Information and digital literacies; a review of concepts

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Authors	Bawden, David
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Information and digital literacies; a review of concepts. David Bawden. Department of Information Science. City University London.

Abstract

The concepts of 'information literacy' and 'digital literacy' are described, and reviewed, by way of a literature survey and analysis. Related concepts, including computer literacy, library literacy, network literacy, internet literacy and hyperliteracy are also discussed, and their relationships elucidated.

After a general introduction, the paper begins with the basic concept of 'literacy', which is then expanded to include newer forms of literacy, more suitable for complex information environments. Some of these, for example library, media and computer literacies, are based largely on specific skills, but have some extension beyond them. They lead to general concepts, such as information literacy and digital literacy, which are based on knowledge, perceptions and attitudes, though reliant on the simpler skills-based literacies.

Introduction

While there have been several reviews of the concept of 'information literacy' - see, for example Snavely and Cooper (1997), Mutch (1997), Carbo (1997), Behrens (1994), Doyle (1994), Dess (1991), Ochs et. al. (1991), Olsen and Coons (1989), and Kulthau (1987), McClure (1994), Bruce (1997A, 1999) - and some comparisons with the other 'literacies' discussed here (these are noted later), there has been no previous attempt to relate this concept in the full context of all the other relevant literacies. This paper attempts to do so, with a particular emphasis on the relation between the, relatively, long-standing idea of information literacy, and the newer topic of 'digital literacy'.

No attempt is made to give every reference which uses, or even defines these terms; certainly not for 'literacy' itself, nor even the much less commonly used variants of information or computer literacy. Rather, references are selected which introduce the concept - the originating reference is given where it could be found - which explain it clearly, if inconsistently with others, or which give an unusual or informative perspective. An attempt has been made to include contributions from as wide a subject base as possible, though most of the references come from the library/information sector, reflecting the nature of the literature: as Behrens (1994) notes, despite the wider significance of the information literacy concept, discussion of it in the literature 'remains essentially confined within the LIS discipline'.

Part of the difficulty of understanding this area is that writers tend to eschew definition in the interests of giving practical advice, sometimes explicitly and avowedly so: thus, for example, Barclay (1995) notes that his 'how to do it' manual on teaching electronic information literacy 'does not concern itself with the important issues of .. what makes a person an electronic information literate'.

There is no comprehensive bibliography of the concepts discussed here, but fuller selections of references dealing with specific aspects, or from particular perspectives, are given by Dupuis (1997), Snavely and Cooper (1997), Doyle (1994), Behrens (1994), and Ridgeway (1990).

Wherever possible, arguments have been illustrated by direct quotations from the original authors, as a means of conveying directly the flavour of the views expressed.

This review, after briefly discussing the occurrence of various terms in the literature, deals first with the concept of literacy itself. It then considers 'skill based literacies', concepts developed to deal with an information of increasing complexity, and developing technologies.

Occurrence of terms in the literature

Various terms related to information literacy have been used in the literature. Excluding 'literacy' itself, which is widely used in many connections, six terms (some of which have others which appear to be used synonymously) are found:

information literacy
computer literacy   synonyms IT/information technology/electronic/electronic information literacy

library literacy
media literacy
network literacy   synonym   Internet literacy, hyper-literacy
digital literacy   synonym   digital information literacy

In order to gain an impression of the scale of usage of the various terms over time, searches were carried out on Library and Information Science Abstracts (LISA) and on Social Scisearch, from 1980 to 1998. Duplicates were removed and the unique items ranked by publication year. While this is a somewhat 'rough and ready' procedure, including, for example, book reviews as well as original publications, it serves to give a general idea of changing significance of concepts.

	Information	computer	library	media	network	digital
1998	65	18	0	15	4	4
1997	89	30	2	10	4	5
1996	62	34	0	9	1	0
1995	57	26	1	2	1	0
1994	27	32	3	3	1	0
1993	17	15	6	1	0	0
1992	24	14	2	2	0	0
1991	40	15	1	0	0	0
1990	17	6	6	0	0	0
1989	7	13	2	2	0	0
1988	2	8	2	0	0	0
1987	2	19	1	0	0	0
1986	1	15	6	3	0	0
1985	1	30	4	2	0	0
1984	3	36	2	2	0	0
1983	3	44	2	0	0	0
1982	1	10	0	0	0	0
1981	1	8	2	0	0	0
1980	0	0	1	1	0	0

Computer literacy and library literacy have maintained a steady presence in the literature, the former with greater volume than the latter. Information literacy maintained a low volume throughout the 1980s, expanding considerably in the 1990s. Media literacy's low presence has expanded considerably in the late 1990s, while the concepts of network and digital literacy have emerged only in this time.

Literacy

Literacy: the condition of being literate   (Chambers English Dictionary)

Literate: learned
                 able to read and write
                 having a competence in or with   (Chambers English Dictionary)
from the Latin *litteratus*, derived from *littera*, meaning letter - a literate person was therefore lettered

Although the meaning of literacy may appear obvious at first sight, the term, and the various concepts which it describes, have had a variety of meanings, considerably altering over time. These are well summarised by McGarry (1991A, 1994) and by Snavely and Cooper (1997). In particular, the dictionary definitions noted above suggest three concepts of literacy: a simple ability to read and write; having some skill or competence; and an element of learning. These three glosses on the central idea will be relevant throughout the discussion below. The declaration by the United Nations General Assembly of 1990 as 'International Literacy Year', marking the start of a ten year programme to reduce illiteracy, has also led to an increased interest in the meaning of literacy in an information-rich society (Behrens 1994).

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An informal definition of the simplest form of literacy would be the ability to use language in its written form; a literate person is able to read, write and understand their native language. More formally, literacy is conventionally understood as 'the ability to use graphic symbols to represent spoken language [so that] what is collectively known by the group is externalised and fixed in time and space' (McGarry 1991B), or 'above all, concerned with the human capability to use a set of techniques for decoding and reproducing written or printed material' (Graff 1994). This is simply described as literacy, whereas, as McGarry (1994) points out, it would more accurately be denoted as 'print literacy' or 'alphabet literacy'.

But, as McGarry (1993) points out, literacy is, and has always been, a relative concept:' to be literate in the Honduras is not the same as to be literate in Hampstead, London NW3. Literacy can denote a minimal print-decoding skill; it may denote a critical awareness of the cultural assumptions, the ethical norms and the aesthetic value of the printed word'. [This overlaps with the related issue of 'cultural literacy', generally taken to mean a knowledge of the norms and values of a culture, together with an acquaintance with a canon of classic texts; see, for example, Hirsch (1987), Raskin (1992).]

