


Education Departments' Superhighways Initiative

Group S: Curriculum Projects in Scotland

Final Report

Scottish Council for Research in Education

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THE EVALUATION

1. This report describes the findings of an evaluation carried out by the Scottish Council for Research in Education (SCRE) of two Scottish projects included in the four UK Education Departments' Superhighways Initiative (EDSI). The two projects were *Modern communications for teaching and learning in Argyll and Bute* and *Superhighways Teams Across Rural Schools (STARS)*. The evaluation was managed by the Scottish Council for Educational Technology (SCET) for the Scottish Office Education and Industry Department (SOEID), and ran from January 1996 to March 1997.

2. We wish to acknowledge the help and co-operation of a number of people: in particular, the project co-ordinators and all the teachers in Argyll and Bute and in the STARS project who spent a considerable amount of time answering our questions and explaining their uses of electronic communications. We would also like to thank our advisory committee for sharing their expertise and ideas with us.

3. We are grateful to Bob Munro of Strathclyde University, consultant to the project, who provided technical expertise and also undertook some of the fieldwork. We also thank our secretary, Kay Young, for her support and expertise.

Section 3

Cross Project Observations and Recommendations

OVERVIEW

1. In this chapter, we draw conclusions from the evaluation on a wide range of issues relating to the use of electronic communications technology in an educational context. In some areas, the findings from both projects produced similar conclusions. In these cases, the conclusions have been combined. In others, however, the differences between the two projects mean that this has not been possible, and they are listed separately.

   We also make recommendations for the education service, for suppliers and for policy-makers at the end of this chapter.

OBSERVATIONS

Future development of initial teacher training and continuing professional development

2. Effective professional development is crucial to the success of electronic communications initiatives. A basic level of competence is necessary for all staff involved in such initiatives. This includes an understanding of both the principal functions and the educational potential of the main methods of electronic communications, including fax machine, e-mail and electronic conferencing, video communications and the Internet, and a degree of confidence in their use. The principle established by Argyll and Bute that the introduction of the technology should not divide staff into 'experts' and 'technophobes' has helped to ensure that the rights and responsibilities of all staff to basic training have been respected.

3. In the context of the STARS project, technical training delivered electronically has proved to be successful where considerable back-up support is available. It is a particularly convenient method for busy teachers in areas remote from training centres. However, professional development in the use of the technology cannot be delivered entirely by electronic means. Teachers need to discuss new educational ideas and develop approaches collaboratively, and this requires a degree of face-to-face contact and the establishment of social relationships.

4. The evidence of both projects makes it clear that training is best delivered in the context of the curriculum. Teachers are more willing to learn new skills and better able to retain them when they can see how they are to be applied and are convinced of the benefits to pupils. In Argyll and Bute, structures which facilitate staff identification of training needs, as a result of their own explorations of the technology and its application to the curriculum, have ensured that centrally-delivered training is relevant and effective.

5. The evaluators did not have the opportunity of looking at initial teacher education within these two projects. However, it is clear that this needs to play a full part in developing student-teacher skills in this area. As practising teachers become more competent and more confident in the use of electronic communications in the classroom, newly qualified teachers may find themselves at a disadvantage if they have little or no grounding in this area of work. Argyll and Bute's development of links with providers of initial teacher education and further professional development for teachers has the aim of ensuring that providers become more fully aware of the potential of the medium and support curricular development which takes this into account.

Institutional organisation and administration

Issues for schools located in rural areas

6. It is clear that electronic communications have the potential to empower teachers and pupils in rural schools in ways which were previously extremely difficult or impossible to achieve. Many of the schools involved in the two projects were one-teacher schools in remote locations. Teachers in these schools have considerable responsibilities and little opportunity to discuss any aspect of their work with colleagues, particularly in an informal context. Formally too, teachers in remote schools, particularly those on islands or in very isolated areas of the mainland, have considerable problems attending in-service courses and enrolling for higher diplomas or degrees. Electronic communications provide such teachers with the means to contact other teachers in similar circumstances, to share experiences and ideas and to develop collaborative approaches to the curriculum, teaching and learning, and school management. By doing so, they replicate electronically the day-to-day experience of teachers in larger schools, who have the opportunity to discuss ideas and compare notes informally. Only limited attempts have been made in the past to develop collaborative contexts for teachers in isolated rural schools because of the time and travel costs involved. More formal provision for professional development has suffered from similar constraints.

