The evolution of distance learning

EDWARD F. SPODICK
Hong Kong University of Science & Technology Library, HK

Abstract: While distance learning is far from new, recent years have seen an explosion in the mechanisms and tools available for its implementation and support. Distance learning has successfully integrated new communication technologies several times in the past: previously, distance learning providers were faced with the choices of sending their staff to the learner, shipping them increasing quantities of study and research materials, or investing heavily in audio and video broadcast technologies. Broadcast capabilities especially helped to revolutionise the scope and capability of distance learning programmes — but at a tremendous financial cost, and with a number of restrictions on the learner.

More recent advances in computer networking technologies showed great promise for distance learning. Computer-based instruction programmes could be rapidly revised and disseminated, and users were given more freedom of time and location for their studies. With the exponential expansion of network access worldwide, coupled with the development of cross-platform standardised tools for multimedia and hypertext access, complex distance learning programmes are able to reach farther and wider than ever before. In addition, more instructor-student interaction and feedback can be incorporated into the programme materials.

Protocols like the hypertext environment of the World Wide Web and network-capable videoconferencing using CU-SeeMe herald the increasing availability and utility of network-based learning. Coupled with the drastically reduced costs for both transmission and delivery (compared to satellite transmission facilities and base stations) and the increasing pervasiveness of globally-capable computer network connections, distance learning has the potential for explosive growth and acceptance.

Keywords: distance education, distance learning, computer networking, videoconferencing, satellite

1. Introduction: what is distance education?

In 1994, Sir Geoffrey Holland, Vice-Chancellor of the University of Exeter, stated that:

"by the year 2020 every education and training programme leading to a qualification or a credit towards one will be available in three modes: full time, part time, and through distance learning" (Ref 1).

Such a sweeping and generally accepted statement requires a careful look at distance education in general, and at the factors driving the almost geometric explosion in its implementation and acceptance.

Distance education, also called distance learning, has existed for centuries. It involves obtaining knowledge outside of the traditional avenues of attendance at learned institutions. Some recent definitions have focused on it as a new development, involving advanced technology. A few have even sought to define it in terms of a single technology — usually the one they are reviewing or marketing (Ref 2). Others have viewed it simply as a recent extension of the classroom environment into a remote location (Ref 3). Such definitions have proven too restrictive and fail to recognise the actual needs of distance education users or providers.

A better definition is provided by Ian Mugridge, who states that it is:

"a form of education in which there is normally a separation between teacher and learner and thus one in which other means — the printed and written word, the telephone, computer conferencing or teleconferencing, for example — are used to bridge the physical gap" (Ref 4).
This definition neglects a crucial factor of growing significance — separation not just in space but in time. In the past, this time factor has often been a requirement of the technologies in use, and perhaps Mugridge is promoting an ideal of simultaneity. But in this age of increasing global communication, physical distance can involve significant time displacement.

It also implies that the ideal learning situation is in a face-to-face classroom setting, where all participants are physically present. Distance education, therefore, would be an inferior version, trying hard to fit into this mould. It may be that this is true, but there is an increasing body of research which is exploring other options, especially in light of developing instructional technologies and changing social dynamics.

A simpler definition, more open to expanded possibilities, would be that distance education should provide whatever educational opportunities are needed by anyone, anywhere, at any time. Mugridge uses this as the definition for Open Learning, with distance learning as one means of achieving it, and perhaps this will prove more accurate as 'distance education' continues to be 'characterised by great diversity of practice.'

Whatever words are finally settled on, the end result will be increased educational opportunities for broader segments of the population, accommodating different situations and needs.

2. Who needs/uses distance education?

Before examining the tools available and under construction for the distance education market, it is important to understand what that market is and how it is developing. Over 300,000 people are engaged in distance education in the United States alone (Ref 5).

2.1. Adult learning

In the past, most distance education focused on adult learners, especially in rural districts. The largest use was for 'short courses to help farmers and small businesses adapt to new technologies' (Ref 6). This remains the most common usage worldwide. Estimates of the number of distance learners in China range from one to two million. Other adult-oriented programmes include the entire Open University in the UK, and extensive programmes from Norway to South Africa (Ref 7). In recent years, complete post-secondary degree programmes have begun to appear.

2.2. K-12 education

The most rapidly-growing distance learning sector is the pre-university age group — what in the US is referred to as K-12. This is usually in the 'form of curriculum enrichment modules and ongoing telecommunications projects' (Ref 8). This is an exploding market and universities are increasingly providing advanced course programmes for middle school students — courses for which there is not enough demand at their local school to allocate the resources, but which can prove profitable when made available to students at all of the area K-12 schools.