Furthermore, the term literacy has always had (at least) a dual nature, brought out clearly by McGarry (1991A), by comparison of a variety of dictionary, and other, definitions. The first, and simplest meaning implies only the ability to read and write. The second certainly implies this ability, but also requires something beyond it. 'The concept of literacy goes beyond simply being able to read; it has always meant the ability to read with meaning, and to understand. It is the fundamental act of cognition' (Gilster 1997). Similarly, as Clifford (1984) suggests, 'expert opinion has abandoned the dichotomous framework, of literate or illiterate, in favour of the conception of literacy as a continuum; at one end lies some ability to reproduce letter combinations .. at the other end, to such language learning behaviours as are called logical thinking, higher order cognitive skills, and reasoning'. For most of the centuries that the term has been in use, it has meant being well educated, well-read, versed in literature and 'letters' (the 'learned' aspect of the definitions quoted at the start). More recently, it has taken on a more prosaic meaning, that of being able to make effective use of *information*, gained from written material (the 'competence' aspect of the initial definitions):

- 'Literacy, beyond embracing the basic abilities of reading and writing, now embodies the general ability to understand and perform functions successfully' (Depuis 1997)
- 'Literacy can be defined as having the skills one needs to make the connection to the information necessary to survive in society' (Olsen and Coons 1989)
- Literacy involves the integration of listening, speaking, reading, writing, and critical thinking; it incorporates numeracy. It includes a cultural knowledge which enables a speaker, writer or reader to recognize and use language appropriate to different social situations. For an advanced technological society .. the goal is an active literacy which allows people to use language to enhance their capacity to think, create and question, in order to participate effectively in society' (Campbell 1990)
- 'Literacy is that demonstrated competence in communication skills which enables the individual to function, appropriate to his age, independently in society with a potential for movement in society' (Hillrich 1976)
- 'The term "literacy" means an individual's ability to read, write and speak English, and to compute and solve problems at levels of proficiency necessary to function on the job and in society, to achieve one's goals, and develop one's knowledge and potential' (National Literacy Act 1991) .

Hence the three alternative general definitions, with which this section began.

Following this third path, the term 'functional literacy' was originally introduced by Unesco to imply a purposive skill able to contribute to the public good:

'A person is literate who can with understanding both read and write a short, simple sentence on his everyday life … A person is functionally literate who can engage in all those activities in which literacy is required for effective functioning in his group and community and also for enabling him to continue to use reading, writing and calculation for his own and the community's development (UNESCO 1986).

The term has been widely used to describe the state of being able to read and comprehend basic information, such as an ability to understand how many tablets to take in one day, from the instructions printed on packets of over-

the-counter medicines. The 1998 United Nations annual Human Development Report concluded that more than 20% of British adults were functionally illiterate by this definition. In the same vein, a survey published by UK Office for National Statistics in September 1997 suggested that almost a quarter of Britain's adults cannot follow train timetables or understand what they read in newspapers. A report to the UK government by Sir Claus Moser in March 1999 found that 6% of adult Britons have very low literacy skills, such that they struggle to read even the shortest and simplest of texts, while a further 13% have low literacy skills, such that, which they may be able to read simple text, they are unable, for example, to look up entries in alphabetic directories.

Even this more restricted concept of literacy may also be relative, as is clear from Grey's 1956 definition, by which a person was considered functionally literate 'when he has acquired the knowledge and skills in reading and writing which enable him to engage in all those activities in which literacy is normally assumed in his culture or group'. The importance of context in assessing literacy is emphasised by other authors, e.g. Graff (1994).

There is another particular problem with most definitions of literacy *per se*, being more pronounced with those closest to the simplest 'able to read and write'. These carry the implication that the presence or absence of literacy in a person, or a population, can be measured accurately. Further, that there is an opposite of literacy - illiteracy - which may be 'cured' by well-defined means, and the effectiveness of the cure measured. [That this view has indeed been taken by some can be seen from the title of a volume of conference proceedings - Coping with information illiteracy: bibliographic instruction for the information age (Mensching and Mensching (1989)]. This aspect has caused problems for the various literacies which we will consider in this article.

Detailed discussion of the rise and significance of literacy, in its various senses, throughout history is beyond the scope of this article. The topic has been thoroughly reviewed for various perspectives, for example by Meek (1991); by Kintgen, Kroll and Rose, who provide an overview of many perspectives on the topic; by Street (1984), who particularly emphasises the different meanings of literacy for members of different groups, with correspondingly different uses and ways of attainment; by Ong (1982), who points out that literacy enables a grasp of abstract concepts, and of abstract connections, such as cause and effect; by Oxenham (1980), who gives an overview history of the concept; and by Graff (1994), who reviews the changing criteria for literacy over time, noting keypoints in the history of Western literacy. More specifically, the rise of literacy in England has been discussed in relation to education (Stone 1969) and to popular culture (Vincent 1989). Havelock (1986), in discussing the rise of literacy in classical Greece, draws attention to the general relation between literacy and an appropriate script and alphabet. Arp (1990), Breivik (1991) and Behrens (1994), give an account of the changing nature of the literacy concept in the information society, while the various contributors to the volume edited by Tuman (1992) review the changing concept of literacy when print is supplemented, and to a degree supplanted, by digital and multimedia resources.

It is worth noting at this point that, in their detailed analysis of the debate about the appropriate usage of the term information literacy, Snavely and Cooper (1997) consider a number of 'literacy' phrases taken from book titles and similar sources, to indicate the justification for the use of 'literacy' to mean competence, or basic knowledge of a field of study. Their 34 examples include:

- agricultural literacy
- cinematic literacy
- dance literacy
- geographic literacy
- legal literacy
- workplace literacy

as well as computer, library and media literacies, which are considered later in this article. Their conclusion is that this usage of the word provides a justification for the use of the phrase 'information literacy', without concern about the measurement aspect. Arp (1990) makes much the same point, though with fewer examples. Bhola (1997) notes that the 'multiplicities of literacy' are used to indicate either the presence of more than rudimentary knowledge in a particular knowledge domain (e.g. scientific literacy) or a level of competence (e.g. workplace literacy), or possibly an indication of the user's particular ideological position on literacy promotion (e.g. empowering literacy).