7. Similarly, there is considerable potential for pupils in remote rural schools to benefit from electronic communications. A number of the primary schools involved in the two projects had under 30 pupils in total, between the ages of 5 and 12. This means that individual pupils have few peers in their own age group, and sometimes none at all, as intake is not necessarily even over the years. Electronic communications offer such pupils the opportunity to communicate with other children of similar age and interests, often children whom they will subsequently meet when they transfer to secondary school.

8. Effectively, electronic communications in this context provide a form of enfranchisement for teachers and pupils, providing them with the kind of intellectual stimulus and social contact which those from larger schools take for granted. Teachers in such schools have, in the past, been concerned about their pupils' transfer from small local primary to large, often distant, secondary school, precisely because they are aware that their pupils have had limited opportunities to develop social 'survival' skills and often lack confidence in their intellectual abilities when they have had few opportunities to compare themselves with others. Teachers too can suffer similar effects.

9. However, there is a danger that such potential will not be realised in rural schools, precisely because of their remote location. It is likely that the infrastructure will not be as highly developed in rural Scotland as, for example, in south east England, where the potential user base of services such as cable is many times greater, and some applications are restricted as a result. There are already inequities in different

rural areas in Scotland. For example, Argyll and Bute has been able to install ISDN lines in a substantial number of schools, following the British Telecom roll-out programme, but other areas, including most of those covered by the STARS project, do not have access to ISDN. Similarly, commercial providers of hardware, software, and telephone lines etc. may be less interested in sponsorship in areas where competition for products is not likely to be particularly intense or remunerative. Even in the case of the development of educational applications, it may be that rural schools are not seen as being in the forefront of curriculum innovation, although our evaluation makes clear that this would be an unjustifiable assumption.

10. The small size of most of the schools involved in the projects and the small budgets at their disposal is also potentially problematic. Where an education authority develops a coherent policy to support the development and use of an electronic network, as is the case in Argyll and Bute, a number of these difficulties can be overcome. In the case of the STARS project, however, it is clear that schools which cannot afford additional telephone lines and which are perpetually concerned about the size of the telephone bill will not be able to make full use of electronic communications even when they have the necessary equipment and an established network in which they can participate. If a school makes use of only one computer for school administration and management, development of basic IT and word-processing skills, and electronic communications, this is similarly stretching the resourcefulness of teachers and pupils.

Use of network technologies for school management and administration

11. Electronic communications have proved a particularly cost-effective tool for school management. The co-operative structure adopted by Argyll and Bute has supported this development, and the establishment of 'cluster' type arrangements, which create natural partnerships, is likely to be an effective strategy for other authorities. While electronic management practices such as electronic agenda setting and video conferencing are still regarded as experimental in Argyll and Bute, and are the subject of a separate evaluation by researchers at Strathclyde University, preliminary findings suggest that, where the agenda is carefully planned in advance in order to reduce the costs of video conferencing, this can lead to more efficient management practices and consequently fewer management meetings. Use of the fax and e-mail have also promoted efficiency and cut costs and management time. However, it is clear that all management work involving co-operatives cannot be handled electronically. Face-to-face contact is highly valued among teachers accustomed to working most of the time on their own and will continue to be an essential element in management practice.

12. Administrative networks established by the various LEAs involved in the two projects were not the focus of the evaluation. Argyll and Bute currently operates an administrative network which is not part of Argyll Online and was not included in the evaluation. Some of the LEAs involved in the STARS project also operate administrative networks but these were entirely separate from the project. However, the evaluators are aware that these have been a valuable development, particularly in the context of remote schools.

Location, number and types of workstations and network points

13. Where feasible, it is preferable to locate electronic communications equipment in classrooms in primary schools. To do so supports the notion that such equipment is a tool to be used to support learning when appropriate, rather than something to be used on special occasions. Pupils can use the equipment independently of the teacher without having to ask for permission but also without disappearing from

view. At the same time, some equipment, perhaps particularly video-conferencing units, require a degree of privacy for the user, and also avoidance of disruption to the rest of the class which can be achieved by the use of alcoves or screens. The widespread use of the fax machine in schools in Argyll and Bute is undoubtedly due to the location of most machines in classrooms, effectively making clear that the fax is a tool to be used by pupils as well as teachers, and that it has an educational as well as an administrative function.

14. In order to allocate equipment to classrooms, there clearly needs to be sufficient numbers of workstations and network points in classrooms. This may be easier to achieve in small schools with composite classes, although there were schools in both projects who were unable to achieve this because of inadequate space in classrooms, the need to share equipment, or, in the case of some schools in the STARS project, because of an insufficient number and the inappropriate location of telephone points.

