

Strand 2: Innovative Delivery:
Methods and Approaches

Paper 14:

SCHEMA: Network Computers, ISDN, Learning and Social Networks, Network Computers and Learning

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Introduction

- SCHEMA aims to investigate the use of multimedia telematics to deliver and support a series of training modules oriented towards the continuing professional development needs of nursing, education and social work professionals living and working in high priority regions of Scotland, Germany, Sweden and Finland. Particular attention will be paid to the functionality of Net Computers (NCs™) connected by Euro-ISDN, as vehicles for an educational environment which stresses collaboration and interaction. In addition to evaluating the technical viability of client-server topologies for delivering and supporting educational multimedia, SCHEMA will examine the nature of the learning processes involved and the implications of electronic communities for social integration.

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Network Computers and Learning

SCHEMA is a project funded by the European Commission under the Joint Call orchestrated by the Educational Multimedia Taskforce. The Project is co-ordinated by the University of Stirling, with partners in Finland (Oulu and Lapland), Sweden (Trebro and Karlskrona) and Germany (Stuttgart). The Project began in February 1998 and runs for 30 months.

1. Objectives

- SCHEMA aims to develop and evaluate the use of multimedia telematics, based on Network Computers™ (NCs) to deliver and support training modules designed to meet the needs of health, education and welfare workers in remote areas. In addition to investigating the utility of NCs for delivering and supporting open and distance learning (ODL) SCHEMA will address issues of collaboration and community identity.

Specific objectives are as follows:

- To develop and evaluate the use of NCs and ISDN for the delivery and support of educational multimedia.
- To develop and demonstrate a range of multimedia courseware and resourceware designed to meet the needs of professional workers in the community.
- To evaluate the use of telematics-based multimedia as a means for the dissemination of curriculum material and for the development of collaborative project-based learning.
- To investigate the use of CMC as a means of providing student support, enhancing group interaction and encouraging the development of a sense of community.
- To investigate the feasibility of using the SCHEMA infrastructure as a means of providing access to open and distance learning in remote areas.

- To contribute to the methodology of educational and social evaluation.

2. Overall strategy

- SCHEMA aims to evaluate the use of a low cost, easily managed network solution, based on NCs and Euro-ISDN for the supply and support of educational multimedia in open and distance learning (ODL). This low-cost, user-friendly approach has the potential to enable far greater market penetration by telematics-based education and training and will represent a significant new use for Euro-ISDN. Given the innovatory nature of the technology, alternative approaches to providing network services involving thin clients and conventional PCs will also be examined.

SCHEMA is targeted at the needs of professional workers in the health, education and welfare sectors living and working in remote areas of the Community, but the evaluation of the delivery system will stress its utility as a generic means for the delivery and support of educational multimedia.

SCHEMA will develop, verify and demonstrate a virtual learning environment delivered over the Internet and emphasising a collaborative, interactive approach to learning. By involving learners from different professions and regions in collaborative research projects based on local communities, SCHEMA is also designed to address questions relating to the role of telematics in group activities and to the extent to which electronic networks can supplement networks based on face-to-face contact.

Work Packages:

SCHEMA is organised in terms of a number of work packages. Each work package addresses issues identified by one or other of three EU Programmes: TEN-Telecom, TSER and LdV.

The packages fall into a number of categories:

1. WP2 addresses the interests of the TEN-Telecom programme in assessing the feasibility of developing online educational

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multimedia. The work package examines the generic functionality of a client-server approach to the provision of educational multimedia for ODL. Delivery will be based on Network Computers, connected through Euro-ISDN and incorporating Smart Card facilities. The NCs will run a web browser, word processor, vector graphics programs, video players and spread-sheet applications. An important element of the Project is an evaluation of the extent to which inexpensive network devices in a client-server topology can be used to enable users to access multimedia resource materials and to communicate both with fellow learners and with tutors. The adoption of common Euro-ISDN connectivity will facilitate the use of an existing infrastructure and will optimise the communications bandwidth currently available in remote areas. The use of NCs will be evaluated against other client-server solutions in which the local machine acts as a 'dumb terminal'.

