Some Influences of New Telematics Possibilities on the Nature and Organisation of Learning

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Abstract

New telematics possibilities open up a powerful range of new possibilities relating to learning. For secondary and tertiary education in Europe what are the most likely influences in the short- and longer term? What are the constraints on the potential, particularly with respect to the organisation of education? In this paper we argue that telematics possibilities, even though limited by constraints, will come to be associated with a number of changes in the organisation of learning. These changes will take time, will occur as much outside as inside traditional secondary and tertiary education institutions, and which will have powerful and problematical effects.

Telematics and its Potential Applications to Learning

An analysis of the emerging literature from a number of disciplines suggests that three key sets of telematics-related tools or systems to support the learner separated in time and/or place from his or her teachers, fellow learners, or learning resources can be identified. These tools and systems can be grouped in a set of three dimensions relevant to secondary and tertiary education: (a) a dimension which can be thought of in terms of the "remote classroom" where allowing realistic participation in a live classroom situation even though one is not in the physical location itself is the general goal; (b) a dimension which can be thought of in terms of "extended contacts", where allowing expanded opportunities for contact with learning resources and for the extension of one's learning community are the general objectives; and (c) a dimension related to "the collaborative group" where facilitating a group in its problem-solving task is the major focus. Figure 1 visualizes these "telelearning" dimensions.

![Figure 1: Dimensions of telelearning](image)

The gray area in Figure 1 indicates the emerging technical convergence of these dimensions through a single desktop-computer environment supported by adequate processing power and network connectivity so that synchronous and asynchronous multi-media conferencing and document sharing can be supported. Also, in practice, it can be seen that these dimensions are not mutually exclusive. Extended contact via telematics can be sought in both traditional and remote classrooms, as can telematics-mediated collaborative learning experiences. Brief comments about applications of these dimensions to secondary and tertiary education follow.
The remote classroom: applications in secondary and tertiary education

This dimension relates to participating in a "virtual" organized learning session, such as a lecture, a seminar, or a class. The key characteristics are the presence of a leader/teacher whose instructional delivery is to be conveyed effectively to the distant learner; the facilitation of questioning and moderated interaction among the participants; and the provision of appropriate documentation to the participants to support their participation in the organized setting (i.e., lecture notes, agenda materials, handouts to accompany the session, etc.). Telematics offers functionalities for each of these aspects and can support what Farnham-Diggory (1994, p. 470) calls the four major activities of the teacher—talking, lecturing, presenting information verbally, talking back and forth, and questioning; displaying: modelling, showing, demonstrating; coaching; pointing out cues, suggesting changes, guiding, all while the student is doing something; and arranging the learning environment: setting up a self-instructional or practice situation for the students.

Main applications of the Remote Classroom dimension of telematics in secondary education relate to bringing educational opportunities to students in small or remote schools who would not otherwise be able to participate in specialist instruction, and to a lesser extent, to offer enrichment opportunities to students with adequate local resources to deliver a full range of curriculum. In addition, teacher in-service education is also a well-established remote-classroom activity, particularly in the USA and Australia (see, for example, Foster & Jolley, 1993). At the tertiary level, the motivation for application of the Remote-Classroom dimension is more frequently related to the opportunity to expand the institution's student base or to reduce the number of face-to-face sessions in which the student has to be physically present.

Extended contacts: extending available resources

While the Remote Classroom dimension involves the attempt to bring the experience of a traditional class in as realistic a way as possible to a distant learner, the Extended Contact Dimension of telematics applications in secondary and tertiary education aims instead at enlarging and enriching the existing classroom experience. One way to do this is to bring access to externally located information sources. These information sources can be local and institution-specific or can be external and broadly based. The resources can be organized within various structures such as a BBS or a World-Wide-Web server, or a Gopher server. They can be of the nature of distributed databases, or free text. They can be text, or digitized graphic and audio data and, within constraints, even video. They can offer information to the learner, and teacher, far beyond what could be available in any local library, and often in a more timely way than could occur when pursuing locally available resources. And an aspect is added that is not possible with the local collection of resources—the possibility to make contact directly with the provider of the resources, or other human sources of expertise.