Security issues connected with access to networks for learners and tutors

15. Security in relation to access to networks has not been a major concern for either project. In both projects, separate conference sites for staff and pupils were established on FirstClass™ networks. While teachers have access to pupil sites, pupils would not normally be aware of the passwords needed to enter staff sites. Teachers did not expect to hold or exchange confidential information on systems used by pupils.

The changing role of the teacher/tutor

16. Both projects showed that the role of the teacher is likely to change and develop as electronic communications become increasingly integrated into the work of the classroom.

In the STARS project

17. The potential of a college-based network to introduce and develop approaches to teaching and learning, in this case problem-solving and critical and creative thinking, was demonstrated.

18. Teachers became aware of previously unsuspected abilities and skills among their pupils as a result of their interactions with other adults and pupils in other skills, and were able to make use of this new knowledge in other areas of work.

19. Teachers became more aware of how they might use electronic communications networks for a range of classroom activities.

20. Teachers' experience of the project suggested that in the early stages, when pupils were relatively unfamiliar with the technology, teachers needed to work quite intensively with them. Later, as they gained technical skills and confidence, the teacher's role was closer to that of 'facilitator'. However, this pattern of working may be a familiar one to teachers in small schools in other contexts too.

In Argyll and Bute

21. The focus has been on how technology can support and enhance existing practice rather than on changing practice to accommodate the technology. For example, it has supported existing work on developing pupil autonomy.

22. There has been a particular focus on developing multimedia distance teaching and learning methods which has made significant changes to the ways in which peripatetic specialist teachers work.

23. Collaborative work using electronic communications involves pupils, and consequently teachers, working across schools, and the concept of the 'extended classroom' is now well-established within co-operatives.

Access issues

Ease of access to networks by learners and tutors

24. Physical and organisational ease of access to networks is enhanced by strategies which encourage pupils and teachers to make use of them and promote the notion that electronic communications are a valuable classroom tool rather than an exotic phenomenon. Curriculum-related initiatives which seemingly incidentally require teachers and pupils to acquire the necessary technical skills are particularly effective in achieving this.

25. While schools in both projects have made extensive and creative use of the networks to which they had access, they did not have efficient and affordable access to the Internet because of the absence of broadband technology in rural parts of Scotland.

Physical organisation of groups of learners

26. Preferred models of organisation for groups of learners are for pairs or small groups to work in secluded areas of the classroom. Policies that stress the need for all pupils to gain technical skills, and for individuals to set themselves targets in this regard, help to ensure that pupils share in physical tasks associated with the use of the technology, such as typing, down- and uploading, and writing of faxes, and that all become competent in the basic technical requirements.

Practical issues

Undesirable applications

27. There have been few problems with pupil access to unsuitable material because each project has managed access in ways which have avoided this possibility. Establishing closed conference sites in both projects has clearly been one key way in which access has been restricted to schools participating in the projects. In Argyll and Bute, the practice of communicating principally with other schools within a co-operative has a similar effect. Communication with outsiders has been more closely monitored by teachers. For example, in Argyll and Bute, video-conferencing initiatives involving external organisations, such as the Museum of Science, have been set up and managed by staff rather than pupils. In the STARS project, schools which had access to the Internet and used this in the course of the project did so in a highly-structured way, specifically to help pupils learn how to identify the information they need, but also in order to avoid pupils inadvertently encountering unsuitable material.

Implications for learners with special educational needs

28. The evaluators have not been aware of any practical issues affecting learners with special educational needs. Teaching and learning issues affecting such pupils are discussed below (see paragraphs 3.42–3.44).

Number of learners: age, sex, disability

29. Approximately one hundred pupils were involved in the STARS project, most of whom were primary school pupils between the ages of 8 and 12. A small group of secondary school pupils were also involved. Equal numbers of boys and girls participated.

30. The whole school population of Argyll and Bute makes use of electronic communications in a variety of ways. There are in total 7835 primary pupils and 5670 secondary pupils in the Authority. In the two co-operatives which formed the focus of the evaluation, there were 429 primary pupils altogether. The ratio of boys to girls is not known but assumed to be equal.

31. Figures for pupils with special educational needs are not known for either project.

Technical issues

External connectivity and interoperability

32. The Argyll and Bute project has demonstrated the advantages of a centralised development strategy which ensures that all schools in the Authority are using compatible equipment. In contrast, the STARS project shows that initiatives which seek to create networks based on equipment already in place have a more difficult task, particularly where the transference of files as 'attachments' is concerned.

Software

33. FirstClass™ has proved to be a flexible conferencing system well suited to the needs of school networks. Both teachers and pupils found it easy to operate, particularly in relation to e-mail. Synchronous communication has been more difficult to achieve for reasons of costs and timetabling.