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Skill-based literacies

Skill-based literacies; Introduction
The initial concept of literacy, which has we have seen goes considerably beyond a simple ability to read and write, has been complemented in recent decades by 'skill based literacies', concepts developed to deal with an information of increasing complexity, and developing technologies. We now consider: library literacy, media literacy and computer literacy.

Skill-based literacies; Library literacy
This term has two meanings. One, discussed below, refers to competence in the use of libraries, and is arguably a precursor to information literacy, and with a particular emphasis on being able to make informed decisions about sources of information. The other refers to the involvement of libraries in literacy programmes in the traditional sense, i.e. the teaching of reading skills; see, for example, Johnson (1986) for examples of evaluation of such programmes, and Main and Whitaker (1991) for an overview of computer-assisted adult literacy programmes based in libraries.

This term has been used as the heading for a regular column in RQ, a journal devoted to aspects of reference librarianship first established in 1980, and dealing with aspects of library instruction and user education. In the first of these columns, library literacy was defined as 'the learning of the basic skills of finding information' (Lubans 1980). Over the years, the column has dealt with a wide variety of topics within this general theme, with a gradual acceptance that the topic is rather broader and more complex than the original definition might suggest (Fatzer 1987).

Dusenbury (1989) emphasises self-sufficiency as an essential part of library literacy, arguing that this allows 'the ability to make an intelligent decision about the best way to answer an articulated question, to pursue a more or less efficient organised search for the answer, and to know when the intervention of a specialist is necessary'.

Fatzer(1987) regards library literacy 'not as the presence or absence of skills, but as progressive stages .. the library literate can follow a systematic path or search strategy to locate texts and evaluate the relevance of the information'. She suggests, by analogy with the progressive stages of literacy itself, from total illiteracy to full literacy, that there may be several stages of library literacy:
- pre-library literacy (library illiteracy): the individual cannot find a book on the shelf without assistance
- semi-library literacy: the individual can find books in a catalogue and on the shelf, and find articles in simple readers' guides
- library literate: the individual can follow a systematic search strategy to locate and evaluate the most relevant information on a given topic
- library fluent: understands patterns of communication and publication and is able to generalise and modify a search strategy to meet a variety of information needs

Rudolph, Smith and Argall (1996) use the phrase 'The Library Literate' as the title of a 'guide to information literacy [sic] at the University of Memphis Libraries'. They suggest that the term has gone through a number of generations of meaning: initially 'being library literate .. meant asking a librarian to retrieve library materials for you', then at a later time '.. knowing how the card catalog was organized and how to translate call numbers into library locations'. At the present time, it includes an understanding of the range of choices of media and formats in which information is provided, and, beyond this, 'only those who are library literate can sort through the information and give it context in their pursuit of knowledge'. The term here takes on some of the connotations of information literacy, and digital literacy, discussed below. These authors also echo Fatzer (1987) in perceiving several levels of library literacy 'from mere awareness to successful library research'.

'Library literacy' is often taken as synonymous with 'bibliographic instruction', 'library skills', and the like. As noted below, it was one of a number of terms considered by Snavely and Cooper (1997) as alternatives to information literacy to best describe the newer type of formal instruction in library, and other, information resources. The term has somewhat fallen into disrepute as being too much, even exclusively, centred on library

resources, though in practice it has often encompassed a broader scope: 'good library instruction has always transcended what its name implies' (Breivik1989).

Skill-based literacies; Media literacy
This term is used to imply critical thinking in assessing information gained from the mass media: television, radio, newspapers and magazines, and (increasingly) the Internet (see, for example, the papers in the volume edited by Kubey (1997)).

'Media literacy, the movement to expand notions of literacy to include the powerful post-print media that dominate our informational landscape, helps people understand, produce and negotiate meanings in a culture made up of powerful images, words and sounds. A media literate person - and everyone should have the opportunity to become one - can decode, evaluate, analyze and produce both print and electronic media.' (Aufderheide and Firestone 1993)

Media literacy has an obvious overlap with more general concepts of information literacy, since the information gained from these sources often overlaps with, and complements, that from more formal library sources; see for example, Graham, Bawden and Nicholas (1997), Sheppard and Bawden (1997). As noted below, an early use of term 'information literacy', by Hamelink (1976), had much in common with media literacy. However, most authors who have considered the inter-relation of the concepts prefer to see media literacy as a component of information literacy, see, for example, McClure (1994).

Dilevko and Grewal (1998) consider the need for librarians to assist their users in becoming media literate, by encouraging them to consider the accuracy and validity of newspaper stories reprinted from other sources, and suggest that concepts from what they term the 'critical-thinking and media literacy movements' could be incorporated into library's bibliographic instruction programmes.

Skill-based literacies; Computer literacy, IT literacy, and electronic literacy
Computer literate: competent in the use of computers (Chambers English Dictionary)

This simple dictionary definition conceals the fact that there is a spectrum of views as to quite what this 'competence' involves, somewhat analogous to the variation in definition of 'literacy' per se.

Most common has been a pragmatic skills-based approach. Typical is the UK Royal Society of Arts computer literacy training scheme (RSA 1993), which is defined as being for 'accreditation of those practical information technology skills necessary for work and indeed daily living'. In practice, this translate to an introduction to the skills required to operate a variety of computer applications packages - word processing, databases, spreadsheets, etc. - together with some general IT skills, such as copying disks and generating hard-copy printout. The text introduces these skills in a structured format of overview, build-up exercises, checklist of commands, self-assessment tests, and assignments. Similarly, Kanter (1992) denotes computer literacy as 'usually implying the ability to use a personal computer', and Oxbrow (1998) as 'development of skills to use technology'..

Examples of wider definitions of computer literacy, beyond the simple skills approach, involve some explicit indication of the importance of computers, and an ability to use them, in a social context. Typical are:
'whatever a person needs to be able to do with computers and know about computers in order to function in an information-based society' (Hunter 1983)
'whatever understanding, skills and attitudes one needs to function effectively within a given social role that directly or indirectly involves computers' (Husen and Postlethwaite 1985)
 'that compendium of knowledge and skills which ordinary educated people need to have about computers in order to function effectively at work and in their private lives' (Haigh 1985)

A report of the Committee on Information Technology of the US National Research Council criticises the whole concept of computer literacy, with its skills connotation, as being far too modesty; the committee prefers the term

'IT fluency', to encompass skills, understanding of concepts, and an intellectual capability for abstract thinking about information (Committee on Information Technology 1999).