2.3. Disabled and homebound

Individuals who cannot easily travel, including senior citizens and the disabled, are natural candidates for distance education. Some people also may not be able to manipulate the technologies required physically — a situation which will worsen as technologies evolve, unless specific action is taken to reduce the problems. Devices exist to alleviate physical barriers and need to be incorporated in instructional designs.

2.4. Non-native language speakers

Increasing population migration has led to a growth in the numbers of people in all areas who are non-native language speakers, and who are unable to comprehend the classes normally on offer (Ref 9).
2.5. Shift from industrial to international service sector economy

1956 saw the number of white-collar workers in the US surpassing the number of blue-collar workers. By 1987, over 50% of the labour force in the US could be categorised as 'information workers' (Ref 10). This has contributed to a number of factors which must be considered:

2.5.1. Changing work patterns. There has been an increase in alternative work arrangements, including flexitime and work-at-home arrangements. Coupled with the flattening of institutional hierarchies engendered by new management theories (e.g. Total Quality Management), this has led to greater individual responsibility and thus increasing learner autonomy. To maintain currency, workers increasingly need to collaborate with widely dispersed colleagues and peers whom they may never have seen' (Ref 11).

One effect has been a strong trend towards having programmes delivered to companies, especially in global corporations. Cathay Pacific airline executives in Hong Kong, for example, are enrolled in three-year distance education MBA programmes through the University of Michigan (Ref 12). For many workers, taking a year or two off from work to go back to school is an increasingly unacceptable tradeoff. It is much tougher to look for another job afterwards, despite new training, since the training may not directly relate to the changes in the job which have come about during those years (Ref 13).

2.5.2. Changing social patterns. Traditional desires continue, such as the opportunity to hear speakers and take courses which would otherwise be unavailable in the local community. Expanding global awareness has also led to an interest in other cultures and desire for exposure to different social, cultural, economic, and religious environments (Ref 14).

More significantly, the rising cost of living and tightening labour markets have led to more two-income families. It is no longer possible for many to return to school while their spouse works to support the family. And there is an increasing need to balance academic involvements with work and family commitments. People are less able to pick up and move, for whatever reason.

2.5.3. Changing education patterns. Changing work patterns are leading in the direction of lifetime learning. Increasingly rapid changes in the work environment are bringing about a need for periodic retraining. There is a growing demand for employees with diverse and continually evolving skills, unlike the industrial era when the skills needed for different jobs were relatively fixed (Ref 15).

Adults especially need to be able to begin courses at any time, rather than at the beginning of the traditional semesters. This usually involves self-paced tutorials, with some computer interaction (e.g. the continuous registration policy at Athabasca University) (Ref 16).

Many of these patterns result in distance learners who are older than traditional campus students, and 'they are usually self-directed, experienced, and motivated by extrinsic factors such as job promotion and salary' (Ref 17).

All of these developments are also leading to a growing social acceptance of distance education.

3. Changing needs/roles of providers

The changes in demographics of distance learners are tightly interrelated to the changes being experienced by education providers. These are changes which are expected to dramatically increase in intensity.

3.1. Increasing rate of technological change

The rapidity of technological development has an enormous impact on distance education, and educational needs are providing much of the direction for end products. Tools for distance learning must be flexible and adaptable for a variety of different needs and situations — including their own obsolescence, where possible.

Most importantly from an institutional viewpoint, the expectation has developed that expanding technology will enable expanding service, and that distance education will prove more effective and less expensive than constructing new campuses (Ref 18).
3.2. Decreasing geographic barriers

Decreasing barriers of distance and communication are leading to the expansion of institutional boundaries and involvements. An 'increased catchment area' beyond regional/national boundaries is developing, and many educational institutions are starting to move into overseas markets — often in direct competition with local educational suppliers (Ref 19).

This is causing increasing competition between education providers for 'market share.' New paradigms are required concerning institutional boundaries. While this is not a new development, the increasingly real 'global village' is accelerating the pace and these issues must be addressed.

3.3. Growth of the service industry

Whole economies are transforming from an industrial to a service foundation. To maintain competitiveness, institutions need to be innovative. One idea is to offer courses for which there is not enough local demand to justify the expense of programme creation (Ref 20). Local course offerings can also be improved by planning programmes which would not be possible without distance education, such as pulling together part-time instructors who are geographically disparate experts in their fields (Ref 21).

