups of different sizes, from individuals to a large class
    - considering involvement of both browsing and focused use of resources.

14. Key issues for pedagogical consideration will be:

- preparation of pupils before use of resources such as broadcast programmes
- alerting pupils to focus upon particular elements as appropriate
- considering the role of different intervention mechanisms within lessons, such as discussion, watching and observation, or direct intervention
- care in the use of worksheets in activities
- considering how to integrate ICT resources into learning experiences to encourage evaluation, analysis and synthesis of ideas as outcomes
- defining the skills required for learning, and expected learning outcomes from activities
- sharing assessment criteria applied to particular activities with pupils
- developing pupil skills for skimming and scanning texts
- the means to support pupils in searching for their own information
- the means to support pupil e-mail enquiries, for example to experts
- the role of tutorial and independent learning
- when appropriate, the support of pupils in creating materials with a particular sense of purpose or audience.

15. Other key issues for external liaison and links will be:

- identifying the ways to access resources required
- liaison with support staff, such as those involved in finding appropriate sites for use
- developing appropriate working practices with parents and homes.

16. In terms of the professional development needs for those providing INSET, key issues concerned with the development of appropriate practice cover three main areas: reflection and review through existing practice, development of operational techniques, and management practice.

17. Key issues for developing reflection and review through existing practice will be:

- awareness raising to the potential of the use and outcomes of use of the resources
- consideration of pedagogical and classroom management implications
- using a range of support mechanisms to develop practice, including support videos and drop-in support
- use of appropriate in-school development sharing processes, such as a paired cascade process, for example.

18. Key issues for development of operational techniques will be:

- the operation of a range of software packages, such as word processor, graphics package, e-mail and Internet access software, to enable smooth manipulation of information between such a range
- the operation of authoring packages concerned with the manipulation and integration of text, sound, still imagery and video imagery when creating materials.

19. Key issues for the development of management practice will be:

- identifying and prioritising time to look at resources before use
- the ways of working with pupils to both use and create materials
- what to do when problems arise, and who to contact
- alerting teachers to possible access issues concerned with gender
- the means to monitor appropriate use within the school, but not those occurring necessarily at lesson times
- the need to consider downloading resources in advance of use
- the means to consider a balancing of browsing and focused use
- how to integrate parental involvement and support.

Technical and educational training for users

20. In this evaluation, the training for teachers in the operational use of the systems has been provided in a variety of ways, but through sessions no longer than one day in duration. Training concerned with providing familiarity with systems has been used most widely. Most teachers consider the systems they have used to be user friendly. With the use of support materials via video or communication technologies themselves, and on-hand support in school, teachers have managed to acquire sufficient training to develop further their own practice. However, this has often required a high commitment from the teachers involved, and many teachers have not become engaged in this development at this time. The ability for teachers to be able to develop their understanding and usage through utilising and appropriately mixing a variety of training opportunities was considered by them to be important to their successful training outcomes. Such practices will need to be employed with all potential users, not just with teachers and pupils, but with parents and those who might be involved in support or otherwise in the wider community. Some schools are providing, or considering the provision of, courses for pupils that offer information skills appropriate to the use of communication technologies for educational purposes. Where these exist, the skills tend to be generic learning skills rather than specifically IT related.

21. Approaches to handling the vast quantity of information will be needed. Given the mass of information that can be made available via Internet or iTV, there are currently limited arrangements within schools and homes for processing that information for educational advantage. Part of the training requirement must be to consider what steps can be taken to overcome the potential information overload.

22. A further set of implications face those wishing to author material. If schools wish to author material on a communication system, and if it is envisaged that pupils should be able to access select Web sites for information, and work on the development of interactive magazines with other schools, for example, then there are wide technical and educational training implications. This is of particular significance when certain statements are considered, for example when the

headteacher at one school indicated that he felt that use would depend upon the IT confidence of staff involved, especially when performing certain tasks such as the sending of text. He indicated that he felt that exploration of a communication technology resource would depend upon levels of IT enthusiasm of the staff. Clearly, not all schools are at the stage of use of some schools observed in this evaluation; a proportion are likely to be at the stage of the primary schools observed in the iTV project.

Implications for institutional organisation and administration

Management issues

23. Development of projects of the form within this evaluation will rely heavily upon management sponsorship. The evaluation of these projects has shown clearly that it is essential to have support from school management and senior staff for projects and developments of this nature. Managers in schools need to create time for developments to occur, and for opportunities to arise. Establishing meetings, providing for timetable needs, and supporting and encouraging others are essential components for success. Building working teams and groups, and developing rapport between those internal to the school and those from sponsor organisations or other agencies external to the school, are necessary functions to ensure long-term commitment and development. While the champion of particular uses or developments does not necessarily need to be a person within the senior management team, the messages of value are less likely to emerge from schools if the senior management is either not supportive through open communication, or not enabling the champion to work with others.

24. In terms of the professional development needs for managers, key issues are:

- the reasons for and means to integrate ICT uses across the school
- the provision and allocation of time for development support
- providing and enabling appropriate access and location of resources
- creating teams to work on appropriate shared developments
- the increasing need to work with parents
- the deployment, development and use of library and other support personnel
- the increasing need to work in more diverse locations and at more diverse times.

25. The role and responsibilities of the co-ordinator will be vital to the development of ICT practice within schools. In terms of the professional development needs for co-ordinators, key issues are:

- understanding the role and responsibilities involved
- knowing about a range of possible uses of ICT resources
- appropriate deployment and location of equipment
- the means to develop resources
- being able to develop teams to create Web pages and materials

- identifying appropriately when, where and how IT and information skills are taught, whether it be in PSE, in core lessons, cross-curricular, or outside main school lesson times.

Use of ICT for school management and administration

26. The potential of Information and Communications Technology (ICT) systems to support school management and administration, and wider links, is high. Sharing resources and data between schools has been highlighted as a possibility by a number of schools within the projects. Some schools have indicated the need for this sharing with regard to administrative data, both for management and curriculum purposes. For example, one school would like to place material developed by pupils on the system in order for it to be used for moderation procedures across a number of schools. The results from questionnaires circulated to teachers involved in using the Highdown Information Hub show that teachers are already, after only a few months of active use of that facility, using it at home for lesson planning, making lesson notes, for school and class administration, for keeping records, and, in a small number of cases, for linking school and home records. However, many teachers have reported that such developments involve additional time commitments for them, and that they need to rethink and manage their time in alternative ways.