34. A perceived lack of suitable software for use by pupils involved in video communications led to the development of SchoolLink software by Argyll and Bute advisers in collaboration with Academy Computers Ltd. This has been highly successful in enabling pupils to operate relatively sophisticated technology with ease.

35. Specialist teachers involved in distance teaching and learning may identify a need for particular applications.

Teaching and learning issues

Potential value of electronic communication

36. Electronic communications have the potential to become an extremely valuable tool in teaching and learning. Specific gains identified in each project include:

In the STARS project

- Promotion and development of particular approaches to learning, such as problem solving and creative and critical thinking, were enhanced by greatly increased opportunities for pupils to share ideas and work collaboratively across schools.
- Challenges to and support for able pupils, and for other participants, led to higher standards of work and higher expectations of themselves and others, and to teacher recognition of 'hidden' qualities in pupils.

- There were greatly increased opportunities for teachers to share ideas and work collaboratively across schools.
- Pupil access to a wider range of teachers and other adults, apart from their own classroom teacher, was achieved.
- There was increased access to information and experiences.
- Pupils increased their levels of confidence.
- There were improvements in pupils' information-seeking and presentation skills.

In the Argyll and Bute project

- Curriculum enhancement through shared materials and collaborative development of new materials in the context of national curricular developments took place.
- Successful models of interactive teaching and learning were developed.
- There was support for the development of pupil autonomy.
- Access for primary pupils and classroom teachers to specialist teachers increased.
- Greatly increased opportunities for teachers and pupils to work collaboratively across schools were provided.
- New ways of working, in particular in relation to the fax, which would have been difficult or impossible without electronic communications were developed.
- Pupils' access to a wider range of teachers and other adults, apart from their own classroom teacher, was increased.
- There was also increased access to information and experiences, for example the opportunity for pupils from Argyll to question experts from the Science Museum in London.
- Pupils increased their levels of confidence.
- There were improvements in pupils' information-seeking and presentation skills.

Importance of speed

37. Speed has proved to be of crucial importance in schools' decisions about which media of communication to use. In both the STARS and the Argyll and Bute projects, there has been a tendency to prefer asynchronous communication, for example, e-mail and fax, over synchronous communications because of the slow band transmission rates. The exception has been the use of video communications in Argyll and Bute which has been feasible in areas of the authority with access to ISDN lines. ISDN is not widely available in the area covered by the STARS project, and this is one reason why video communication in that project was eventually rejected.

38. Slow response times in accessing the Internet are among the main reasons schools in the two projects have made little use of the Internet in their work.

Technical and educational training for pupils

39. In both the STARS and the Argyll and Bute projects, training in the technology has included teacher demonstration, written materials appropriate to the age and experience of the pupils, operation of a 'cascade' model, whereby pupils who were already proficient in the use of the technology train those new to it, and use of a

range of practice activities designed for individuals and for collaborative endeavour. Training for pupils delivered electronically has also been successful in the STARS project.

40. In Argyll and Bute, training in the use of the technology has been carefully integrated with *5-14* Information Technology curriculum. This includes the staged development of skills appropriate to age and experience, and the recognition that relatively sophisticated technologies, such as video communications, require specific training needs to be identified and met.

41. As with teachers, training is best delivered in the context of the curriculum. Pupils are keen to learn new skills and better able to retain them when they need them in order to complete the work on which they are engaged. In the STARS project, pupils' enthusiasm to participate in the project ensured that they quickly learnt all the technical skills needed in order to do so. In some schools in Argyll and Bute, the focus on pupil autonomy in identifying appropriate uses of technology in relation to the work on which they are engaged has enabled pupils both to identify training needs and to become proficient in the skills which are of most use to them.

Implications for pupils with special educational needs

42. The STARS project contained a particular focus on supporting and extending isolated able pupils, and demonstrated that the technology has considerable potential in this context. The materials developed were deliberately designed to challenge pupils of high intellectual ability, while collaboration across schools enabled such pupils to come into contact with others, in some cases for the first time, with a number of beneficial consequences. While there was concern at the outset that the effects of the project might be to isolate still further such pupils within their own schools, most schools reported that the collaborative element of the work within individual schools enabled able pupils and others to work together in ways which they had not previously experienced. Indeed, it is the case that all pupils have gained from the opportunity to make contact with a wider circle of children of their own age. This addresses one of the key special educational needs experienced by many pupils in small schools, a feeling of isolation leading to low levels of self-confidence.