Computer literacy was, from a relatively early date, recognised as important for library/information workers; Ovens (1991), for example, noting that 'computer literacy has become more and more important in libraries'. Its exact meaning, even in this specific vocational context, was interpreted somewhat differently.

Whilst getting away a little from a strictly skill-based definition, Morgan(1998), giving an informal definition typical of those cited in the library/information literacy, still emphasises hardware and software knowledge, particularly general purpose software packages:
'Computer literacy means taking control of your computer and not letting it control you. You are computer literate when you feel you are telling the computer what to do and not the other way around…. It's not necessarily knowing what button to push, but it's knowing the difference between a word processor and a text editor, a spreadsheet and a database program, or a local hard disk drive and a networked file server… In short, computer literacy is knowing what a computer can and cannot do.' This last point echoes Horton (1983), 'Computer literacy has to do with increasing our understanding of what the machine can and cannot do', in terms of both hardware and software. McClure (1994) gives a similar definition, while Schwartz (1992) notes that most computer literacy courses include an emphasis on the fact that computer operations are not infallible, and that the results are dependent on the quality of the input data and the assumptions behind the processing methods..

Conversely, Ovens (1991) sees training in specifically library IT systems, e.g. OPACs, as being a solution to the perceived computer literacy problem; general purpose software packages are also mentioned, but very much in second place.

Lowell (1997), following McClure (1994), noted that computer literacy in the 1990s had often been seen as 'an extension of traditional literacy'. This was, however, in the restricted skills context noted above, 'requiring that individuals can complete basic tasks on a computer, such as word processing, creating and manipulating data on a spreadsheet, or using other types of software…[although] 'anything from the ability to do word processing to fluency with network applications might be considered computer literacy'. In a survey of ALA-accredited library schools, Lowell found that computer literacy was generally required for admission, and, while there was some variation in definition, this generally equated to an ability to use applications software packages.

Tuckett (1989) sees computer literacy as having three components. The first two are those mentioned already: a general understanding of what computers can do, and the skills necessary to use them as an effective tool. He adds a third component: the demonstration of self-reliance in use of computers. He argues that, even if someone uses a computer to accomplish useful tasks every day, and has an idea of what, in totality, can be accomplished by its use, they cannot reasonably be called computer literate if they are entirely dependent on others for instruction in computer use, and for assistance should something go wrong. This element of self-reliance also appears throughout the literature on information literacy, though often implicitly rather than explicitly.

As noted below, Snavely and Cooper (1997), following earlier writers such as Olsen and Coons (1989) emphasise that information literacy, understood in the sense of library instruction, should not be used to refer to the acquisition of computer literacy. This is perhaps in response to earlier writings which saw the concept at least partly in this way; for example a National Institute of Education report which envisaged a kind of hybrid 'computer/information literacy', largely focused on hardware and software tools (Johnson 1985); a report from the US Department of Education which foresaw a learning society in which each person would be required to manage complex information in electronic and digital form [sic], and therefore placed emphasis on computer literacy (Department of Education 1983); while in the Netherlands during 1984 the Advisory Committee for Education and Technology proposed a hybrid new subject, information literacy and computer literacy (ICL), defining it as 'the knowledge and skills concerning the use of computers for getting information to solve a given problem or to know more about a certain subject, as well as for the control of processes' (van Weering and Plomp 1991). There is an emphasis on 'general' databases such as bus timetables and encylopedias. More recently, this ICL concept has moved towards general information handling and skills, and towards differentiating between data, information and knowledge, though still remaining slanted towards computer applications (Behrens 1994).

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Similar early formulations of information literacy placing undue stress on IT aspects are noted by Olsen and Coons (1989). This issue was recognised at the time by writers such as Taylor (1986): 'there is an unfortunate tendency to equate computers and information, and hence to equate computer literacy for information literacy. Computer literacy, however, is not enough and never will be enough for intelligent survival'; and Tuckett (1989): 'while you can be computer literate without being information literate, you cannot possibly be information literate .. without also being computer literate'.

Tuckett (1989) gives a thorough discussion of the distinction between computer and information literacies, arguing that they are separate but related concepts, but that '[it is not] particularly important [to] define the exact difference between them - whether, for example, computer literacy is actually a subset of information literacy, or whether they stand as separate, distinct, but related sets of skills and knowledge'. Most other writers have seen information literacy as a superset of, or advance on, computer literacy, the latter being a necessary condition for the former. This is so, even when the information literacy concept has been seen very much in IT-focused terms, e.g. Horton (1983) 'information literacy, as opposed to computer literacy, means raising the level of awareness of individuals and enterprises to the knowledge explosion, and how machine-aided handling systems can help identify, access and obtain data, documents and literature needed for problem-solving and decision-making'. Horton sees information literacy as bridging a 'literacy gap' between knowing and not knowing what is available and how to access it; it goes beyond computer literacy in that it updates the working knowledge of users on machine-aided tools and resources, such as online databases, e-mail and library networks: 'while computer literacy is a prerequisite to information literacy, it is no longer adequate'. This approach, very much along the lines of the later ICL initiative noted above, sees information literacy as a kind of broader version of computer literacy.

Lynch (1998) similarly sees information literacy and information technology literacy as being 'distinct but inter-related'. The former is concerned with content and communication (though Lynch notes the need for an understanding of, for example, the workings of computerised search engines within it), the latter with an understanding of the technology infrastructure. He sees IT literacy as having two clear components: skills in the use of tools, which he regards as very useful but extremely limited, and an understanding of how the technological world works, which he believes to be poorly covered in curricula. The Committee on Information Technology (1999) drew largely on this work in comparing content-oriented information literacy with their concept of IT fluency.

Oxbrow (1998) sees information literacy as differing from, and going beyond, computer literacy by virtue of a changed *focus*: on 'the content that flows through the technology - a focus on information and knowledge'. Without this broader focus, he suggests, 'a computer literate society is likely to be inefficient and frustrated'. Similarly, Johnston and Webber (1999) suggest that information literacy is 'emphatically not just computer literacy: but rather the ability to identify and evaluate information (using whatever tools are appropriate - such as those provided by IT) and learn to "read" information within its cultural and social context.'