27. Within the projects in this evaluation group, administrative uses have only just begun to be explored, but some of the hints of the potential can be gathered from those uses that have been explored to a limited extent. Potential user awareness of possibilities is a necessary pre-requisite, but ICT offers education the potential to:

- provide an information resource
- share administrative information, across either an iTV or an Internet system
- provide links and resources within a 'walled' intranet provided by a service provider, just as a Centrex line provides a telephone communication system
- provide reports or forms where responses are completed and returned
- provide administrative links to parents as well as teachers and LEA personnel
- keep all who can connect up-to-date, which could include support personnel, librarians, parents, pupils and the community, as well as teachers and LEA personnel
- share resources between classrooms, particularly where joint planning has occurred or is desirable
- enable documents that are created in one place to be available in another, without their directly being transported
- provide the means to undertake lesson planning, school or class administration, and the linking of home and school records for teachers.

28. Security of information is likely to be a particular concern for management. If intranets are to become available for access outside schools, then security of materials is an issue. Such issues can be tackled from two different angles: relying upon network capabilities; or prioritising security needs of the data itself. Currently, much emphasis has been placed upon security from network-capability standpoints. In essence, however, schools have alternatives to attempting to analyse deeply the

comparative virtues of particular or different network security systems. That is, schools can consider the priority of security of their data. If some data, such as staff records, is considered to be a high security need, then such records can be maintained on a single dedicated computer with no network access. Disk transfer to and from this machine could satisfy any need for mobility of such data.

29. Schools may take the option to become information providers. Some of the schools in this evaluation are likely to become Internet Service Providers (ISPs) in their own right, i.e. the material they offer will be provided as a service to others. The schools where this is the case are clearly concerned with the rights they have over their material, the copyright issues involved, the access that others have to the materials, and the viability of their authoring centre. Schools who wish in the future to encourage home–school links that lead to particular practice are likely to need to consider this form of provision for themselves. Indeed, this evaluation has shown that home–school links where schools are not providers may well lead to pupils being able to undertake homework assignments, but nothing more. Home–school practice, where pupils, teachers and parents inter-relate and communicate, and where support is on the home–school agenda beyond the setting and doing of homework, is likely to require a provision based on an ISP system.

Decisions on location, number and types of workstations and network points, and LANs

30. The creation of an internal school networking infrastructure should be a major concern. Providing a cable connection to the doorway of a school does not ensure that the school can use the connection. It neither ensures that the school can build the internal physical networking required to utilise the resource in the areas where it is needed for appropriate teaching and learning, nor that teachers in the school can gain access to the resources that they find most useful when confronted with huge ranges of unstructured resources or ranges of resources that have been filtered by others.

31. Appropriate access is only likely to arise from appropriate internal networking. For developing the use of facilities such as the iTV, the headteachers at several primary schools felt that ideally there should be access in each classroom and in the hall. Width of access provision, necessary for all curriculum and management areas, was also high on the agenda of secondary schools.

32. Present and future building regulations for schools should require the need for networking infrastructures to be included. The nature of the infrastructure should depend upon its projected use, but it should also look to future viability. Schools need to consider carefully how they wish to use such infrastructures, if they are to gain maximum benefit from any provision they identify. For example, provision might vary depending on whether a school focus is on e-mail, the use of educational resources via the Internet, or on authoring of resources. There are major differences in implications for a school, depending on whether the school chooses to 'use' the resources available via the technologies, or to 'generate' resources for availability via the technologies.

The changing role of the teacher

33. Using resources via communication technologies potentially shifts pupil–teacher interventions and interactions. Teachers recognise that they need to reflect upon their roles when using resources offered via ICT. The teacher will ultimately be faced with both the potential offered and the challenges raised when pupils are able to undertake more homework independently, and with facilities and resources that are not necessarily 'corporate' or 'known'. Within the classrooms observed during this evaluation, the use of resources via communication technologies is leading

already to more project-based approaches. Teachers are planning uses over more than single lessons, but are not indicating undue concern that links cannot be maintained over these periods. Not only are uses leading, in instances where successful outcomes are identified, to more planned differentiation and individual learning for pupils, but teachers are using project-based approaches to match the differing skills that pupils have, so that transfer of abilities between pupils becomes as important as that between teacher and pupil. Teachers are managing classroom interventions and interactions to far greater extents, and their attentions are being focused for longer time periods upon that management than they are upon their delivery of subject content. Teachers often handle intervention at a greater distance. There is a greater perceived distance of learning interaction occurring, because the technology is playing a crucial role within that interaction, and the teacher link can become that bit more distant than it was previously. Even so, teachers observed in this evaluation have not felt 'redundant'. Indeed, their commitment has been high, and their interest has been maintained by their recognising that they are acquiring and using a new range of skills in managing the interactions taking place. Interestingly, the stimulus that activities have provided for many teachers has been twofold: that provided by spontaneity and diversity of involvement and interest; and that provided as a challenge when those teachers have recognised the need to find out how they can utilise the resources in ways that enable others to be as much, if not more, 'up-to-date' than they are.

The developing roles of parents

34. Where parents have become involved in active and purposeful school links, this has been due to their desire to:

- increase communications between school, home, business and other social areas
- access resources via the Internet and other domains for themselves as well as for their children
- enable children to continue to work at home on school tasks
- enable access to up-to-date and wider resource materials
- increase their own and their children's capability with using computer and communication technologies
- increase their contacts with teachers, other parents, and other pupils.

35. Where home–school links have been successfully developed within projects, this has been due to:

- involvement of parents in active ways within the whole development process
- encouraging parents to undertake development functions from which they will be ultimately benefiting
- considering the reasons why parents would want to support home–school links
- recognition of the opportunities that the technology can provide through active use of links.

36. Where parents are beginning to explore the potential of their increased involvement with educational provision and support for their children, they are finding that their roles are demanding them to become:

- more active in terms of developing resources or their access
- more active in terms of educational interactions with their children
- more committed to understanding current education and learning needs
- more involved at social and personal levels with their children and others.

Access issues

37. Access is a clear requirement if any use of facilities is to occur. Within this evaluation, there has been no evidence to indicate that any particular individuals or groups, including ethnic minorities or those with special educational needs, have not been able to access resources through operation of the equipment. In all cases observed, opportunity for all has been available, and levels of potential access have been high.

Learners at home or in the workplace

38. Resources made available via communication technologies enable pupils to work on materials at home, and enable parents to support their children in this use. Early findings of outcomes arising from home–school link developments suggest that the potential outcomes for further developments of this nature could be significant. However, as evidence is identified only from the earliest of uses, it is suggested that continued observation will be required to monitor continued effects and outcomes.