43. Although the evaluators are not aware of any current work in Argyll and Bute with a specific focus on pupils with special educational needs, learning support teachers are currently considering how best the lessons learnt from existing developments in distance teaching and learning for specialist teachers might be applied to their work.

44. There is also incidental evidence from both projects that electronic communications can support individual pupils with particular needs. Two examples of pupils with Asperger's syndrome were drawn to the evaluators' attention, and in both cases, pupils had gained from using the technology. There were other cases of children with poor concentration or weak communication skills who had also benefited. Indications that children with particular difficulties had, on one or two occasions, been excluded from work involving electronic communications because they were not regarded as sufficiently competent may suggest that ideas about pupil entitlement need to be examined more closely.

Issues of equity: teachers and pupils

45. Electronic communications are of particular value to schools in remote or isolated areas. They provide greater access to information and increased opportunities for contact with other pupils and teachers, leading to a variety of collaborative activities. Such possibilities have been particularly limited for these schools in the past.

However, for reasons which are discussed in more detail in previous paragraphs (see paragraphs 3.6–3.10), schools in remote parts of Scotland are in danger of lagging behind more densely populated and affluent areas of the UK because of gaps in the communications infrastructure, for example, cable, which appear likely to remain unfilled for economic reasons.

46. In neither of the two projects were issues relating to gender or race a particular feature. Argyll and Bute does, however, operate a policy which states that all pupils and teachers have the right to learn how to use electronic communications technology, and this appears to help to ensure equality of opportunity for all. In contrast, such policies have yet to be developed by the education authorities involved in the STARS project, and their absence may have discriminatory effects. There is some evidence to suggest that children involved in the project who had previous experience of computers, usually at home, were coming to be seen, and to see themselves, as 'experts' while others rarely made use of the technology.

47. Gaelic-medium schools, particularly those involved in the STARS project, raised some linguistic issues in the general context of IT and electronic communications, such as the translation of on-screen commands and support materials. While these issues are already being addressed by the Gaelic-speaking community, it is particularly important for this group to ensure that Gaelic, as much as English, is associated with new technologies and their use.

48. Issues relating to pupils with special educational needs were discussed in the previous section.

Management issues

49. This section looks at management issues in relation to the classroom. Issues relating to school management are discussed in an earlier section (see paragraphs 3.11–3.14). Issues relating to management at network level are discussed later on in this report (see paragraphs 3.58–3.60).

50. The introduction of electronic communications technology in schools has required teachers to take a number of decisions, ranging from the location of network points and work stations to the restructuring of ways in which pupils work, in order to ensure effective use of the technology. Most teachers in both projects have responded to the challenge enthusiastically and have gained from the opportunity to review more generally the ways in which they organised physical space in the classroom and to explore different work patterns.

51. At the same time, a few teachers in each of the projects voiced concerns about their own lack of control over input and output where pupils were communicating with pupils and teachers in other schools. There can also be tensions between the need to provide support for pupils as they learn to use the technology and the importance of enabling them to make use of the equipment independently when they have achieved the level of competence which enables them to do so. There is a fine line between autonomy and neglect on the one hand, and support and 'mollycoddling' on the other. Where these issues had been thought through carefully, strategies had been developed to ensure that pupils became progressively more independent without feeling abandoned.

Costs

52. The two projects offer very different models of funding for projects involving electronic communications.

STARS

53. The aim of the STARS project was to make use of technology already in place in schools, and therefore that costs both for the College and for the participating schools would be kept low. As more schools acquire equipment which allows them to communicate electronically, this is undoubtedly an approach which many will attempt to replicate, and the cost issues which arise from this evaluation are likely to be relevant in the future.

54. It is worth noting, therefore, that while the costs of setting up the project were minimal, schools found that their telephone bills increased substantially. In some cases, schools would have been forced to reconsider their involvement, for this reason, if the project had continued. The project co-ordinators also aimed to provide the bulk of professional development for teachers electronically, and this was successful, and markedly cheaper than bringing all teachers together in a central location. However, a face-to-face element proved to be essential, and therefore the costs of at least one day's in-service need to be included for a project of similar nature and duration.

55. The amount of co-ordinator and teacher time spent on the project was probably considerably in excess of that formally recognised by the College and by the Education Authorities.

Argyll and Bute

56. Argyll and Bute identified the development of an electronic communications network as a key element in a communications strategy for a Division, and subsequently an Authority, covering a predominantly rural area with a number of remote, isolated schools. A high level of commitment in the early stages, in terms of funding, has enhanced the profile of the Authority with potential sponsors, and enabled them to reduce some of the costs of setting up and running the network in return for the development of commercially viable applications or approaches.