Extended contacts: extending the learning community

The support of distributed learning communities, groups who interact with one another for a specific learning task or for more on-going interaction and intellectual growth, is another phenomenon greatly enhanced through telematics. The individual can become part of a number of different human networks relating to learning. These include communicating through countless local or regional BBSs, with discussion groups of strangers that somehow evolve a sense of community through on-line networks, and on-line communities based on well-defined groups who enrich and extend themselves through their on-line interactions. This latter sort of group is beginning to occur among teachers (see Veen, Collis, De Vries, & Vogelzang, 1994, for various European examples) and school administrators (see Steward, 1993, for a New Zealand example). The potential of technical networking to bring "virtual communities" into the school, parallel to the face-to-face communities available in the school, has been predicted to be a major development in education that is already well underway (Dede, 1994; Honey & Henz, 1993). For traditionally isolated teachers, it offers new opportunities for idea exchange, motivation, and support of reflective practice. At the tertiary level, the opportunity to participate in extended learning communities can be an important aspect of professional development into a profession, where the novice must move through a long period of acculturation into the world of the expert. As Farnham-Diggory (1994) observes, the process of becoming a member of a professional community can be "described as coming to understand shapes emerging from a fog"; an understanding that
comes through skills and practice, but also through extended opportunity to "acquire the tacit knowledge of the expert through immersion in the culture" (p. 466).

**The collaborative group**

This dimension of telematics applications in secondary and tertiary education relates to working collaboratively with a distributed learning group, where the key needs relate to group management and maintenance, task clarification and decomposition, management of and development of communal resources and output, support for decision making, and support for group production.

Independent of whether learning occurs in a traditional classroom setting or a remote classroom, the incorporation of more activities involving collaborative work among students is seen as desirable, from cognitive and social-psychological dimensions as well as workplace-orientation (see, for example, Jones, Knuth, & Duffy, 1993, for an application to teacher professional development). CSCL (computer-supported collaborative learning) based on principles of social constructivism and CSCW (computer-supported co-operative work) can be contrasted in various ways (Collis, 1994), but generically they share the foundation that working within a group and as a group are fundamental to a wide range of problems and tasks. Groupware and telematics-mediated instrumentations such as shared workspaces and document conferencing environments are developing quickly in business contexts and are beginning to facilitate collaborative learning.

**Thus, considerable potential for secondary and tertiary education**

In potential as well as in (pockets) of practice, telematics facilitates at least three sets of educational applications: those that support the long-distance classroom; those that allow access to distributed resources and facilitate membership in different human networks for both informational and apprenticeship reasons; and those that support collaborative work and learning. In theory, these could make a powerful impact on the nature and organization of learning. But the major point of this essay is still to come: What are the constraints on this potential for secondary and tertiary education? Are these constraints short-term or more intractable? How do they effect our predictions of the future impact of telematics on the nature and organization of secondary and tertiary education?

**Constraints on the Possibilities**

Possibility is not the same as probability. What are the major constraints on each of the above functionalities significantly impacting the nature and organisation of education at the secondary and tertiary levels?

**Lack of a driving need within the system**

Despite the theoretical benefits, perhaps the major constraint on the potential of telematics in education, particularly within the secondary education, relates to the lack of a sense of a fundamental need for these benefits within established educational institutions. Notwithstanding opportunities for extension, enrichment, and acculturation, society still expects its secondary-school age students to "go to school" and still expects completion of set courses and examinations in order to demonstrate success, both of the institution and of the individual student. As much as the possibilities for telematics addressed above are desirable, and even accepted passionately by some, they are basically still seen as add-ons to existing practice in the secondary and tertiary segments; as attractive things to do to expand one's service range (from the institution's perspective) or because of individual motivations, generally based on the enthusiasms of specific persons or on local opportunities. Such motivations are not enough for substantial change. We have seen this in society's decade of experience with computers in schools: except for courses where using computers becomes part of the testable curriculum, computer use remains an option, an add-on, an experience most likely to be available to those fortunate enough to have a teacher motivated to extend or enrich traditional instruction with computer use (see Pelgrum & Plomp, 1991, for an international analysis of computer use in secondary schools).
Time and management

Given their current add-on status, in order for these potentials of telematics to be realised in existing educational institutions, they must generally come to reside alongside the traditional delivery and organisational practice. But then problems of time and management form a huge and formidable constraint. Teachers are too busy with the demands of the curriculum, of the upcoming examination, of the challenges involved with guidance and management of their students, to handle the changes needed to reorganise their teaching in order to exploit the potential benefits of technology. Extending the classroom with conferencing and access to distributed resources also adds considerable time and management demands on the instructor. By adding remote students to our existing teaching, the instructor must handle variations in timing, and in technical availability on top of all other teaching tasks.

Numbers and workload

The business of handling large numbers of students and trying to serve them fairly and reasonably does not fit well with instructional variations that in fact can lead to increased workload for the instructor or at least changes in workload on top of traditional roles and expectations. For example, attempting to realise the idea of students becoming acculturated into a community for example takes time and commitment and opportunity for individual contact and mentoring. There just are not enough potential mentors, nor enough time, to realise this acculturation or apprenticeship, unless one cuts back on the decision to serve as many students as are now in the educational system. Adding asynchronous discussions as an extension and enrichment of teaching brings large time demands on the instructor, and can become overwhelming as class sizes increase. The point is: as long as institutions must fit in telematics alongside of existing organisational practice, the weight of the inertia of the existing practice will dominate and telematics applications will require extra time and work of the instructor. This creates a natural constraint.