39. If the school–home interface with on-line resources is to do more than TV and video have done, then much more focused material and methodology will be needed. A great deal of effort will also be needed on the part of schools to create a climate and culture of appropriate provision and use. One of the projects in this evaluation has built in considerable measures to support and develop appropriate parental involvement in home–school practice.

40. Parents require resource 'information' that supports their abilities to understand how material will be used as well as knowing what its content might be. Parental misperceptions of on-line resources being worksheets or on-line books for reading will require appropriate means to develop their understanding of the nature of the provision being developed and offered.

41. The concept of homework is not a new one. For many generations, pupils have been taking work set in school back to the home for completion. Pupils can continue to do that, but communication technologies offer them advantages in a number of respects, including those concerned with resource access and ranges of materials available. Pupils are increasingly, however, identifying alternatives when completing homework. Teachers are beginning to recognise that they are likely to meet the unexpected when presented with completed homework. Some pupils have always been conscientious; communication technologies will enable such conscientiousness to continue. Some pupils may be encouraged to work to higher standards. While there are currently no reports from schools in this evaluation of pupils 'over-working', it is a possibility to which teachers and parents should be alerted. Many parents see communication technologies as a potential to support their children when they are not considered to be working enough, but parents should beware of the dangers that could result if pupils become 'hooked' into the use of communication technology systems. Certainly, those parents who are able to become involved in supporting their children through communication technology uses may well have advantages that other parents may not have. In essence, educational support from the school is being made available in the home for those who may choose to take it. Such potential social inequalities may well need to be

considered further, so that support for those who are disadvantaged might be tackled in appropriate ways. Schools have as much a potential role to play in this as do libraries or community centres.

Physical organisation of groups of learners

42. Organised resource areas can offer a range of different alternative forms of access. Access by pupils in these projects has ranged from whole classes, where pupils have individual access to a computer station, through those where pupils work in groups of perhaps three or four, to where groups of pupils work with one group using the computer access available while others are engaged in non-computer-based activities. Sometimes, there is access for individual pupils in schools, either during individual study time or where single individuals access resources as required during lessons, as well as for individual pupils working at home. Currently, most access in schools is provided in locations such as library and resource areas. Increasingly, however, access is being considered on a subject or yeargroup basis.

Measures taken to monitor and protect pupils and other users from exposure to undesirable applications

43. Some schools and homes are encountering situations where pupils are accessing undesirable material, particularly pornography. Some measures have been taken to counter these. Addressing the problem through appropriate management of the situation is a particularly important need for schools. One school has told pupils that they use RM Auditor to monitor the sites which children access, though in fact the school does not undertake this monitoring. Pupils are generally conscious of the need to use the resource appropriately. However, when improper use is observed, it leads to access being taken away from those pupils. The deterrent is generally effective. It is reported that pupils returning to the system use it appropriately afterwards. Some pupils find what they consider to be pornographic or offensive material without searching directly for it. About one-fifth of 539 pupils reported via a questionnaire that they had found what they considered to be offensive material on the Internet. In one school 'prefects of the Internet' have been used to monitor access and to identify problems with offensive material. Filtered ISPs have been available for some schools, particularly that provided by RM, but access available through cable-company provision is not filtered. 'Contracts' for pupil use are being considered or used in some schools. In such contracts, the pupil and parents agree to accept the conditions of access laid down by the school. If these conditions are violated, access will be denied in school.

44. Where homes are concerned, parents are reporting that they have found a need in some circumstances to take measures to protect their children from undesirable or offensive material. In general, two courses of action are taken: local monitoring and observation of use at times when parents offer access; and use of on-line filtering devices such as Cyber Patrol and Net Nanny.

Technical issues

External connectivity and interoperability with other networks

45. Base access technologies enable users to gain access to resources via four forms of communication technologies:

- telephone modems, which are widely used outside the projects in this evaluation group, and are within other evaluation group reports

- cable TV infrastructure, used by the Highdown Information Hub Project and the Superhighways in Education Project
- ATM networks, used by the Acorn Home-School Links Project
- radio communication, used by the College of North East London to form links across its sites and to a remote transmitter site at Middlesex University (see Report B2.5.72–79).

46. Within this evaluation, performance of both cable-network access and iTV access through an ATM system have not led to any identifiable problems that sponsors have not been able or willing to solve. Where problems have occurred, these have been concerned more with delays in connectivity, rather than performance of systems once connections have been completed. The speed that cable systems have offered has not, of course, solved the problems of delays at certain times of day when the number of connections to remote servers is high. During the afternoon, for example, access to the Internet can be as slow through a cable link as through a telephone link.

47. Particular features of each linking technology offer certain advantages. For example, cable modems provide greater speeds of delivery than traditional modems. The ATM system used has demonstrated certain advantages that this networking technology can offer, for example:

- reliable transfer of multimedia, video, audio and graphical data
- the ability to transfer synchronised video with other data forms
- rapid connection to a variety of information sources.

Schools need to be fully aware of the advantages and disadvantages of each linking technology, and the range of future implications, if they are also to understand commercial pressures in this area.

48. A number of specific technological issues have arisen during the evaluation that appear to warrant particular attention for the future:

- future interoperability may well be dependent upon developments of agreements on standards in a range of areas
- schools could become 'locked in' to proprietary, non-standard systems
- considerations need to be made with regard to security of accessible material, both that authored by the schools, and that being accessed
- the encoding and storage services for multimedia provision may require particular conditions and levels of investment, such as more expensive computers
- it cannot be assumed that future access to material will be automatic or free
- expertise in courseware production is limited currently to particular skills and interests developed by certain individuals.

49. Schools will need to consider whether commercial providers offering networking provision are likely to tie them into particular hardware and software that will not provide a desirable or necessary openness and interoperability. In the past, examples of this were the specific networking solutions offered by DEC (DECNET)

and IBM (SNA), which were closed systems. While most organisations and companies recognise the need for open solutions, when standards are not yet finalised or do not exist, there is the possibility that some providers may develop a 'unique' solution. Industry-led standards forums such as the Asynchronous Transfer Mode (ATM) Forum and Digital Audio-Visual Interoperability Council (DAVIC) are significant to this discussion.

50. Issues of interoperability between what are currently resource and physical intranets need to be considered as a matter of urgency. There should be a focus upon project developments that enable this issue to be examined. Some industrial project personnel are convinced currently that adherence to Internet standards will be sufficient; however, for schools accessing systems this case does not appear to have been fully tested.