One of the most interesting points raised is that by involving off-campus participants in course programmes which included local students, 'adding this networked community to the discussion has sharply increased the quality of the course for [local] students' (Ref 22).

At the same time, programmes of marginal quality will need to be eliminated and their resources redirected to strengthen mid-range programmes (Ref 23). Competitiveness will become increasingly important and the potential learners will go to whoever can provide training tailored to their needs. We will continue to see universities scrambling to experiment with different instructional paradigms.

What very few researchers mention is the strategic importance of providing improved support services to distance learners, from library systems to remote course registration. These 'add-ons' may make the difference for a number of institutions.

3.4. Changing institutional contexts

The California State educational system expects to as much as double its student population from 326,000 in the next ten years. To do this in the traditional manner would require building a new campus during each of those years — a clear impossibility. While some doubt these sorts of figures, for now administrators are looking for options (Ref 24).

The ever-expanding directive to educate more people with limited or declining resources, without lowering standards — to do more with less — will lead to increased competitiveness in the distance education market along with demands for increasing faculty, staff and student productivity. There are increasing expectations that technological development will lead to market expansion through non-traditional educational institutions and methodologies (Ref 25).

There is an increasing need for institutional collaboration and resource sharing. This is coupled with a rising ability to pool human resources, share experts in different fields and reduce duplication as technology develops.

Another driving force will be the need to develop new markets by offering unique educational experiences. One example is a collaborative exploration of the performing arts using a two-way video link between New York’s Lincoln Centre and schoolrooms around the US (Ref 26).

Providers of distance education will need to carefully explore these changes, and make decisions which match their local resources, target audience and institutional philosophy. Institutions offering distance education programmes need to focus on what best fits their particular mission, goals and circumstances.

4. Tools available for distance education

The past 100 years have seen phenomenal growth in avenues of information development and dissemination. The earliest form of distance education simply involved people reading what scholars had written on a variety of topics, and was almost exclusively the province of the upper classes, who could afford both the time away from survival-oriented tasks and the cost of individually hand-crafted manuscripts.

Gutenberg's invention of the printing press was perhaps the earliest example of technology revolutionising distance education. The written word could now be mass-produced with relative efficiency.
Coupled with the emergence of international postal services, correspondence courses began to appear. Through the latter half of the nineteenth century and up to the middle of the twentieth century this was distance education. A much larger segment of society had access to the thoughts and ideas of their fellow men (as opposed to women, who have remained marginalised throughout much of recorded history).

The next great advance was radio. In the space of a few decades, programmes and materials were available which greatly reduced the barrier of distance. Much more revolutionary was the advent of instructional television. Technology seemed to have provided a mechanism to duplicate the classroom setting, in a medium which could be sent right into the learner's home.

But both of these technologies had significant drawbacks. First, they were one-way mediums of communication. The learner remained essentially enrolled in a correspondence course but with some useful supplemental materials. Second, the broadcasts were only available 'live' (Ref 27).

With the development of phonographs, audio and video tapes, and xerographic equipment, all of these course materials could be duplicated with relative ease. Production costs declined, more varied course schedules could be accommodated and review of materials became commonplace. In addition, with the widespread availability of telephone communications in some parts of the world, distance learners and educators finally began to be able to provide fairly rapid feedback and communication (Ref 28).

The development of microwave and satellite technologies greatly expanded radio and television coverage. Signals could be broadcast farther, to more locations, at reduced cost compared to terrestrial systems. In the past 10-20 years, as the cost of reception equipment has declined and the variety of programmes available has increased, there has been a significant increase in television-based distance education courses. But this remained a one-way means of communication. Critics complained that distance education programmes 'should be more than a passive transmission of academic information' (Ref 29).

The big change needed was interaction — starting with two-way communication between the learner and the instructor. Joan Fulton put forth five fundamentals of an effective programme:

- contact between the student and the instructor;
- active learning through writing out answers;
- timely feedback to the instructor on students' comprehension;
- timely feedback to students on work done;
- opportunity for students to make revisions to work done and learn from their mistakes (Ref 30).

Four of these require timely bidirectional communication. Communicating by mail was increasingly unsatisfactory. Telephone and conference calls helped a great deal, but remained awkward and expensive. It is also not feasible for the instructor to communicate with every learner in this manner. Fax machines took up some of the burden, especially easing administrative tasks. As computer networks expand, electronic mail is beginning to take hold as the principal alternative for non-real-time communication between learners and instructors, and among learners themselves. This is a rapid and inexpensive method of communication, and it is flexible enough to accommodate both individual and group communication (Ref 31).