By contrast, Brouwer (1997) sees information literacy as a component of a broader concept of computer literacy. He based this upon a 'critical thinking approach to information technology', with tree principle components:
- an understanding of the power and limitations of technology tools
- information literacy, based upon a critical approach to understanding and using information
- social-political dimensions of understanding information technology use

The broadest conception of computer literacy has been put forward by Shapiro and Hughes (1996) who describe a curriculum for computer literacy based upon seven dimensions, which are in turn other literacies:
- tool literacy - understanding and using IT tools, including hardware, software and multimedia
- resource literacy - understanding the forms and access methods of information resource, especially networked resource
- social-structural literacy - understanding the social situation and production of information
- research literacy - use of IT tools for research and scholarship
- publishing literacy - ability to communicate and publish information
- emerging technology literacy - ability to understand innovations in IT, and to make intelligent decisions about new technologies

- critical literacy - ability to evaluate critically the benefits and costs of information technologies [note that this does not equate to 'critical thinking' discussed elsewhere]

The term information technology literacy, or IT literacy, may also have carried with it an initial connotation of a somewhat broader perspective than computer literacy; Lynch (1998) is an example. However, in practice the terms have been used largely synonymously - certainly so in a library/information context - to indicate a set of basic competencies with computer and telecommunications systems; a typical example is Henri (1997). In the business computing literature, the term 'information literacy' has generally been used with a strong emphasis on IT systems and applications, as discussed below. In other circumstances, it has appeared to mean a general 'comfort factor' in computer use: e.g. a comment, in accounting of different usage of the BIDS database system, that staff and students in science, engineering and mathematics 'tend to be more IT literate than elsewhere' (Pinfield 1998).

Coles (1998) noting that defining and measuring IT literacy is not a straightforward task, and that there are many ways of interpreting the concept, as well as measuring it, adopted an approach based on what she describes as quite simple criteria . As part of a study of use of electronic sources in UK public libraries, users were asked about the number and nature of application packages which they used, the environments (home, work, etc.) in which IT was used, the number of computers in their home, and their levels of anxiety or confidence in using computers. The data enabled a classification into six levels of IT literacy: non-users; reluctant users; work-related users; casual users; experienced users; high-flyers. This again is an effective equivalencing of the concepts of IT- and computer-literacy, albeit that the types of applications used were much broader than the 'office packages' often used as the benchmark, and includes games, e-mail, library OPACs and CD-ROMs, and the Internet.

The terms 'electronic literacy' and 'electronic information literacy' were used by Barclay (1995) in a book with the title 'Teaching Electronic Information Literacy'. Aimed at those teaching the use of electronic information systems, it opens with 'electronic literacy' and learning theory as the two basic tools, … and continues with advice on putting together an 'electronic literacy workshop', teaching basic electronic searching strategies, and using the Internet to teach the Internet. There seems to be, apart from some consideration given to sources such as CD-ROM, little difference between this concept, and those of network literacy or Internet literacy, to be discussed later.

Skill-based literacies; conclusions

These skills based literacies all emerged to meet the needs of a more complex information environment, with new technologies, and a wider variety of media and services. Centred around a core of skills, all of them moved beyond this, showing that, as with literacy itself, these seemingly simple forms of literacy require a wide spectrum of skills, knowledge, understanding and attitudes This leads us on to a consideration of a form of literacy appearing from the outset to be based on rather wider premises than one or more skills: information literacy.

Information Literacy

This term seems to have been first used by Paul Zurkowski (1974). Its early usage, and in particular its emergence as a close relation to ideas of educational reform, particularly in the USA, are reviewed by Behrens (1994), Doyle (1994), Ridgeway (1990), Rader (1991) and Kuhlthau (1987).

Zurkowski's initial usage of term, however, in a submission to the US National Commission on Libraries and information Science in 1974, in his capacity as president of the US information Industries Association, was rather different. Describing the information service environment within the USA, and focusing on the private sector, Zurkowski suggested that national information literacy within a decade was a reasonable goal. He saw information literacy as emerging from the transformation of traditional library services into more innovative private sector information provision, and the policy issues associated. Information literacy was associated with the effective use of information within a working, probably commercial, environment, and specifically with problem solving:
'People trained in the application of information resources to their work can be called information literates. They have learned techniques and skills for utilizing the wide range of information tools as well as primary sources in moulding information solutions to their problems'.

A somewhat similar early use of the term, again emphasising problem-solving, was given by Burchinall (1976):

'To be information literate requires a new set of skills. These include how to locate and use information needed for problem-solving and decision-making efficiently and effectively'

However, even at this early stage, a view was being expressed of information literacy as something serving a wider function than simply efficient problem solving in a work setting, and extending to the functions of citizenship - e.g. 'beyond information literacy for greater work effectiveness and efficiency, information literacy is needed to guarantee the survival of democratic institutions' (Owens 1976) - while the US Information Industries Association in 1979, though retaining a problem-solving emphasis, had broadened Zurkowski's original definition away from a strictly work-related focus, defining an information literate person as someone who 'knows the techniques and skills for using information tools in molding solutions to problems' (Garfield 1979). Taylor (1979) introduced the term to the library literature in much the same terms, while broadening its scope:
'an approximate definition of [information literacy] would include the following elements: that solutions to many (not all) problems can be aided by the acquisition of appropriate facts and information; that knowledge of the variety of information resources available (who and where) is a requisite of this literacy; that the informing process, which is continual, is as important as the spot information process, which is occasional; and that there are strategies (when and how) of information acquisition.'

25 years later, Doyle (1994) defined the term in a more succinct statement of similar principles:
'information literacy is the ability to access, evaluate and use information from a variety of sources'.

Another early, and very different, usage of the term was by Hamelink (1976), who used it to refer to the need for the general public to be liberated from what he saw has the oppressive effects of news media, which provided too many 'pre-digested explanations', and which could be overcome only by provision of news channels free from control by political or economic interests. This view of information literacy as the ability to obtain an individual and independent view of news events does not seem to have been followed subsequently, though it has something in common with media literacy, as noted above.

Thus, from the earliest time of its usage, 'information literacy' has had very varied connotations. Arp, writing in 1990, noted that the phrase's meaning was unclear, especially to those outside the library community, where some measure of consensus, albeit limited, had arguably been reached at the time of Arp's article. In the intervening years, little progress seems to have made in clarifying matters. In 1997, Snavely and Cooper still had to conclude that 'disagreement over the term information literacy is fairly strong and seems to be widespead'.

One prevailing problem appears to be the enthusiasm of many commentators to give a single all-encmpassing definition of information literacy, whereas it has been recognised from an early stage as a multi-faceted topic. 'True information literacy is made up of the effective combination of a number of knowledges and skills .. the kinds of knowledge and capabilities that any educated person will need to operate effectively in an information-rich technological society' (Taylor 1986).