Interfaces and connection services

51. Interfaces that are generally available and used within the projects in this evaluation have been based upon menu-choice systems. A menu-choice system is only useful if the user understands what the menu is offering, and where it might lead. In cases such as the iTV system, where a range of programmes is accessible, teachers want quickly to identify the desired item to play. Therefore, a key-word entry system or a listing of programmes, internally or externally available, would be likely to aid this process. Computer-based access systems rely upon a mixture of visual and textual information. While 'click-on' screens provide ready access, some less confident users find that they are confronted on subsequent screens with different choice systems where the clicking may need to be done in different places, or the arrangement is different. A virtual 'invisible' interface means that the user would have a single system through which to move when searching and selecting. Voice activation for such a system would be likely to be a means by which most users would be able to navigate readily. In particular, the ideas of those who experience greater problems with the interfaces should be considered fully.

52. The development of a virtual 'invisible' interface is a vital need if it is to be desirable for as many people in the future to become users as readily as possible. Support mechanisms via the technologies themselves should be encouraged and developed further; help support via the systems themselves is likely to be a powerful means of training and developing practice, but the mechanisms used to date are still not able to address the needs of all non-users.

User friendliness

53. Teachers judge the use of resources via communication technologies on the basis of:

- reliability of equipment
- amount of resources available
- time involvement required to access and use resources
- costs incurred in gaining access to resources.

54. User friendliness as judged by an existing user, therefore, is likely to be entirely different to that judged by a non-user. The voice and needs of non-users must be heard in future developments if the division between technology users and non-users is not to widen.

Resource management

E-mail messages

55. Use of e-mail in schools has varied considerably. In some cases, e-mail has been used by teachers and pupils to contact specific experts, while in one school e-mail was used by pupils to maintain contact with parents who lived or worked abroad. Examples and levels of use of e-mail in schools are provided from the results of questionnaires returned and completed by parents, pupils and teachers. The proportion of pupils using e-mail in schools where they are not directly involved in home–school projects is in the order of one-third to one-quarter. Where parents, teachers and pupils are involved in specific home–school projects, the proportion is some two-thirds or more. This suggests that both access and purpose are required if this facility is to be utilised fully. The number of messages sent by those involved in a specific project is also proportionately higher than those who are not involved. Again, purpose as well as access are suggested as parallel needs.

56. The patterns of times when e-mail messages are sent by pupils, parents and teachers show distinct differences. Pupils send messages mostly during school time, after school, and in the evening. Parents send messages mostly in the evening, while teachers send messages throughout the day, when at home and at school. As might be expected, this is likely to be dependent upon access opportunity and access purpose. Frequencies of sending messages, however, appear to be linked more at this time to age category. Parents and teachers show polarised patterns with regard to use; either they report low usage of e-mail or high usage. Pupils, on the other hand, whether within a project or not, display similar usage patterns, which tend to be about once a week or at more frequent levels. Problems encountered with connections via e-mail are not uncommon. About equal numbers of parents and teachers in one school where home–school use is being developed reported problems with connection compared with those who reported no problems with connection. Parents generally judge the use of e-mail to be at least ‘useful’.

Future directions for suppliers

57. The resources used within this evaluation have been of two types: broadcast TV and radio programmes on demand, which run in a set sequential way; and resources via the Internet and CD-ROMs, which can be manipulated in a range of ways. In the case of radio and TV broadcasts, the evidence suggests that there needs to be both a larger critical mass than has been made available so far in these projects, and that the resources need to be chosen by teachers and applied much more specifically to curriculum uses within any one school term. In the case of resources via the Internet, teachers in a number of schools have found sufficient resources to be able to use them effectively. However, other teachers report limited resource availability via this medium. One factor that seems crucial to success is the ability of teachers to recognise the use of resources in integration with other school resources, rather than perceiving resources via the Internet as being an end in themselves, or a replacement for existing alternatives. Developing further masses of on-line books and worksheets alone is not evidenced from this evaluation as being likely to lead necessarily to useful or usable resources.

58. Judgement about the usability of resources needs to be considered at three levels:

I. its presence, or existence, i.e. whether or not it exists, and where it exists, for example the IFL pages list resources available

II. its use by others; where material does exist how useful it has been judged when used by ‘users’ rather than ‘generators’, as this is likely to be a measure of potential generalisability of application

III. outcomes from use by others; where material is used by others, it is the outcomes of use, rather than the use itself, that are likely to provide the most valuable ideas of usability, and might point towards some specific limitations for use, such as level of language used.

In terms of the projects within this evaluation group, the established resources that have been shown to be particularly usable are Internet sites accessed for information, and e-mail. Those technologies that have been usable in certain circumstances are remote CD-ROMs, and Internet pages and sites created by the schools themselves. A technology that exists, but which has not been tried beyond an experimental stage, is iTV.

Gaps in the range of products supplied

59. Some resources, both via iTV and the Internet, have been identified by teachers as being particularly useful. But many teachers have identified gaps in provision. The point made by a number of teachers that they would welcome more involvement in selection and provision of materials available is likely to be significant in terms of future working practices. Providing an increase in knowledge-based resources alone will not be in itself sufficient to ensure use. Products in the future will also have to be tied with adequate support and infrastructure, either in a phased way, or provided at the same time.

60. Where video and programmes on demand are concerned, there is a need to offer teachers training in how best to use such educational material to support learning. This is true both for initial teacher training as well as in continuing professional development of teachers. There is very limited consideration given to the use of video-based resources within development programmes, and the potential access that could be developed in future should be matched by provision of training on how to approach teaching with these materials. Suppliers may well feel that they are not in a position to offer this kind of training, but the technological provision of access that suppliers enable would suggest that their working with professional education development organisations would be productive.

61. With regard to iTV, some primary schools would not be willing to move into a wider iTV trial unless BBC and Channel 4 programmes were much more widely available. In this case, the trial would get the support of every member of staff in those schools. Providers might explore the mutual benefits of transmitting programmes from any network to match the curriculum plans of schools. The access to the Internet is not considered by teachers in those schools to be an incentive to use the system, as access can be gained in other ways. Some headteachers and teachers in primary schools have indicated the range of products via iTV that they would like to see available, including film clips and reviews of films; series such as the *Railway Children*; advertisements for evaluation; *Tomorrow's World*; *Newsround*; General Election coverage; programmes to cover cross-curricular areas such as multicultural issues; programmes from other countries; international linking with other schools; the sharing of text; writing for an audience; the sharing of surveys; ready access to CD-ROMs; and a bulletin board.

62. Remote CD access and use has been shown by these projects to work technically, and potentially educationally, but licensing and copyright issues remain problems, particularly if access is to be made available through a school intranet to homes. In these circumstances, the question of whether a site license is sufficient will need to be considered. Copyright is a major issue for authors of materials to consider. Both access to material and the ongoing creation of content raise issues of copyright. Those who access, use or create materials in any way must in the future be clearly informed about copyright.