57. The Authority has gained in terms of the quality of the curriculum and of approaches to teaching and learning, as well as to school management, which the network has facilitated, though it is difficult to determine, ultimately, how cost effective this approach has been. This is in part because of the still experimental nature of some of the work and in part because many of the practices which schools now engage in routinely, for example collaborative work among pupils in different schools, were not possible at all before the introduction of electronic communications.

RECOMMENDATIONS

Future directions for the education service

Creating productive networks at local, national and international levels

58. Effective use of electronic communications technologies will make it essential to think in terms of bigger organisational structures than individual schools. The technology is valuable only if users have a purpose for communicating with each other. Networks will support the introduction and development of the use of the technology if they have clear goals of their own, i.e. if they are not devised simply in order to provide users with communication partners. An education authority in itself forms a natural network structure, but others, such as professional organisations or college-based networks designed to support professional development, as in the case of the STARS project, are equally appropriate. The

education service could support the integration of electronic communications technology into the range of activities in which schools engage by identifying potential networks and encouraging schools to link with each other via networks which represent their shared interests. Participation in several networks will enable schools to develop a critical perspective on more and less-effective methods of communication and to develop communications strategies.

59. While there may be a temptation to encourage schools in rural areas to make links with schools in other rural areas elsewhere, or indeed with urban schools, both projects suggest that what is most immediately useful to schools in remote and isolated parts of the country is links with neighbouring schools, with whom they have much in common but, precisely because of their isolation, can contact or meet only rarely by conventional means. Such local networks can build on existing 'natural' networks, whether cluster groups or other geographically defined groups, which are likely to have reasons for communicating with each other and therefore to make effective use of electronic media. In the long term, of course, links with other rural areas in the UK and elsewhere in Europe are attractive and potentially valuable.

60. The two projects evaluated here offer very different models of network development, one LEA-based and one based at a College of Education. We list here the advantages of each model, noting that while Education Authorities will benefit from centralised development strategies, as in the case of Argyll and Bute, the likelihood in the future of schools participating in a range of electronic networks means that an emphasis on acquiring flexible applications will be beneficial.

Advantages of the college-based structure

61. A college serving a large geographical area has the ability to link schools in similar circumstances and to provide a unifying focus. The opportunity for teachers working in isolation to make contact with each other in the context of an initiative which has, among other aims, a professional development element, is particularly valuable. While the STARS project suffered from a lack of funding, the experience of attempting to develop a network without substantial resources has enabled the schools themselves to see what is required if they are to make full use of the electronic communications equipment they already have. They have also been able to look wider than their authority boundaries and to compare approaches to electronic communications policy and practice across authorities. This experience may in future inform developments within their own authorities which are, in most cases, currently in the early stages of deciding how best to exploit the potential of electronic communications in education. At the same time, issues of equity in resources at local and national level need to be resolved if such networks are to work well in future.

Advantages of an authority-based structure

62. An authority-based structure enables key decisions about the nature and distribution of resources to be taken centrally and can thus avoid basic inequities and incompatibilities. In the case of Argyll and Bute, key factors in the success of their model have included strong leadership at senior level and a powerful vision of what is to be achieved. Having decided that electronic communications are central to the communications strategy of an authority dealing with a large rural population including a large number of small schools on islands and in remote mainland areas, Argyll and Bute Council has been committed to the success of the initiative from the outset and to ensuring effective returns on its investment. At the same time, a recognition of the need for teachers working in remote areas to work collaboratively with others in their area, and to retain a relatively high level of autonomy in decisions relating to the educational use of the network, has produced a network

which is both effective and flexible. It seems likely that both of these characteristics are needed if an initiative on this scale is to be successful.

63. Clearly, authority-based models are particularly vulnerable at times of political change. At the time the evaluation began, Argyll and Bute was dealing with the immediate consequences of local government reorganisation which transformed it from a Division of Strathclyde Regional Council to an authority in its own right, incorporating in the process an area formerly in another Division which had very different traditions in relation to IT and little experience of electronic communications. Currently, the Authority is considering how best to absorb substantial budget cuts resulting from reorganisation and the change to funding only on a per capita basis, i.e. one which does not make special allowances for the rural dimension, as happened in the past. While the commitment to electronic communications remains, concerns about funding make it difficult to plan ahead.

Implications for staff development

64. Teachers require professional development to help them to develop the basic technical skills they need to make use of electronic communications equipment but also, and more crucially, to help them to identify appropriate uses of the technology in the context of the curriculum. This means that the training component of proposed innovations which seek to introduce or make use of electronic communications technology in an educational context needs to be specified at the outset and should be closely linked to the curricular goals of the innovation.