In an illustration of this, McClure (1994), after pointing out that information literacy must deal with information in whatever format, i.e. encompassing both print and electronic formats, positions it at the intersection of four other literacies - traditional, computer, media and network - and within a wider set of information problem-solving skills.

Tuckett (1989) suggests that information literacy can be seen as a hierarchy of skills, at three levels. In ascending order of complexity, these levels are:
- simple information skills
using a single information tool, e.g. a library catalogue
- compound information skills
combining simple information skills/tools, e.g. preparing a bibliography by searching several databases
- complex/integrated information skills
making use of a variety of information networks, evaluating and repackaging information

Tuckett argues that this model can be used in the design of training programmes, and also suggests that it illustrates the intimate relation between information literacy and computer literacy, since the latter provides a set of skills needed at each level of the hierarchy.

Information Literacy and Learning

As Ford (1995) and Ridgeway (1990) note, the term having been first used in the 1970s, its rapidly changed its meaning in response to educational reform, and to international concerns:' information literate people are those who have learned how to learn because they know how knowledge is organised, how to find information, and how to use information in a way that others can learn from them' (Ford 1995).

This link between the concept of information literacy and learning has been a consistent theme, and has strongly coloured the meaning of the term. Educational institutions and associations have urged the incorporation of information within each and every programme of study. Take for example a pronouncement of the US Association of Supervision and Curriculum Development (Ford 1991): 'Information literacy, the ability to locate, process and use information effectively, equips individuals to take advantage of the opportunities inherent in the global information society. information literacy should be part of every student's educational experience. ASCD urges schools, colleges and universities to integrate information literacy programmes into learning programme for all students'.

In the same vein, Lenox and Walker (1992) argue that 'the dynamic and changing information environment of the last quarter of the century makes the acquisition of information literacy during formal education both a practical necessity and a moral right'. Defining information literacy rather broadly as 'that skill which allows us to express, to explore and to understand the flow of ideas among individuals and groups of people in a vastly changing technological environment … the process, skills and habits of accessing and using ideas and information are undergoing revolutionary changes. Information literacy refers .. to this set of complex, integrated, higher-level skills appropriate to our age'. They are critical of the ALA approach to information literacy as being too library-centred, and are particularly critical of the view of information literacy as an extension of bibliographic instruction (both of these are discussed below). [Reichel (1990) similarly argues that a 'political' aspect of the use of the information literacy term is its provision of a link to the 'nonlibrary world'.] Lenox and Walker argue that information literacy must include sources far beyond those provided by libraries, including films, television, posters, conversations, etc., and that students: 'if we are to teach information literacy, we must teach students to sort, to discriminate, to select, and to analyze the array of messages that are presented. MacAdam (1990) makes a similar point, in respect of the teaching of information literacy to students of mass communication. There seems here to be a strong flavour of media literacy, though these authors do not use the term. (It is also fair to note that other authors, such as Rader (1991) have argued that information literacy must include information from sources such as television and newspapers.) Further, Lenox and Walker argue strongly against information literacy as an isolated skill, seeing it as a formative agent, central to the whole educational curriculum: 'teaching information is .. a conceptual framework for the development of educational models and curricular concepts in systematically addressing information skill development in a diverse society .. a curriculum and pedagogy designed to help [students] use their knowledge in deciding, acting and behaving in this world'. Information literacy is then closely associated with resource-based learning, in which teachers and librarians both act as facilitators of students' learning (Brevik and Gee 1989, Lenox and Walker 1992).

By contrast, Johnston and Webber (1999) argue that information literacy may be developed as an academic discipline, and taught in its own right. They give the example of a one semester (12 week) course, taught to undergraduate students in the Business School of Strathclyde University, aiming at providing students with a foundation of information seeking and communication skills for use in their studies of other topics.

One important strand of an emphasis on information literacy as a component, perhaps a core component, of formal education is an emphasis on life-long learning, for which information literacy is seen as essential, and in a series of initiatives undertaken in the USA, information literacy was promoted in this way. Educational associations predominated among more than 50 national associations represented on the US National Forum for Information Literacy, formed in 1993, and described as 'an umbrella group of national organizations committed to turning people into effective information consumers' (Breivik and Ford 1993). The idea of information literacy as a vital

tool for lifelong learning was also promoted by Candy, Crebert and O'Leary (1994) in a report dealing with Australian undergraduate education.

The first significant response of the library / information community to the emerging concept of information literacy was that of the American Library Association (Brevivik 1989, Ridgeway 1990, Rader 1991), whose Presidential Commission reported in 1989 (ALA 1989), also taking a view of information literacy firmly from the educational, specifically lifelong learning, viewpoint: 'What is called for is not a new information studies curriculum but, rather, a restructuring of the learning process .. based on information resources available for learning and problem solving throughout peoples lifetimes .. [which] would not only enhance the critical thinking skills of students, but will also empower them for lifelong learning and the effective performance of professional and civic responsibilities'.

The report addressed the importance of information literacy to individuals, to business and to citizenship., arguing that the key to providing for all three areas was the establishment of information literacy as a part of formal education, but then applicable throughout an individual's lifetime. It took a wide definition of information resources, by no means restricted to formal library sources, and arguing that information could come from 'a computer, a book, a government agency, a film or any number of other possible resources'

The ALA's definition of the term (ALA 1989) includes the following:
'To be information literate an individual must recognise when information is needed and have an ability to locate, evaluate and use effectively the information needed .. Ultimately information literate people are those who have learned how to learn. They know how to learn because they know how information is organised, how to find information, and how to use information in such a way that others can learn from them'. The ALA report called for a revamping of the learning process itself, rather than of any particular curriculum, ensuring that students were competent in six general areas:
- recognising a need for information
- identifying what information would address a particular problem
- finding the needed information
- evaluating the information found
- organising the information
- using the information effectively in address the specific problem

Murdock (1995) paraphrases this, with an emphasis on library users, as information literacy referring to 'users who understand the importance of information and who have the competence to locate, evaluate and manage it comfortably'. Similarly, Mosley (1998) summarises it as 'information-seeking, assimilation and critical analysis skills'. A somewhat broader definition, along the same lines, is that given by Olsen and Coons (1989), for whom information literacy can be defined as 'understanding the role and power of information, having the ability to locate it, retrieve it, and use it in decision making, and having the ability to generate and manipulate it using electronic processes'. Jackson (1989) expresses it simply that 'information literacy involves knowing your way around in the information world'.