63. One project in this evaluation has demonstrated that the linking of Internet and VOD is possible, where an HTML link opens a video window that can run a selected portion of a video accessed through a VOD system, for example part of yesterday's news. This form of material might be utilised in two ways in education: using resources that are ready-made, like current Web pages; and the creation of materials specifically designed to meet particular lesson or topic needs. The question of who should prepare such materials is only likely to be valid if the issue of time can be resolved. Existing pages of this type can be accessed and used in similar ways to existing Web pages, where teachers or others have the time to search and select those that are usable; but pages could be developed by teachers and pupils as required if the time to do so were available.

Implications for roll-out models

64. Given the nature of resources available and developed in each project included in this evaluation, the range of projects offers three different models for the development of school use, and for the development of home–school and community links. With regard to school use, two significant elements that lead to successful practice are strategic involvement of senior managers in providing access, time and opportunity; and tactical implementation by teachers in considering useful ways to integrate resources into required curriculum practice.

65. In only one project has there been a development in involving parents and the wider community in a planned and managed way. In this project, the expectations and enthusiasm of self-selected parents for involvement are high. Parents have been willing to be involved actively in development rather than being passive recipients of a service.

66. Those approaching projects or initiatives of this type should consider the concepts of 'lead' and 'follow' schools. Some schools feel the need to be ahead, and to be creative in terms of their involvement and initiative. Other schools are content to fulfil requirements laid down for them and do not see their role as being concerned necessarily with taking the initiative for leading development. The proportions of these two types of schools are likely to determine the way in which particular initiatives develop. A 'follower' school should not be expected to inject 'creative energy for inclusion of new development', unless that is a clearly defined part of the initiative itself, which implies both cost and time needs.

67. A consideration of a roll-out model for an authoring centre needs to take particular areas into account, such as the availability of expertise. Where schools have been involved in authoring, strong issues of authoring support arise. The issue of the scalability of such developments needs to be considered for any future possible development.

Replicability

68. Schools in this initiative have been fortunate; they have had considerable opportunity for professional development, and have been willing to receive it. More widely, where such opportunities and willingness do not exist, development needs will have to be considered in alternative ways. Exact replication is not always possible because opportunity, kudos and willingness are not necessarily ingredients in schools that become involved in the second, third or fourth wave, and may not exist to the same extent and in the same ways as they do for schools in the first wave. Outcomes of previous developments in education have all pointed to the need to increase professional and staff development in parts of a project that occur behind the first phase. Whilst the experiences of schools and teachers will be valuable to any next phase, there is no evidence from these projects that professional and staff development can be addressed in any less a way than it should have been in the

past, to ensure that the opportunities for wider national initiatives could be integrated and fully embedded in practice.

69. Replicability will depend upon time availability. Schools must both gain and provide time for implementing developments, training, authoring and identifying resources. If the use of resources available via communication systems requires teacher, pupil and parent 'users' to be 'autonomous' learners, then it is important that these groups are enabled to work in ways such that they can work independently and purposefully. They must be able to recognise that their use of ICT is legitimated by others, by teachers or parents, but also know that their use is meeting either a personal, a local, or a national requirement or need.

70. Replicability depends upon how resources are used or authored. Within this evaluation, two of the schools within the Superhighways in Education Project have provided models that appear to be replicable for schools wishing to use existing resources, and the Highdown Information Hub provides a model for developing the early stages of a learning community development. In essence:

- Depending on the cost of the connection and STB, iTV is a relatively inexpensive model for providing widely distributed access. However, it is in its trial stages and will rely upon involvement with local companies since it is unlikely to become available easily on a national basis, although recent developments with satellite TV companies providing Internet access should be carefully monitored for the future. Staff training will be vital if the use of iTV is to do anything more effective than video and TV do currently.

- The Superhighways in Education Project is completely replicable if an ISP chooses to offer CD-ROMs. However, the licensing problems will need to be resolved.

- The Highdown Information Hub Project is replicable, but the demands upon the one school becoming the Hub are high. Time needs and resource costs involved are high, which makes this model an expensive one, at least in the initial stages.

Future directions for the education service

71. Paradoxically, issues that are likely to benefit from national decision-making are likely to create greater diversity. This evaluation is highlighting some issues that suggest that there are major implications for all concerned with regard to future and further developments. For education, such issues are not likely to be able to be handled effectively on a school-by-school basis. However, what is also clear is that schools in the future will be able to create opportunities using communication technologies in ways to suit their local needs. This is likely to create a diversity across schools, which will create challenges for national guidance and policy.

72. The management of teaching in the future will not only need to take on board relevant pedagogical needs, but also appropriate management of time, when teachers are potentially committed to providing a service from 8.00 a.m. to 8.00 p.m., up to 7 days per week. Clearly, this will involve teachers in practices that do not conform to regular or standard terms and conditions of service.

73. The management of learning will need to concern cognitive and metacognitive demands placed in creating appropriate pupil interactions, but will also need to consider realistically how time involvement by pupils is related to achievements. The fact that pupils are able to learn at different times and in different places will not necessarily mean that they are able to achieve more. Indeed, rather than increased

hours on task leading to improved attainment, some evidence in this evaluation suggests that increased attainment arises from using the increased potential of the resources in more effective ways.

74. The management of education will need to take on board the potential shifts that are implied with regard to the status of education, and the emphasis that can be placed upon it in terms of time. Having the facility to gain educational provision at different times and in different places puts an enhanced emphasis and priority upon education for society. Whilst this in itself is not necessarily a bad thing, education has been in balance in the past, as one of a number of societal domains. A new emphasis or priority would mean that new ways of handling and conceptualising such a priority would be needed. For example, the concept of using increased time for educational activity might be falsely or unrealistically linked to the notion of it being possible to gain increased outcomes or attainments as a result.

75. At a school level, implications for the future will depend on:

- the extent to which schools will want to individualise integrated resources
- the balance schools require between broadcast and integrated forms of resources
- the amount of resources actually available and usable
- restrictions that may be placed on schools by regulations or by access costs
- the extent to which resources created in one area are accessible or interoperable with another.

76. There are implications for those concerned in creating policy and statutory requirements. The use of resources via communication technologies is not currently supported directly through National Curriculum documentation. Creative approaches of teachers in matching uses to the required curriculum is, therefore, a fundamental factor in determining any successful use. Future curriculum documentation should support such integrated creative approaches.