2. Three work packages are concerned with developing and evaluating innovative continuing professional development modules for delivery online in real-life situations and address issues of concern to the Leonardo da Vinci programme. WP 3 concentrates on the provision of training in social research methods; WP 4 is concerned with the production of local community studies, using the network to support a collaborative learning-by-doing approach to study. WP 8 provides for the cooperative development and validation of a number of other training modules relating to care in the community, developed in response to expressed user need and delivered using educational multimedia across the network.
3. Two work packages are concerned with evaluating a specific learning environment, originally designed in the University of Oulu for language learning, as a basis for telematics-based ODL. WP 5 is concerned with the extent to which computer mediated communication can support tutors and learners involved in

collaborative problem-solving exercises. WP 7 extends the investigation into the use of simulation programs for building network-based learning environments.

4. Work package 6 draws on the previous packages in order to address issues of central concern to the TSER Programme: the potential of educational multimedia to overcome the problems of peripheral location and the nature of the social and learning processes involved in telematics-based ODL.
5. Work packages 1 and 9, Project Management and Implementation, are concerned with the overall direction of SCHEMA and with the production and dissemination of guidelines for the exploitation of the learning environment developed within the Project. Work package 9 culminates with an International Conference, to be held in summer 2000.

3. Marginal Areas

- SCHEMA brings together educational institutions and professional workers serving or living in remote and sparsely-populated areas in four parts of the European Community. Collaboration will extend across disciplinary as well as national boundaries and the Project is designed to demonstrate that cooperation and the adoption of a common set of learning technologies, based on a standard specification and interface, can do much to alleviate the problems of marginal location.

In addition to research on the functionality of a NC-ISDN client-server network for the delivery and support of educational multimedia, SCHEMA aims to provide an opportunity for serving health, education and social service professionals in remote areas to develop research and other skills which can be used in their local contexts, contributing to an improvement in the learning and training systems available to local communities and helping to preserve local identity. Collaboration between the lecturing staff in the providing universities will lead to the development of shared understandings and

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technologies in relation to open and distance learning and to the role of educational multimedia delivered through telematics in supporting the learning experience. The experience gained will be readily transferable to other applications.

Collaboration will extend to the learners involved, across both geographical and disciplinary barriers; an important element in SCHEMA is an assessment of the value of collaborative, problem-solving approaches to learning when conducted over the network and when connecting diverse groups of learners.

4. User Needs Addressed

- The provision of telematics-based learning opportunities in social research methods and other topics relevant to care in the community will address a number of user needs which have already been identified by professional workers in the field. Changes in the nature and organisation of many of the caring professions, including an increasing emphasis on care in the community, and the rapid expansion of relevant knowledge bases in the social and human science, require the adoption of the more flexible and directly accessible forms of open and distance learning that can best be provided by telematically delivered multimedia.

Discussions with training and service agencies and requests received by continuing education units suggest that important elements in continuing professional development for health, education and welfare workers are training in social research methods and the study of the nature of community itself. Both areas are significant for the provision of effective community-based services. The combination of educational multimedia and computer mediated communications provides an effective way of providing the relevant training and will make it possible for workers in remote areas to undertake development activities which are currently not available to them.

Problems of distance and time make it difficult for workers in peripheral regions to take up training opportunities. Where they exist, relevant courses are generally only available in urban areas and frequently involve attendance on specified dates which may be difficult to combine with profes-

sional duties. At the same time, effective learning in the skills of social research and community study is best served through the experience of team work and collaborative learning. SCHEMA addresses these issues by using a combination of educational multimedia and CMC to provide training modules in community research methods and other subjects relevant to health, education and welfare workers.

Behind the interest in evaluating client-server systems for the delivery and support of educational multi-media and for meeting identified training needs of health, education and welfare workers in the community lies a concern with examining ways in which the use of electronic networks can facilitate the development of social networks.

Collaboration between groups of learners will be used to develop shared understandings of community characteristics across a number of remote regions in Scotland, Germany, Sweden and Finland. The extent to which the collaboration continues outwith the tasks set up by SCHEMA and the cultural, socio-economic and other factors which contribute to variations in the nature of the resulting social networks will be the subject of research.