One of the biggest movements currently is the provision and expansion of two-way video communication, whether through satellites or communication networks. Most of these are an expansion from the one-many to include the many-one paradigm. The instructor can see the students, and the students can see and respond to the instructor. This sort of 'full presence' system is becoming the minimum standard required for such distance education programmes (Ref 32). The past year has even brought technologies such as auto-tracking cameras, zoom lenses and other devices which permit the instructor to move around during the class (Ref 33).

As Lorraine Sherry points out, 'Without connectivity, distance learning degenerates into the old correspondence course model of independent study. The student becomes autonomous and isolated, procrastinates, and eventually drops out.' Still missing from most such systems is the ability to accommodate many-many communication — true videoconferencing technology. This permits interaction not just between the learner and the instructor, but among the learners themselves. The most successful distance education programmes incorporate interaction among the students, for it is here that many of the intellectual leaps occur (Ref 34).

Satellites continue to be the favoured medium, but as coaxial and fibre-optic cables spread to more locations this is starting to change. Fibre, especially, has the capacity to handle multi-directional full-motion video (Ref 35). A contributing factor recently has been the sharp rise in satellite costs. The problem is here now, but the cable system alternatives have been installed in only limited areas. Institutions are also finding it increasingly difficult to maintain awareness of the changing technological fields, and to
make long-term purchasing decisions (Ref 36).

As an example, many providers have failed to update their satellite technology and find themselves unable to incorporate new advances — from signal compression to analogue-to-digital conversion. The need for the latter is increasingly apparent, as new technologies evolving with the computer age permit the encoding and transmission of a variety of data formats through everything from telephone lines to satellite links (Ref 37).

One probable future direction will be the leasing of cable services from local service suppliers such as telephone or cable television corporations. This will reduce the burden on the institution for making market decisions, and for handling maintenance and upgrades. It will also position them more effectively for the emerging global electronic information environment.

5. The Internet — changes in tools and toolmaking

One of the limitations on satellite technology is its continuing emphasis on geographic dependence. Satellite classrooms are constructed to which learners must travel. While the distributed nature of the system permits a much wider instructional provision, it is not well suited to providing educational programmes and resources to more remote users, or to those who are unable to attend at the specified time-slots set by the instructional facility.

The Internet, or Information Superhighway, is providing mechanisms for fundamental changes in the way people learn.

5.1. Electronic mail

Electronic mail is the principle tool of the Internet, by far. As has been discussed, it is a simple, portable, inexpensive mechanism for rapid communication between individuals and groups. It serves as the foundation for almost all other network tools.

5.2. Discussion lists/limited conferencing

Organised topical mailing and discussion lists (listservs and USENET newsgroups) have repeatedly proved their value to users world-wide. There are now well over 20,000 such lists facilitating discussion and collaboration on myriad fronts. Some institutions (e.g. Northwestern University) make heavy use of them for instructional support. They are heavily utilised in support of all levels of distance education, as they provide a mechanism for concurrent information dissemination as well as facilitating discussion among learners — principle weaknesses of most distance education technologies.

5.3. Telnet

Along with e-mail, telnet is a standard application available to all Internet users. It negotiates interactive connections with remote computers, in many cases communicating with database search engines. One of the most popular uses for telnet is to access library catalogues during research.

5.4. FTP and gopher

FTP and gopher are protocols for storing and retrieving files from remote computer systems. With FTP, items need to be transferred to the user's local computer for perusal. Gopher incorporates the file transfer capabilities of FTP and adds a hierarchical menu structure to simplify navigation. Users can also read text files as they go. Keyword searching is fairly straightforward, and it is generally a user-friendly interface.

Gopher became enormously popular in the mid 1990s for the provision of institutional information. Its non-graphics-dependant interface makes it a highly flexible and functional tool, usable by almost everyone on the Internet.

5.5. World Wide Web

The Web incorporated the capabilities of most earlier tools and added the ability to handle various media types in a much more usable graphical hypertext environment (Ref 38). Interfaces for the Web exist on all
computer platforms and are easy to use — so much so that Web usage has exploded in the past year, and the amount of academic and commercial information available is increasing at an almost exponential rate. The amount of information available from a desktop computer provides incredible support for research on a variety of topics, including distance education.