Doyle (1992) gives a somewhat expanded version of these points, in defining an information literate person as someone who:
- recognises that accurate and complete information is the basis for intelligent decision making
- recognises the need for information
- formulates questions based on information need
- identifies potential sources of information
- develops successful search strategies
- accesses sources of information including computer-based and other technologies
- evaluates information
- organises information for practical application
- integrates new information into an existing body of knowledge
- uses information in critical thinking and problem solving

Another variation is presented by Bruce (1994) who gives seven 'key characteristics' of an information literate person, as one who:

- engages in independent, self-directed learning
- uses information processes
- uses a variety of information technologies and systems
- has internalised values that promote information use
- has a sound knowledge of the world of information
- approaches information critically
- has a personal information style that facilitates his or her interaction with the world of information

The idea of the 'personal style' as being important in understanding information literacy is emphasised by, *inter alia*, Carbo (1997), who includes individual traits and learning styles as one axis of a model for information literacy, and Siitonen (1996), who sees an understanding of each person's own 'intellectual, psychic and psychological capabilities' as important in a 'truly information literate person'.

A more recent instantiation of the link between new trends and information literacy is the New Learning Communities programme of the Coalition for Networked Information (Tompkins, Perry and Lippincott 1998). This programme, designed to support new initiatives in education made possible by the availability of networks and networked information resources, focused on the convergence of three trends: increased availability of networks, specifically the Internet, in US higher eduaction; increasing requirement for collaboration in teaching and learning; need for students to develop information literacy as part of the curriculum. The concept of information literacy in this programme seems very much to resolve around students identifying, accessing and evaluating Internet resources for project work, with an element of web page creation; closely akin to what has been described elsewhere as Internet literacy.

A much broader definition of information literacy to is given by Rader (1990, 1991). Emphasising that information literacy is essential for survival in the future, she argues that the information literate citizen will be characterised by an ability to acquire and use information appropriate for any situation, within or beyond the library, both locally and globally. This will be brought about by a variety of rather general competencies, so that information literate people will be able to:

- survive and be successful in an information/technology environment
- lead productive, healthy and satisfying lives in a democratic society
- deal effectively with rapidly changing environments
- ensure a better future for the next generation
- find appropriate information for personal and professional problem solving
- have writing and computer proficiencies

Information literacy and bibliographic instruction
The concept of information literacy as being closely linked with formal learning has been taken up with enthusiasm by librarians, particularly in the academic sector, who have seen it as fitting in well with their 'traditional' role:
'Striving for an information-literate population is a basic goal of librarianship .. the work on information literacy builds on many rich traditions in librarianship, including adult literacy and library instruction.' (Reichel 1991)

Most librarians have taken a closely focused view of it as a form of, or perhaps a successor to, traditional 'user education', 'library skills' or, perhaps most directly, 'bibliographic instruction' [though, as noted above, this view has been criticised as too narrow]. As Depuis (1997) puts it, 'many [bibliographic instruction] programs are now working with or evolving into information literacy programs'; confirmation of Breivik's 1989 plea that 'we must move beyond programs of library instruction to information literacy'.

The relation between these two concepts has been discussed by several authors, including Snavely and Cooper (1997), Rader (1991), Lenox and Walker (1992), Rader and Coons (1992), Miller (1992), White (1992), Murdock (1995), and Arp (1990). However, their conclusions are by no means unanimous. The lack of general agreement that information literacy in some way supersedes, or updates, bibliographic instruction is indicated by the fact that the former Bibliographic Instruction Section of the US Association of College and Research

Information and digital literacies; a review of concepts. David Bawden. Journal of Documentation, 2001

Libraries, in its search over more than ten years for a more appropriate, inclusive and modern name, eliminated Information Literacy as a suitable new name early in its considerations, indicating its lack of general acceptance (Snavely and Cooper 1997)

Arp (1990) notes that neither term had been well-defined, so that some confusion was inevitable. White (1992) notes that some, at least, of the stated goals of information literacy programmes are far from new, and were an accepted part of bibliographic instruction. Rader and Coons (1992), arguing that the two terms are distinct, suggested that the nature of the distinction could be clarified: 'bibliographic instruction is more often a situation-specific response, whereas information literacy contributes towards life-long learning by educating individuals to effectively utilize and evaluate information'. Rader (1991) suggests that the two should not be seen as alternatives, nor as competitors, but rather that information literacy is broader concept, and that 'bibliographic instruction is part of an evolution towards information literacy'. Curran (1991) suggests that information literacy is s more holistic concept than bibliographic instruction, and implies an expanded set of roles for information professionals involved in it. Reichel (1990) makes the pragmatic points that whereas bibliographic instruction is firmly tied to the academic library, information literacy is a concept which may be appealing in other library environments.

Murdock (1995) argues that bibliographic instruction has, in fact gone through three generations of rather different definition: in the 1970s, viewed essentially as library orientation; in the 1980s, with a concentration on teaching library patrons to use research sources; and in the 1990s, with an emphasis on the shift from print to electronic and multimedia sources. She believes, however, that bibliographic instruction is 'still dominated by its association with short-range, library-centered, print-bound instruction', and that information literacy provides a new paradigm to include effective use of computer an multimedia technologies.

Wilson (1989) gives a typical example of the ideas of information literacy emerging from this kind of library-based instruction: 'A definition of information literacy emerged as we planned the content and sequence of the course. We wanted the students to understand, first of all, the journey of ideas from a scholar's brain to the various print and electronic indexes where these ideas become accessible to the scholarly community as a whole. Second, we wanted them to recognise the roles of the actors along the way: scholars, publishers, vendors, libraries, computing centres, utilities, users. Throughout the course we explored the role of the academic library as one of the actors in this journey'.