At technical and pedagogical levels SCHEMA aims to develop user-friendly ways of delivering multimedia educational material and to evaluate different ways of providing student support through the use of CMC. Existing client-server approaches which rely on the use of desktop computers are relatively complicated to set-up, are expensive and require considerable maintenance. The NC, with a common interface and major applications downloaded on log-on, promises to provide a service which is cheaper and easier to maintain from the perspective of all the actors involved: end-users, teachers and system administrators.

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5. Innovation

- SCHEMA is innovative in terms of both technical applications and pedagogical approaches.

Technical innovation:

At the technical level the Project concentrates on the extent to which relatively inexpensive Network Computers in conjunction with ISDN can provide a suitable vehicle for the delivery of multimedia materials, including the use of computer mediated communications for student support. The concentration on a client-server approach, using relatively powerful network computers, is designed to optimise the benefits of a common set of user-tools, easy system maintenance and local application. The feasibility of such an approach is precisely what SCHEMA aims to explore.

Five critical operational issues addressed by SCHEMA that stand in the way of the spread of the Internet as a medium for the dissemination and support of learningware:

- the cost associated with using standard PCs
- the layers of PC operation which need to be negotiated before the 'net is assessed
- the problem of maintaining applications packages for use by end-users
- the problem of time/bandwidth required to download multimedia material
- the problem of supporting collaborative group interaction over the network.

The NC-based client-server solution, with ISDN connectivity, aims to overcome all four problems.

1) Cost/Performance

NCs are designed to be cheap and to be 'plug-n-play' machines, keeping track of user preferences and applications through a combination of applications servers and

smart card technology. In contrast to the 'Windows terminal' solutions being developed, amongst others by Citrix and Wyse, the NC has sufficient local processing power to run applications locally, either directly from ROM or downloaded across the network.

2) Ease of operation

All NCs are equipped with a standard web-browser and connection to the specified servers is automatic, requiring no user intervention apart from the insertion of a smart card and the input of an ID number. The adoption of common Web templates within SCHEMA will further simplify the user interface for both learners and course providers.

3) System maintenance

From the perspective of both the ODL provider and the network administrator the greatest advantage of the NC-server solution over networks based on desk-top personal computers probably comes from the ease of maintaining applications: instead of having to install and maintain copies of applications software on each local machine, single copies can be installed on the server. Not only does this make maintenance, fault-finding and upgrading much simpler, but it ensures that all users have access to the same interfaces and versions of the software. The saving in maintenance has been estimated to be approximately 60% over conventional networked PC systems in a LAN. Given the distances involved in SCHEMA, the saving in time and cost may be even greater. The NC promises to provide the solution.

4) Bandwidth demands

The first generation of NCs has been supplied with a modem, operating at 28kbps. For simple text-based communications this is probably adequate but the system is very slow when downloading complex images and other multimedia objects.

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Developments of the NC, for example to enable video-conferencing require greater bandwidth. Although it may be that cable connections using ATM will be a way forward in urban areas this solution is not generally available in more remote regions. The wide-spread availability of ISDN provides an alternative and less costly route.

5) Interaction

As detailed below, SCHEMA is based on the belief that learning is a social process, involving learners interacting with each other as well as with teachers. To date most applications of communications and information technology in teaching and learning have been largely passive, with the Internet, for example, being used mainly as a source of material. In order to use computers to support the interactive nature of learning greater use needs to be made of their communicative abilities. Use of asynchronous computer mediated communications such as e-mail and bulletin boards is reasonably well established and makes relatively few demands on either the network or local facilities; synchronous communications, especially video-conferencing and the sharing of applications, makes much greater demands.

Educational Innovation:

SCHEMA also aims to be innovative in educational terms, exploiting the communications facility of the NC to explore a collaborative problem-solving approach to learning and the effectiveness of CMC procedures for the provision of student support.

Existing computer-based courseware allows limited interaction between the program and the user, for example allowing learners to enter their own data for graphing, using simulation exercises to replicate laboratory experiments or exploring help windows, but the scope for interaction between groups of learners or between learners and teacher is largely unsupported. It is partly for this reason that rela-

tively little courseware has been produced for discursive subjects such as many social science disciplines in which negotiation and disputation is an important part of the learning experience and 'Learning by Doing' is a prime strategy. The interactive use of the Web to develop a virtual learning environment and the development of 'learningware' rather than 'courseware' or 'resourceware' holds considerable promise for supporting a collaborative learning by doing approach.