Technology

The potential is realisable and in some settings realised, but in general, the powerful telematics systems we described earlier are still highly limited in availability. Videoconferencing and other desktop conferencing and document-sharing systems are still not compatible with each other; are expensive and difficult to set up and configure, often provide marginal audio and video quality, and require your partners in terms of interconnectivity to have the same systems as you (see Leeds, 1994, for a recent appraisal of commercially available desktop videoconferencing products). ISDN connections are far from common and far from convenient to realise. And while the explosive interest in the Internet is bringing with it rapid improvements in the accessibility of wide-area networking to the individual, there are still major and difficult "first-level barriers" to telematics access for extended contexts and collaborative activities that practically constrain the majority of potential educational users (Collins & De Vries, 1991).

A new organisational constraint: the computer establishment in the school

The above sorts of time and access constraints within the institutional institution are well known; a more recent constraint comes from within the computer-use sector in the school or institution itself. In the decade that computers have been in secondary schools, most schools now have a well-defined computer course and teachers associated with those courses. The computer courses, called by many different names in different countries, require extensive use of the institution's computer laboratory, and the co-ordinators of those facilities now have a well-thought through system for managing the computer lab, its local-area network, its security, and its maintenance.

In this environment, the teacher who wishes to explore some application of telematics use with his or her students in a subject area such as language or science has difficulty. The lab is booked and busy and may be in a location far-removed from subject-area classroom; how can some of the students access telematics-mediated resources and distributed colleagues during their learning activities? How and when can the teacher explore new uses of the technology? Not while the students are present, surely; but this means late after school, and then it may be that the co-ordinator wishes to lock up.
These collisions are already well known with respect to the attempted integration of computers into traditional subject areas. Recently we have seen them take on a new form in the context of teachers wishing to make use of communications technologies in schools (Collis, Veen, & De Vries, 1994). It is even more problematical to try to connect students to an external network service or system than it is to try to find a way for them to use the computer lab for a familiar task such as word processing. The computer co-ordinators are specialists now in information technologies and LANs, but may have no experience with wide-area networking and its tools and protocols. The school administrator has learned how to gauge costs of computers, but has no idea how to anticipate the costs of students and teachers "navigating the Information Superhighway". Thus, ironically, the computer establishment within an educational institution can be another barrier to telematics applications.

Other constraints
There are many other constraints on the realisation of telematics use in the current generation of secondary and tertiary educational institutions. We have not mentioned realities such as teacher training and support, issues related to supplying and paying for adequate access and on-line time for significant use of telematics for any of the functionalities described earlier, issues related to the design of on-line environments and the software to support use of those environments, and the larger, complex issues of factors influencing the development of a supply-and-demand market for on-line resources and services at a level broad enough to bring economies of scale to the educational user (Collis & De Vries, 1993).

And the issues related to multi-culturalism in the European context will continue to be a constraint on the development of telematics resources for broadscale use. Not only are language and local references a stumbling block to the idea of equitable access to educational opportunities regardless of one's location, but many other issues related to cross-cultural communication and organisational style will the educational potential of telematics beyond applications at the local level.

Predictions of Significant Impact

But despite these constraints, I do predict that telematics over time will be part of some significant changes in the nature and organisation of learning at the secondary and tertiary levels in Europe. Where and how is telematics most likely to make a substantial impact on educational practice? In my appraisal there are five major implications that are likely to occur, over time.

Changing boundaries and "turf wars" at the tertiary level
The rapidly evolving nature of work and self-maintenance in modern society will force the continued development of the idea of life-long learning, that an individual cannot expect to "learn his trade" during a set number of years while he is a teenager and then be "trained". On-going learning, for all sorts of occupations from low-skilled to highly skilled, will be more and more part of one's life story. Thus many other learning delivers outside of the school and tertiary education sector will be competing in the learning-provision market. Society will begin to ask why so much of its communal resources should be spent on school and tertiary education, when in fact other aspects of the need for life-long learning should logically receive social support.