5.6. SLIP and PPP

These acronyms refer to two standard protocols for utilising a graphical interface to the Internet through a regular telephone line and modem. Previously, users had to travel to a central location if they wanted to use tools which relied on graphics technologies — much like the similar need required to utilise satellite conferencing technology.

5.7. Advanced conferencing software

Conferencing software is still very much in the early stages on the Internet. NetPhone from Electric Magic permits real-time transfer of audio across the Internet, much like a telephone call. Some users in Hong Kong are now experimenting to see what other components they would need in order to listen to the US National Public Radio broadcasts through the Internet, as they are not available locally. CU-SeeMe is an experimental one-many and/or many-many video repeater. It is an experimental tool using standard network protocols to provide video feeds to anyone who wants one. Videoconferencing from the desktop will be feasible once more network lines have been upgraded to higher signal capacity. Where fibre-optic cable has been installed, the capacity is already far beyond that provided by satellite. Another drawback to computer solutions is the limited image resolution currently available. Now the hardware and software need to take the next step into utility and viewability.

5.8. Proprietary software vs. open standards

Many information service companies are offering purpose-built proprietary software for specialised applications on the Internet. A common example is Ameritech’s Advanced Video Service, which provides full-motion videoconferencing over standard dial-up lines (Ref 39). Those which fail to incorporate the ability to utilise standard network communication protocols will achieve very limited market penetration. Tremendous amounts of information on every subject imaginable are being provided on servers throughout the Internet. They are following standard protocols, which are constantly under creation or revision. Software which is not able to speak to or query these resources is crippled when it comes to actual utility.

The principle use for such tools as Co-Motion Lite collaboration software from Bitco Solutions, or Video Notes from Lotus Software, is for specialised projects with a limited and clearly identified pool of users. In this setting, such tools can excel because they are able to advance far beyond the state of the art for standards software, as they can ignore those rules to suit their own development process.

5.9. Virtual reality

The next big direction to be taken along the Internet pathways will be the development of virtual reality into a functional network tool. This has the potential to be an order of magnitude more effective than any mechanism previously developed!

The potential of the Internet to revolutionise the field of distance education lies in the comparative simplicity of the tools available; the ease of document authoring; low cost compared to satellite technologies; the continuing trend away from mainframe servers and towards increased power on the desktop; and the theoretical ability of anyone, anywhere to utilise it. Previously impossible institutional mandates for distance education programmes are now becoming practical within the ‘geographic, demographic, social and economic restraints placed upon them’ (Ref 40).

A summary of computer networking advantages over other distance education technologies includes:

- standardised cross-platform tools for multi-media and hypertext access, notably World Wide Web browsers;
- rapid revision and dissemination of instructional programmes;
- increased freedom of time and location for learners;
- world-wide network expansion;
• increased instructor-student interaction and feedback;
• network-capable desktop videoconferencing;
• much lower transmission and delivery costs;
• completely digital environment, with few limitations on transmission of data in any form.

Fundamentally, the Internet expands service provision to the desktop level. Tools developed for the Internet can be utilised from any location, so that learners can be freed from the requirement of travelling to a specific location for instruction. The idea is not new but the tools being developed make its implementation much more viable. Successive waves of support tools will be increasingly simple to use, moving towards transparency of computing technology. This will be aided by the growing technological literacy of the user populations — a literacy which is not a foregone conclusion for all users (Ref 41).

While some users are attempting to run completely Internet-based distance education programmes, most of those involved are using the Web to supplement classroom instruction. One user praised the dynamic nature of Web information, as data (e.g. syllabi) can be rapidly modified as the circumstances change. However, this capability implies that learners will need to have full Internet access from hand-held units so that they do not rely on printouts for accuracy! The field is already looking beyond what had been anticipated (desktop access), and calling for a more comprehensive version of the anyone, anytime, anywhere education provision model (Ref 42).

6. Problems and challenges of distance education

The acceleration in distance education brought on by the development of sophisticated computer network tools is pushing discussion and action on a variety of challenges faced by distance educators. Answers need to be worked out before the field is swamped in a morass of conflicting instructional and institutional directions.

6.1. Technological literacy — including computer literacy

The target population will require training in the use of the tools, and so will the providers. Instructors will need focused training in order to make effective use of the technologies involved.

6.2. Programme evaluation and accreditation

Care must be take to ensure that distance education programmes are as well developed as their in-house counterparts. Mechanisms need to be developed for faculty evaluation of programmes originating at their institutions. There need to be standards for course evaluation and programme accreditation. Successful programmes need to be reevaluated before implementing them in a different cultural environment in this increasingly global village (Ref 43).