SCHEMA aims to use the network as a means for encouraging collaboration between learners, for providing a common educational microworld in which simulations can be carried out by individuals and groups and to provide online support for collaborative, problem-solving activities. The approach takes note of the diverse backgrounds of the learners, allows them to focus on different aspects of the learning experience and recognises the social nature of the learning process; it is particularly appropriate for adult learners taking part in professional development programmes and provide a foundation for the development of social networks between the participants involved, helping to overcome problems of isolation.

6. Pedagogical Approach

- SCHEMA adopts the 'social constructivist' concept of learning (Vygotsky, 1978,1987). This implies that in order to master a new level of understanding, learners have to interact with others who provide appropriate reference standards.

The development of professional skills for health, education and welfare workers, including skills in social research, requires 'constructive understanding'. This involves the learner creating mental schemata or maps which can then be applied to his or her context and used in exploratory and problem-solving activities. Earlier stages of learning, involving reconstructive understanding or comprehension and global reconstructive or 'intuitive' understanding need to be negotiated before constructive understanding can be mastered. Early developments in computer assisted learning tended to concentrate on the rather simpler forms of learning which can be identified as recognition and recall, tasks which can be approached via drill-and-

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practice software and assessed through the use of multiple-choice question banks. The creation of educational software which can support constructive understanding is more complex (see Crook, 1994). SCHEMA uses two approaches: linking material delivered over the network with activities undertaken away from the computer and employing simulations and microworlds to provide an open learning environment in which learners can collaborate on problem-solving tasks.

1) Linking computer-based and other activities

The development of mental maps requires learners to be able to build new knowledge on the basis of their previous understanding. This points to the importance of an individualised learner-focused approach. Although the teacher supplies subject content the locus of control needs to be firmly anchored in the learner. At the simplest level this may require little more than allowing the learner to exercise control over access and pathways through the information supplied; at a rather deeper level it emphasises the importance of individualised learning packages and tutor support. In SCHEMA computer mediated communication will be used to ensure the ready availability of support.

In addition to using CMC to provide support and feedback from tutors, SCHEMA places emphasis on the use of both CMC and simulation techniques for collaborative group projects. The group projects will involve work both on- and off-line, linking computer-based and other activities. Tools designed to encourage reflection and group discussion will be central components used in drawing-up the course modules.

Initial course material will consist of Web-based resources augmented by CMC. Among the CMC materials will be lists of FAQs and an 'answer garden', designed to ensure that learners master basic terms and procedures.

2) Simulation

The achievement of constructive understanding involves situated learning, the recognition that the constructs being explored are relevant to the context (Brown et al., 1989). SCHEMA adopts two approaches to this problem, one relating the material contained in the training modules directly to the stated professional needs of the learners and the second employing simulation techniques to create learning microworlds. In both cases tutor assistance will be on hand to provide expert assistance. Moderated discussion of the results can greatly assist situated learning. Mounting the simulations in a WWW-environment, protected from outside access through Smart Cards and passwords, will allow the rapid evolution of simulations which reflect the everyday, real-life situation of the participants.

7. Conclusions

- SCHEMA's use of NCs is perhaps its most novel feature. These machines do appear to offer a genuine plug-n-play solution to the problem of providing network access from the domestic environment, especially in remote areas where the problems of support desktop PCs would be insurmountable. To use a NC all that is required is a television, a power point and a telephone connection.

SCHEMA's use of a WWW based learning environment is certainly no longer novel but where it is novel is the subject areas it is tackling. The social sciences have traditionally been resistant to the advance of educational technology mainly due to their discursive nature where negotiation and disputation are an important part of the learning process. Through the use of CMC and tutorials, SCHEMA hopes to overcome some of the difficulties posed by the nature of the discipline.

Collaboration between groups of learners and the extent that collaboration continues outwith the learning environment set up by SCHEMA and the

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other factors (cultural, socio-economic) which contribute to the resulting social networks will be a major research theme within SCHEMA

SCHEMA can be summarised as consisting of three major themes: technology, pedagogy and learning and social networks. By delivering high-quality learning materials backed-up by reliable easy-to-maintain technology, SCHEMA can create new types of social networks in marginal areas. Networks that cross both national and cultural boundaries.

References

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