Thus tertiary education in particular will face more competition and will have to diversify to support its existing staff and commitments. Telematics will be a major weapon in this competitive war, in that through its facilitation competition for clients, at their workplaces, will be carried out. As is already happening in the United States where there is strong competition for professional education provision to practising engineers, the client will no longer accept being told he has to send his students away from the workplace and to an institution when other service providers are eager to provide, via telematics, professional development at the workplace (Di Paolo, 1994). Thus existing tertiary institutions, both traditional and "distance" or open university sorts, will compete not only among each other but among countless alternative service providers and telematics-based flexibility will be a base-line requirement.
Peripherlization of the secondary school

The rapid evolution of mass media for communication and information services, as well as the competition for the “learning market” described above will have, in my opinion, a different sort of impact on secondary education, not so much so one of competition from commercial alternatives, but of reduction of centrality in the learning history of the student. Instead of being a phase where important learning critical to one’s future occurs, the secondary school is more and more relegated to being a socialization centre, tolerating the observance of some traditional rituals, such as occasional examinations, courses without an apparent practical application to the student, and instruction delivered in a manner far less compelling than the student experiences everywhere else outside of the school, from the popular press and advertising posters in train stations to “edutainment” on his home television. We run the risk that secondary schools will become an anachronism, operating because students and society still want students to be together in social contact with each other, under supervision and some kind of structure, during their teenage years. But the real learning? That comes from television news and documentaries or newspapers and magazines or on-line services or “edutainment oriented” products competing for the user’s attention as he flips through dozens of possibilities. More than ever, the student cannot be sheltered by artificial (to him) decision making about what he should read or study; he must learn to prepare for the self-responsibility and increasingly undifferentiated range of learning choices with which he will be confronted throughout his life.

More choice in one’s learning colleagues and mentors

While one’s community of friends are still real and immediate to a person, his professional and learning communities will be much more varied and transient. One’s close colleagues from a learning point of view and one’s mentors and models may move and more become persons of one’s own choosing instead of those in one’s own institution. This means that physical location and institutional status will have less relevance in the process of acculturation into a professional community. This has powerful implications, for learners are no longer bound by accidents of time and space in terms of their mentors and models. Because these are communities of real practice, this impact of telematics is not directly relevant to the young student, but more to the older and more-specialised student in tertiary education, and even more, to the educational staff themselves. Thus a major impact of telematics on secondary education may come to be the fact that teachers have the opportunity to extend their professional horizons via telematics (for a fuller analysis, see Collis, Veen, & De Vries, 1994, and Honey & Henriquez, 1993). Learning how to work collaboratively with colleagues at a distance and with colleagues one has never seen will become an increasingly important professional skill.

Away from the textbook toward student choice of resources

The fact of access to distributed resources through telematics could bring with it a way to crack through the pattern of teaching to the textbook that still dominates some subject-matter teaching in secondary education, and also change the traditional organisation of courses in tertiary education (both face-to-face delivered and distance delivered). The instructor will not “select a text” and thus will not be able to evaluate students based on how well they have covered a preset collection of readings. (How evaluation is to occur is not yet clear). Students, as part of a course, will be expected to find at least some of their own relevant readings, as do professionals. Once this occurs on a broad scale, not only will telematics services become critically important but also substantial variations on how institutions order and supply resources to their students will occur. Copyright problems will be a major issue as will be payment for resources chosen. If an instructor selects an expensive text, it is assumed that he can argue that it is worthy the cost to the student; if the student selects an expensive resource, it may well be that the student has little basis for making a decision.

New instructional didactics needed for an apprenticeship-acculturation paradigm

A movement away from a “skill mastery” paradigm of instructional to the instructional paradigm of apprenticeship and acculturation into a community of practice (Farnham-Diggory, 1994) will rely on telematics for its implementation and also will challenge teacher education as well
as teacher-task organisation. How does the institution timetable an apprenticeship model? How are large numbers of students handled in such a model? Do the familiar teacher roles of telling, displaying, coaching, and arranging the learning environment still pertain? Can telematics make them more manageable, in the context of an apprenticeship model of instruction? New instructional didactics, as well as institutional support for the time and logistics needed to carry out apprenticeship-oriented didactics, are needed. We have no systematic models, only an evolving experience base.

Conclusion:
Expanding the Learning Community Offers the Major Impact

For generations, there have been educational voices calling for more student self-responsibility, more individualisation in learning, more learner choice. Society has not yet found a way to handle these calls, organisationally or through its collective mental model of what school and learning should be like. Telematics will offer a way in the future to reduce some of the now-impossible logistics of this individualization vision, through allowing more flexibility in access to persons and resources and to a wider range of learning experiences than possible in any single institution. Thus more individualization in at least some aspects of learning, probably those aspects relating to extended contacts, will become routine. But where will the most powerful impacts of telematics occur? Of the above-five areas of predicted impact, it appears that (1) and (4) have the most positive potential for change in tertiary education, (2) will emerge as more and more of a serious problem for secondary education, (5) will present difficulties and substantial challenges to both secondary and tertiary education, but (3) may have the most long-range impact on learning, both short and long term. The implications of being able to choose one's own significant mentors and learning colleagues and to move easily in and out of different learning circles regardless of one's physical location are broad and substantial. Thus the "Extended Contacts: Extending the Learning Community" may be the way in which telematics will come to have the most profound impact on the nature and organization of learning in the long term.

References

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