Creating productive networks at local, national and international levels

77. Productive networks are needed to enable future convergence of technologies. The convergence of technologies through communication networks is a major issue to consider. Future trends and potentials may well determine the usability of what is put in place now. A manager in Microsoft has indicated that ‘as the technologies advance in both areas, there will be a certain amount of convergence, but to exactly what extent and in what ways are currently unclear’.

78. Because the needs of each region or local area may be different, due to specific contexts, authoring or co-ordination centres are likely to be required in each region or area, with perhaps the need for one major centre per region or area; as well as authoring or co-ordination centres for other educational groups, such as independent schools. However, the validation of material authored locally needs careful consideration. If funding were available for such centres, criteria for funding for regional centres or initiatives should perhaps meet ‘learning community’ aims for development.

79. There are alternative ways to create a resource centre. The models that have been available within these projects have shown how two methods might be applied to such developments in future; using a school as a focus for area development, or

using a national company as a focus for development. There are other models that exist across the country but are not the focus of this evaluation. For example, the LEA has provided a focus for development in Cumbria, in the Broadband Project (see Reports B2.6, B2.7 and B2.8) and the GEMISIS Project (see Report B2.3). What is clear from the projects within this evaluation is the need for those developing potential resource centres to consider their human networking on a much wider front than that which might have been considered previously. In the past, an LEA resource centre could legitimately consider its human networking to schools as being the main or only focus of activity; the potential and need for networking to parents and the community should be considered as a matter of routine in future. Schools and LEAs developing intranets should consider the parental and community network as a routine element within the total human network to be developed if the full and final potential of such a network is to be realised.

80. Provision of access to resources for all of those in society or for communities will need to be considered both nationally and locally. Affordability of resources for parents is an important issue for providers to consider. Some parents may well be offered hardware that only a few can afford. There is a likelihood of creating classrooms and societies that are divided into 'information haves' and 'have-nots'. Clearly, the role of libraries and community-access centres is significant within this area of need. Schools can also take a lead in such situations. However, providing such centres will neither ensure use, nor should it be seen as an abdication of necessary responsibility to lead developed use. If the set-top box concept was expanded, this might offer an inexpensive alternative for homes. However, it would depend upon homes being able to use the access in appropriate ways, which may well involve specific training, and the involvement of one or two local schools in being authoring centres for local needs.

Teaching and learning issues

81. Currently, the use of on-line resources is often within an environment in schools that is socially mediated by the teacher. Within this evaluation, there has been no evidence of how resources are used 'remotely', except those within connected home or homework situations.

82. The resources that have been available via the communications technologies in this evaluation would suggest that teaching and learning benefits from the use of:

- Internet-based resources in a wide range of subject and topic areas
- e-mail in a range of subject areas
- to a lesser extent, broadcast programmes, which could be developed if the scheduling or access were able to be considered.

83. Self-authored materials provide certain potential benefits and outcomes for the author. The impact of self-authored materials is uncertain at this time. There is much evidence of access to such resources, but little or no evidence of their use. However, the ability to restructure resources to suit the topic, subject and learning intentions has been a major factor where successful outcomes have been observed.

The potential value of electronic communication

84. Educational benefits of resources available in the projects in this evaluation have been identified in a number of instances. Resources available have been shown to provide:

- up-to-date information in ways that other sources cannot match

- material that is not available in other ways or forms
- background reading and 'books that the school does not have'
- material to supplement a range of language areas
- additional or alternative viewpoints in political or sociological contexts.

85. Teachers are reporting that pupils using Internet facilities are gaining in a number of ways, including:

- stimulation for an interest in a subject
- becoming conversant with e-mail, network and computer use
- furthering their research skills, reading skills and skimming skills to identify particular vocabulary
- developing fast selecting and sifting skills.

86. Early outcomes of experiences of use by parents involved in home–school developments have indicated that they have recognised that they have been supported in:

- enhanced relationships with their children
- enhanced contact with teachers, other parents, and pupils
- increased access to wider and up-to-date resources
- increased understanding of IT and its use within the educational provision for their children.

87. The social uses of the technologies, and the social contexts in which technologies have been used within these projects, have been demonstrated. Even when educational use and outcomes are considered as priorities by teachers, resources and facilities have often covered social domains. For example:

- e-mail enables social interaction between individuals
- video conferencing enables similar social interaction, but in face-to-face situations that enable pupils connected to different geographical areas or to actors role-playing in different time periods, to be relayed as though they were in the same geographical or time area as the observer
- subject area uses can include topics of social interest, such as weather in geography, or aboriginal traditions and customs in English
- subject or topic areas that are based in a social arena, such as health or crime.

88. The use of resources within classrooms and schools is being seen as leading to potentially significant shifts in the ways that pupils and teachers perceive the 'ownership of knowledge'. It is recognised that pupils increasingly 'enjoy the hunt' for knowledge, and that they are often able as a result to add to the corporate knowledge base of the school. This has clear implications for the role of knowledge as well as that of teachers and pupils in the future.

89. Authoring is a more complex activity, but results are often more interactive and of higher quality than those resulting from access-use alone. The results may be dependent upon individual enthusiasts. The production of self-produced materials may be expensive, but the use of the materials beyond the value for the author is not yet clear.

Implications for pupils with special educational needs

90. Communication technologies have been used with some pupils with special educational needs in schools involved in this evaluation. Some schools are also considering the ways in which communication technologies could support pupils with particular educational needs. For the purposes of considering the potential of communication technologies in supporting pupils with special educational needs, four categories can be separately considered:

- Pupils with medical or physical problems, including sensory impairments, often have limited educational provision available because of the circumstances in which they find themselves. Educational provision for this group of pupils needs to deliver a programme of appropriate material. At least one school in this evaluation is considering how communication technologies could enable the delivery of such programmes at a distance.

- Pupils who are isolated by behavioural or social circumstances may require either a programme of study or material to stimulate their interests. At least one school in this evaluation is using communication technologies to support parents where motivational levels of pupils is considered low.

- Pupils have individual educational needs when they wish to pursue particular interests, review certain topics, or revise particular subjects. Some pupils also have specific learning difficulties. The forms of resources within this evaluation have been shown to provide for such needs, and the development of further resources is likely to further support pupils in these circumstances.

- Pupils who are attaining at levels lower than expected for their age have not been a specific focus in projects within this evaluation, but teachers who support pupils with special educational needs in some schools have indicated their interests in using this medium to support those pupils.