65. Teachers, headteachers and advisers and other local authority staff need to recognise that the introduction of electronic communications technologies is likely to change the classroom in a variety of ways. Some elements of change may be welcome and others may be perceived as threatening. Class teachers need support in identifying what needs to be changed and the benefits likely to ensue. While some decisions may be relatively straightforward, others require considerable reflection and an element of trial and error. As teachers and other staff become more sophisticated users of electronic communications technology, they will identify new training needs. A monitoring and development programme will also help to ensure that these needs are recognised and met. Teachers should also be encouraged to make contact with others involved in the same initiative via the network, for informal discussion of developments and sharing of ideas.

66. Providers of Initial Teacher Education (ITE) and Further Professional Development (FPD) should recognise that the use of electronic communications in a wide range of curricular contexts is likely to become increasingly commonplace. ITE and FPD providers would benefit from reviewing provision made for training in the use of electronic communications in an educational context and considering how to benefit from links with schools or authorities where good practice is well-established. In general terms, providers would benefit from using electronic communications to introduce and develop approaches to teaching and learning and to support teachers' practical applications of innovatory ideas, in order to increase their own expertise and that of the teachers with whom they work.

Implications for pupils' learning

67. A specific focus on the development of pupils' skills in the use of the technology and on their awareness of appropriate use in the context of their day-to-day work is essential if the potential of electronic communications is to be realised. A commitment to ensuring that all pupils have the basic skills needed helps to ensure equality of access. The development, at school and authority level, of a policy

aimed at ensuring equality of access for all pupils will help to ensure that discriminatory practices do not develop inadvertently.

68. Teaching and learning at a distance raise a wide range of new technical, administrative and educational issues for schools to address, as well as offering considerable potential for schools to have access to specialist teaching and advice, for example from educational psychologists and other experts. Developments in this area in Argyll and Bute will be of particular interest.

Costs

69. It is difficult to identify the specific costs of developing an authority-based electronic network similar to that of Argyll and Bute for a number of reasons. Pricing strategies change over time and partnerships with sponsors will be negotiated in different ways. However, a number of useful pointers can be identified:

- Funding for start-up costs needs to be sufficient to establish a basic network, and must include an element earmarked for staff development as well as for the purchase of hardware and software.
- An authority may need to subsidise costs for schools in the initial stages, so that teachers and pupils can become familiar with the potential of the network and identify appropriate uses; when these are established, schools may be expected to fund their participation to some degree.
- A good track record in using equipment and developing applications and materials is necessary to attract sponsors.
- A relatively lengthy period of time may be required for experimentation before an electronic communications network can become cost effective.

70. Networks based on schools' existing resources are likely to become increasingly attractive, but those proposing to set up such networks need to beware of some of the hidden costs, as described above, and also to consider the likelihood that some upgrading of capacity may be needed for some of the schools.

Future directions for suppliers

Gaps in the range of products supplied

71. Educational uses of electronic communications equipment differ from commercial uses. In promoting or developing technologies or applications for schools, suppliers need to focus not only on what these offer, but also on ways in which schools can, in practical terms, integrate such provision into existing ways of working.

72. It is in suppliers' interests to develop partnerships with schools, colleges or authorities to explore the potential of existing technology and applications and to develop new applications which will attract other educational users. Teachers already have considerable expertise in adapting available materials to suit educational purposes. As users, both teachers and pupils have valuable expertise to contribute to the development of appropriate training materials, on-screen interfaces, etc.

73. In the future, the creation of new networks which make use of equipment already in place will become increasingly common and there will be a need for basic standards to be established so that teachers and pupils can collaborate with ease. If schools and other educational organisations are to participate actively in a wide range of

electronic networks, it will be essential to resolve current difficulties in transferring data arising from, for example, incompatible word-processing packages.

74. The uses made of electronic communications technology by educational managers are also likely to differ from those of business managers. The potential market may not yet have been widely recognised. A collaborative approach to the development of effective applications for headteachers and other managers of educational services is likely to benefit both suppliers and users.

Implications for roll-out models and replicability

75. While, in general terms, replicating particular projects in different contexts and at a later date, is problematic, we have identified in the previous section some of the characteristics of the two network 'models', authority-based and college-based, developed in the projects evaluated. Each of these models has different implications for suppliers.

76. An authority-based model will seek to establish a common hardware and software base from which to develop the network and will be attracted by suppliers who can offer systems with the potential for long-term, organic growth, and who are prepared to collaborate with the authority in developing appropriate applications and models of technical support.