6.3 Losing the content in the technology

There is a need to avoid simply providing information, rather than instruction; or simply transmitting lectures through this new medium. This would be a disservice to the learners, and a reduction in content and functionality over the intended result. Avoid focusing on the technology rather than the instructional design and support (Ref 44).

6.4. Alienating instructors

Faculty should be involved in the whole process, and should understand that while one goal may be to reduce costs, this will not be at the expense of faculty jobs. Distance education technologies are not alternatives to teaching. Failing to address these issues can lead to significant faculty rejection of the proposals and may include union confrontation (Ref 45).
6.5. Non-native language instruction

Many of the tools available, whether on the Internet or not, have severe limitations in their ability to accommodate non-native language instruction. Two-byte character systems like Chinese are especially problematic. This is slowly becoming less of an issue on the Internet as standards begin to coalesce.

6.6. Institutional support for distance learners

Academic institutions must remember that course content is just one element of the education they provide. If distance learners are being sought, they will need to be provided with similar support to that received by on-campus users. This includes everything from full library support to academic counselling — in addition to more mundane administrative assistance (Ref 46).

6.7. Increasing regional focus

It is not credible to expect that learners who are a dozen time zones apart will be interested in participating in live programmes when they would normally be asleep. As interactive programmes develop, we may see an increase in two alternatives. First, institutions seeking to market their educational products beyond their shores will offer sessions tailored to the needs of students in specific areas. Second, regional consortia or education hubs may begin to form. There is a danger of becoming isolated from the more global learning environment. In most cases there will be benefit in designing programmes which include challenge and stimulation, and which involve the learner in discussion and collaboration with those outside their immediate circle of fellow ‘classmates’.

6.8. Copyright issues

While few researchers raise the issue explicitly, all are aware that many questions of copyright in an electronic environment remain unanswered. It is important to examine the goals and intentions of the programme and to make sure that the necessary clearances have been obtained as needed.

7. Conclusion

The growth of the Internet is bringing many changes to distance education, and forcing providers and instructors to consider a number of difficult issues. The Internet may be on its way to replacing almost all other mediums of communication utilised by distance education programmes worldwide. It should be kept in mind, however, that little of this is new.

Fundamentally the same needs exist, although in some cases on a more accelerated basis. Most of the goals and directions are the same. The potential exists for significant change, however. The role of the teacher and the dynamics of the student-teacher relationship could undergo significant adjustment, depending upon how everything develops.

The way education is viewed continues to evolve, as do the tools available for shaping its growth and development. What may be emerging is a more social view of education, focusing on collaborative learning. Between the changing tools available and the possible social modifications, educators are being challenged to come up with new ways of instructing which may provide some much-needed insight into how people learn. It will be fascinating to follow these developments in the coming years.

References

[8] Sherry, L. (1994) Issues in Distance Learning, online draft for peer review, Denver, Colorado,
[16] Howard, D.C. and C. van Duren (1993) Computer literacy at a distance, *the Distance Education Online Symposium*, 3(9), DEOSNEWS on listserv@psuvm.psu.edu.
[34] Sherry, L. (1994)
[38] Chadwick, J. (1995)

Appendix: additional references

*The American Journal of Distance Education*, University Park, PA, Office for Distance Education of the College of Education at the Pennsylvania State University.


Discussion of distance education, alt.education.distance USENET Newsgroup.
Distance education, School of External Studies, Royal Melbourne Institute of Technology Limited, Melbourne.
Distance education clearinghouse, University of Wisconsin-Extension, Madison, gopher://gopher.uwex.edu:70/11/distanceed.
Distance education database [computer file]. International Centre for Distance Learning, Open University, United Kingdom.
The Distance education online symposium, DEOSNEWS on listserv@psuvm.psu.edu.
Educational Resources Information Center (1986-) The ERIC database [computer file], SilverPlatter Information, Boston.
Evans, T. and D. Murphy (Eds.) (1993) Research in Distance Education 3, Deakin University, Institute of Distance Education, Geelong, Vic.
Online Chronicle of Distance Education and Communication, DISTED on listproc@pulsar.acast.nova.edu.
Open Learning, Milton Keynes, Open University, UK.
Wallace, B. (1994) Groundbreaking ATM plan to get under way in June, InfoWorld, 16(22), 1,103.