91. With regard to projects within this evaluation group, pupils with special educational needs have gained from the use of ICT resources in two main ways. Those pupils recognised as able or of average ability have been extended in their learning, by their being able to:

- pursue individual lines of enquiry

- access and understand a range of texts

- evaluate different sources of information and identify those that are useful for particular tasks

- gain different effects through appropriate linguistic, structural and presentational devices

- encounter resources where relevance, up-to-date content and immediacy of impression have engaged educational activity.

92. Those pupils recognised as having particular educational difficulties have been supported in their learning by:

- media that have led to less frustration, in spite of any language difficulties that they might encounter in some materials
- the speed of their learning being tailored to their needs
- encountering material where repetition is provided and readily possible
- being provided with material where key words and phrases are or can be readily highlighted.

Importance of speed

93. Speed of access to resources in communications technologies may lead to a range of positive effects. Teachers have reported that the use of Internet resources is effective in learning because of its 'immediacy'. Clearly, 'immediacy' can be interpreted in a number of ways:

- immediacy of access
- immediacy of relevance
- immediacy of ownership
- immediacy of social value or perception.

If many, or all, of these factors are satisfied, then the information may well be able to be assimilated particularly effectively.

94. Physical speed of networking is an important consideration. The importance of speed has been highlighted by a range of project personnel. The project manager in one school considers that the success of the project has been due in large part to having a cable link rather than a modem link. She also believes that having support personnel available has contributed greatly, for example having an IT technician to support the use of software and to help in finding useful sites. The RM manager with responsibility for the Superhighways in Education Project indicated that he felt that, for materials to be used, there would need to be, in any given situation, access to useful resources; sufficient speed of access; and the potential for the integration of material into the curriculum.

Management issues

95. Management is likely to be very significant in developments of projects similar to those evaluated. Managing projects of this nature to the point where learning outcomes can be measured takes much longer than original timescales suggested, perhaps taking twice the length of time planned or up to five times as much. This may be partly due to the fact that the projects all rely upon negotiated outcomes rather than commissioned targets, but a major limiting factor for all projects in terms of their development has been time availability. Working across organisations adds time, as does installation and set up of equipment, and getting it to work reliably takes longer! In some projects, such time constraints have limited resource creation, and in others it has reduced the searching for usable and suitable resources.

96. Projects such as these have diverse communication and management needs at a range of levels, including:

- company–school

- school–school
- school–parents
- within school.

97. Management may have to deal both with enthusiasm and disillusionment. Many teachers are enthusiastic about projects of this type; they want to try out the use of 'new' resources via communication technologies. However, within a climate where enthusiasm is generated, disillusionment can easily occur for a variety of reasons:

- misunderstanding of intentions
- technical problems, particularly regarding connectivity
- support problems, even with using what might be considered by some to be simple hand-held remote IR iTV control devices
- lack of 'information' resources on line that are appropriate or relevant.

98. It is almost a truism that good management of projects can make the difference between success and failure, or more often partial success and partial failure, in achieving objectives. The experience of these projects bears out this statement. Working with companies is not an easy experience for schools. The ethos, work patterns, lines of communication, management and decision-taking structures differ considerably between schools and commercial companies. When schools are working with companies, it is possible for unanticipated perceptions to arise, which can cloud the potential for further development. Company-directed projects can lead to perceptions within a school of a need to develop in a revolutionary way, while school-led projects can lead to perceptions of the need to consider how to develop in an evolutionary way. Clearly, such perceptions have implications upon the ways in which ownership and control of projects are themselves perceived within schools, and this can potentially limit or otherwise affect the extent of the development within the joint project.

99. In particular, schools find it hard to dedicate staff resources to developing new projects, and this is often made up for by enthusiasm and long hours by a dedicated few. Teachers are often unavailable or difficult to get hold of during the day. Even those involved in this kind of project may not have their own e-mail address, let alone a dedicated telephone or fax machine that is easily accessible.

100. Thus, any success in overcoming these formidable obstacles has to be acknowledged as significant. It would appear that, where schools and companies have devised joint communication and management arrangements, progress has been greatest and problems have been overcome most quickly.

101. Success of implementation to date is observed in cases where consideration has been given to the development of three successive networks:

I. a human network, identifying the personnel who should be involved in a range of ways, and ensuring that they are aware and able to contribute

II. a physical network, created in order to fulfil the needs of the human network

III. a resource network, based upon a consideration made of the needs of groups of individuals, and the forms and types of materials that they want on the physical network.

102. Schools involved in authoring resources have a particular set of management problems. Authoring Web pages and interactive material can be straightforward, so

there is a wide scope for many people to be involved. However, it is quite intensive in person hours, and does require appropriate staff training. At early stages, schools authoring resources should perhaps explore a number of points in relation to their potential for management, including:

- What strategy is there for preparing in-house educational material and managing its delivery? What timescale will be involved?
- How will the school-to-school interface be managed to encourage genuine partnerships between schools?
- How will the home–school contacts be managed? Are there mechanisms for monitoring these and drawing up policies to make them more effective?
- How will the relationships with commercial partners be managed, especially as the project progresses? What paths are considered for an 'exit strategy' from the project phase?
- How will individual input to the project be protected? What are the implications for Intellectual Property Rights (IPR) and copyright?

Costs and cost effectiveness

103. Cost implications for schools can be considered under seven main headings:

- school networking infrastructure
- equipment costs
- software costs
- connection costs
- running costs
- maintenance costs
- authoring costs.

104. When considering the implications of cost, schools should compare, under the headings above, the costs incurred by their linking in alternative ways, using either telephone, cable or radio connection, dependent upon their particular local circumstances. Schools should consider whether technology is standard and robust, and whether particular access will be easy to use in their situations, for example the implications of linking technologies most usable in rural areas.

105. Even where cable companies take cables to the door of the school, the evidence from schools suggests that an infrastructure within the school to enable connection to all classrooms and access areas may well imply considerable additional costs. The cost will be dependent upon the school size and building arrangements, perhaps varying between about £20,000 and £100,000. Schools are only likely to benefit if internal networks are well designed and robust, and enable full interoperability and access.

106. Equipment, connection, and running costs are likely to be the area of most interest to schools when they are considering viability for development. Schools look for certainty and price competitiveness, so the recent offer from the Cable Communications Association (CCA) is likely to be of particular interest. Cable and telephone costs will depend upon the bandwidths used, and the charging of that

bandwidth. For cable connections, the CCA has announced connection charges of between £100 to £500 per annum for schools, dependent upon their pupil numbers. A press release from the CCA dated 8 January 1997, and entitled *Cable Industry Internet Offer for Schools: One Price, Unlimited Access* stated that 'an ISDN or equivalent high-speed 64k link will only cost £50 per month. There will also be a tiered fixed price tariff for the standard dial-up device: £100 per annum for schools up to 250 pupils; £250 per annum for schools with 251–500 pupils; £500 per annum for schools with 501+ pupils'. For home users, the connection charge for cable services is £20, with telephone line rental additionally at £7.50 per month, and between £14 and £30 a month for cable services. Customer charges for cable modem products have not yet been defined completely, but it is stated at this time that it is likely to be between £200 and £400. The costs of a simple telephone modem, the annual connection fee, and average telephone call charges are estimated by one company as being around £500 per annum for schools. The cost of computer equipment will depend upon the number of computers required, but is likely to be in the region of £1,000 per machine.