77. A college-based model, or any model which seeks to draw on schools' existing resources, will have a particular interest in applications which allow schools with different hardware and software bases to build on their existing equipment and to communicate with each other with ease. In such cases, an audit of schools' existing resources at the outset, including telephone lines, network points, and space for workstations, and the identification of additional elements required are essential if the network is to function effectively.

78. More generally, schools have to make complex decisions in relation to the cost-effectiveness of various options available to them. For example, if synchronous communication is an expensive option, then schools are likely to focus on the development of strategies which make use of asynchronous communication. The pricing of hardware and of applications for the schools market may need to be reviewed if suppliers wish to encourage schools to make use of particular types of technology.

Rural users

79. Although it appears that those engaged in developing the electronic communications infrastructure currently see limited commercial potential in remote rural areas of the UK, recognition that rural users are likely to have specific needs means that a review of current policy may be beneficial. For example, while schools in these areas may have greater difficulty in finding funding for start-up costs, volume of use may be proportionately greater than in urban areas, as electronic communications enable such schools to achieve educational goals which schools in other areas can achieve in other ways. These differences need to be borne in mind when determining pricing strategies.

80. In the long term, the advantages of developing a skilled user base, through collaboration with educational organisations, in areas likely to make substantial use of electronic networks in the future, should also be taken into account by all those with commercial interests in developing hardware, software and related applications.

Future directions for policy-makers

Potential of electronic communications to enhance teaching and learning

81. The evaluation suggests that the use of electronic communications in schools has the potential to provide an effective stimulus to innovation and higher standards generally in schools. This feature should be systematically exploited. In both projects, the technology has been successful in motivating pupils and teachers to engage in a wide range of innovatory practices, some of which are directly linked to electronic communications, for example the development of interactive teaching and learning, and others which are stimulated or supported by it, but which might have been achieved in other ways, though possibly in a more limited fashion, for example the increased focus on collaborative learning.

82. A number of factors are involved. For example, the technology provides access to an external audience made up of a range of different groups such as other pupils, other teachers, and other adults unconnected with school, and it seems likely that external scrutiny encourages pupils and teachers to raise the standards of their work, both as a matter of pride and, more simply, because poorly communicated messages will not achieve what the sender intends. Speed of development and productivity gains are also influential.

Potential of electronic communications for schools in rural areas

83. The question of how equality of access for schools in rural areas can be achieved in a market-led context needs to be addressed. At national level, it should be recognised that electronic communications technology has the potential to make substantial improvements to the quality of education in rural areas and that, for this reason, the uses to which electronic communications are put in a rural context are likely to differ considerably from use in densely populated, urban areas. The potential benefits, however, are limited by the uneven development of the infrastructure, in particular the absence of broadband, and of ISDN in some areas. Lack of access to the Internet, and therefore to a range of other networks which make use of it, seriously disadvantages schools in rural areas of Scotland, and particularly so in a context in which access to conventional sources of information, such as libraries, and physical networks, such as those provided by professional or social organisations in more urban areas, may also be severely restricted. A purely commercial rationale for the development of the necessary infrastructure to improve access needs to be questioned.

84. At local level, education authorities with responsibility for rural areas may need to review strategies for introducing and promoting the use of electronic communications technology in schools. The Argyll and Bute project makes clear that education authorities need to identify key aspects of teaching and learning and school management which would benefit from electronic communications technology and to make a commitment to supporting innovation and training in this context. Monitoring and evaluating progress is also essential.

Resources

85. Resource-related obstacles to access, such as insufficient telephone lines and inappropriate location of network points and equipment, need to be addressed. It seems unlikely that electronic networks across schools can flourish if all resource-related decisions are delegated to individual schools on the basis of devolved school management.

86. Integration of the use of electronic communications in the delivery of the curriculum requires the equipment to be available for use whenever required. This is particularly the case in schools where pupils are encouraged to make their own decisions about appropriate use. A number of factors, among which cost will be prominent, will influence the extent to which authorities are able to provide classroom-based resources. Where equipment has to be shared, it may nevertheless be useful to consider the feasibility of ensuring that all classrooms have network access points, in order to maximise flexibility of use. It is clearly inappropriate for pupils to be confined to a staffroom or school office when using electronic communications equipment for educational purposes.

Costs

87. The balance of costs sustained by education authorities and by individual schools requires consideration. While the Argyll and Bute project indicates ways in which some costs can be transferred from the authority to schools over time, this authority had the opportunity of developing such a model in a period where schools were moving towards devolved school management. It is clear from both projects that small schools may find participation in networks proportionately more expensive than larger schools.