107. Costs for software should be considered carefully; software is essential to access the resources available, and costs for appropriate software packages and upgrades to connect to the Internet and to access text, video and sound material need to be accounted for.

108. Maintenance costs should also include technical support costs, whether this be for a technician on site or for a contracted-out agreement, and resource search costs, where a librarian or support person is involved, should also be taken into account. Costs involved here are likely to be in the region of £15,000 to £20,000 per annum for an IT technician on site, and £15,000 per annum for a resource support person. Maintenance and training are support costs that are hidden. Primary schools in particular will require more technical support if this area of development is to become successfully used in the future, and it is clear that all school budgets will be stretched to provide the necessary amount of training time. Microsoft personnel predict that on-line maintenance will, in the future, reduce some of these costs considerably, as support will be provided by directly accessing systems on line, without the need for site visits. However, this facility is not yet widely available.

109. For those schools who become resource authors as well as resource users, the additional costs will be in both terms of equipment and human resources. If the authoring is that of creating a limited range of home pages, then this can be undertaken on equipment that many schools currently possess, with equipment costing only in the region of £1,000 or £2,000. A sufficiently large server and peripheral equipment to author full multimedia resources, with video, sound and Internet integration, are likely to cost in the region of £25,000, and a resource author or manager, even to run a school pupil team, is likely to cost in the region of £25,000 per annum. Many schools are particularly interested in the area of Web authoring, which is relatively simple to undertake, but needs time both to find usable materials and to prepare new ones. Some schools are using non-teaching staff, such as librarians, to devote time to searching and authoring.

110. Some local areas have already provided access for schools through their own initiatives. For example, Cambridgeshire County Council has installed a Centrex line, a managed telephone service by a carrier where lines go from a customer's premises into a switching system that is owned and run by a provider to their establishments, including schools, with costs for all facilities, including e-mail, being charged at the rate of £10 per month.

111. At this stage, possible costs incurred, and willingness to pay for costs involved, are important factors for future implementation. Many parents who have been users of the Highdown Information Hub have indicated the extent of their willingness to pay

for access and use of systems in the future on questionnaire returns (9 out of 17). Others have stated that they would not be willing to pay (two parents), but a number have indicated their uncertainty (six parents). Most parents would be willing to pay at least £10 per month for access and telephone charges (nine out of 17) but some have indicated a lower rate (four parents), and some a higher rate (four parents). Most parents (12 out of 17) would be interested in a package that offers cable TV, telephone and Internet access (five would not). Many parents have indicated their willingness to pay £15 per month for such a package (seven out of 17), but some would pay more (six parents).

These statistics can be compared with parents from a number of schools, who are users but who have not been involved in a specific project linking home and school practice. Many parents have indicated their willingness at this stage to pay for such a system (five out of 13). Some have indicated that they would not be willing to pay (three parents), and a number have indicated their uncertainty (five parents).

112. In terms of cost benefits, actual benefits have been identified within projects in this evaluation group through the additional value provided by:

- commercial sponsorship and support
- an increase in resources available
- increased use and effectiveness of use of existing resources
- librarians becoming directly involved in educational support, rather than their continuing with a more passive supervisory role
- parental support and involvement
- parental satisfaction and approval.

Cost benefits of networks for administrative communication both within and between institutions, including LEAs

113. Without doubt, in all three projects evaluated, the levels of involvement and commitment have been high, both from companies and sponsors, and from schools involved. While it has been difficult to ascertain or estimate such involvement in cost terms, recognition of these high levels is an indicator of the interest and importance being attached to the developments from both educational and commercial viewpoints. Many cost benefits could accrue over longer periods of time than the projects have currently run. Some of the cost benefits being proposed, but not tested through this evaluation, rely upon the abilities of schools to:

- attract pupils by providing communication technologies that are well developed and used routinely
- maintain contact between parents, teachers and pupils in ways that reduce costs currently incurred
- maintain the delivery of educational provision even when pupils are not in school, supporting higher levels of attainment over those periods of time
- provide delivery of courses to students others than those in the school
- deliver course elements that may not directly exist within schools
- provide course elements with minimal teacher-time involvement

- develop flexible working practices where access to particular requirements can be fitted in, rather than it being dependent upon presence at particular venues at particular times
- use materials on line rather than using more expensive recording and reproduction of video and paper-based materials.

Implications for industry–education partnerships

114. Industry–education partnerships need to be managed. In all of the projects observed, more than one school was involved. However, communication between schools, and management arrangements between schools, were very mixed in their effectiveness. This seemed to arise because, apart from one project, schools had not chosen to work together but had been invited by companies to take part. Arrangements seem to have improved in some cases as projects progressed, but this is clearly an area where common ownership and clear working arrangements discussed at the outset of projects can make a very significant difference. Where companies are involved with schools, exit strategies, where companies are withdrawing or relationships are changing, need to be considered in advance.

115. Positive school involvement allows the school to take an evolutionary approach to development. These projects have adopted different modes of approach with regard to their own developmental integration. The Highdown Information Hub Project has been integrally involved with all aspects of process development, and could be considered to have adopted an evolutionary stance within the development. Integration has evolved as development has progressed. The other projects, being company-led, have required the schools to be 'creative', and therefore to take more revolutionary stances.

116. Many industries are advocating industry–education partnerships. A manager from Microsoft has indicated that the company believes that schools should create partnerships, for example with cable companies, to encourage parental involvement through IT and Internet access. Further, they believe that schools should be 'working with the local LEA to provide services to access community information, and to support other schools and their teachers and parents to benefit from increased collaboration'. In considering a provision, including education, one project consultant stated that education might need to be the core material if other information were to be 'sold' as a service. He indicated that there were no funds available for developing services for education, but that there were funds available for services such as shopping and banking.

117. Partnerships may be the means needed to move forward positively in the future. The evidence from this evaluation indicates that significant outcomes arise when the partnership between public and private sector interests is considered and created in ways that will enable the potential benefits for all parties to emerge.