The usage of the phrase in the context of library education, its appropriateness, and possible alternatives are discussed in detail by Snavely and Cooper (1997). They conclude that, despite remaining substantial disagreement about the term, which largely relate to the 'broader and more extraneous elements that have been added to the definition, it is possible to discern a measure of agreement that it can be used to describe new trends in library instruction. Specifically, these include:
- independent learning, with students able to undertake all steps of the ALA definition
- ability to apply these principles throughout a lifetime
- instruction in a wider variety of information resources (print as well as electronic)
- shift from strictly content-based instruction on particular resources to a process-based and useer-focused approach
- faculty collaboration
- association with new instructional techniques, such as active learning and critical thinking

This results in a newer form of library instruction, which these authors seem to regard as a successor to traditional bibliographic instruction. They then address the question of whether the old term, the new term , or some alternative is best to describe this, analysing the question in some detail. Among the 36 alternative terms which they consider are
- abstractionism
- information competence
- information sophistication
- information inquiry
- know how to know how
- reading and research
- virtuous instruction

- knowledge R us

They also considered 'library literacy' but rejected it, apparently because of a perceived limitation in scope. Ultimately, their conclusion was that information literacy was an appropriate term to use provided that it was used 'carefully and with clarity', and with appreciation of the unique role of the library. The term should not be used to refer to simple instruction in use of any resource, nor to acquisition of computer skills or computer literacy, nor to the general processes of gathering and evaluating information, which occur in many environments. It should be restricted to programmes enabling students and other users to 'appreciate and find their way through the many voices contributing to knowledge .. the large body of recorded knowledge which libraries (traditional and electronic) can offer, and which complement, and not replace, learning occurring elsewhere.

Information literacy and business information
As noted above, the concept of information literacy has been largely discussed in terms of education, both formal, school- and college-based, and lifelong learning, and of the library environment, particularly the academic environment. This is despite the origins of the term in the context of private sector information services, as noted above, and the inclusion of 'business' as one of the three key areas for the use of information literacy in the ALA's influential report (ALA 1989), which emphasised the value of relevant information in the commercial world. The implication appears to be that, provided long-term information literacy skills are imparted during formal education, they will be used during an individual's working life.

However, the specific and explicit relevance of the information literacy concept to the commercial and business world has also received some attention. Horton (1983) in an early example of the view of information literacy as a somewhat expanded computer literacy, suggested that 'amplifying the firm's intellectual resources is what information literacy is all about', and similarly argued in 1985 for information literacy programmes to convert commercial information centres into knowledge centres. Drucker (1994),using the term 'infoliteracy' to describe an apparently similar concept, emphasised that business managers should themselves take responsibility for identifying, analysing and communicating their information needs, rather than relying on information specialists. Kanter (1988, 1996) explores the importance of information literacy in business, and discusses techniques which information systems managers can use to improve the information literacy skills of business executives.

Mutch (1997) reviews the applicability of the information literacy concept in the private sector, noting in particular the link between 'lifelong learning' and the 'learning organisation' (see, for example, Senge 1990). The lack of appreciation of this link was noted by Daniels, who commented in 1994 that 'relatively few people are information literate and even fewer understand the relevance of information to their business visions'. Daniels, like most commentators, gives emphasis to IT skills in his idea of business information literacy. Kanter (1992) similar sees information literacy as comprising 'an understanding of the general concepts of information processing; how computer systems support and shape a person's job function, the trade-offs between investment and benefits, time expended and time saved; and the application areas that will give a company a strategic advantage.' However, he argues for a distinction between this, and the simpler concept of computer literacy; 'information literacy is a stage above computer literacy, the latter usually implying the ability to use a personal computer'. This tendency to focus on IT is criticised by Mutch (1997), and by Drucker, who, in an interview with Harris (1993), argues for the centrality of information literacy and against a fixation with computers; a brief presentation of similar views is made by Quinn (1991). Similarly, Oxbrow (1998), in presenting a vision of information literacy as broader than computer literacy, and with a focus on information and knowledge, argues that 'companies, organisation, countries and societies that ignore the need to improve information literacy will not be in a position to compete effectively in the new information age.'

Information literacy: skills and components
An early extended definition of information literacy, incorporating a list of skills required, was devised in 1985 by the Auraria Library of the University of Colorado (Fatzer 1987, Behrens 1994). This gave as a general definition that information literacy was 'the ability to effectively access and evaluate information for a given need'. The characteristics of information literacy, thus defined, were that it was:
- an integrated set of skills (e.g. research strategy, evaluation) and knowledge (of tools and resources)
- not just knowledge of sources

- not solely associated with the library
- distinct from, but relevant to, literacy and computer literacy
- not just information finding
- developed through particular attitudes (persistence, attention to detail, caution in accepting single sources)
- time and labour intensive
- a problem-solving activity, and therefore need-driven

Demo (1986) and Behrens (1994) regard the formulation of this definition as being particularly significant, as marking the point at which information literacy became a major issue in the library/information world, but also the beginning of a much broader scope for library-based education in information handling.

A number of lists of this nature, all attempting to define lists of necessary skills and attributes, were drawn up during the late 1980s and early 1990s. A typical example is that of Doyle (1992), based on a Delphi study, which identified 21 outcome measures, of very varied degrees of specificity, for the process of information literacy, such as: ability to access computers and other technologies; ability to identify and information need; ability to formulate questions which focus the information need; to list relevant sources; to know how to learn; to be able to make appropriate decisions; etc.

More recently, Depuis (1997), writing from the perspective of an academic librarian, surveys and references the concept of information literacy as a part of library instruction, noting that 'definitions of information literacy vary slightly from source to source, though the focus is on helping students gain a broad understanding of information sources - including those outside of the library - and honing their ability to deal with that information'. She gives a list of 35 skills necessary for 'creating and nurturing' information literacy, culled from the printed literature and the Internet, which are divided into six principal sections [presented here as a composite of two rather different lists in the original]:

- understanding the information world, including information technologies, while understanding that not all information is found on a computer
- assessing information need, and articulating what information is needed
- assessing and selecting resources, and searching effectively, including and understanding of the structure of literature, the distinctions between controlled and uncontrolled vocabularies, between precise and comprehensive searching etc.
- evaluating and interpreting information, in different formats and media, and employing critical analysis
- manipulating and organising information
- communicating to others the location and content of information found, including citation practices and the integration of new information into an existing body of knowledge

This is very much a composite list, drawn from a number of sources; taken as a whole, it forms a highly ambitious set of skills, which, arguably, very few information professionals would possess in their entirety. This strikes an echo with the thought of Maguire, Kazlauskas and Weir (1994) that information literacy, as commonly propounded, may be a noble concept, but it may also be a utopian one.

As a practical demonstration of this, Olsen and Coons (1989) describe a programme of information literacy education in an academic setting, which appears to have had wide scope, comprising five 'encompassing goals, each of these having between 5 and 8 'subordinate objectives'. The goals, and examples of objectives, were:

- understand the role and power of information in a democratic society
  - how practicing professionals use information and keep currently informed
- understand the variety of the content and format of information
  - distinguish between primary and secondary sources
  - evaluate the quality of information and the usefulness of the content and format of a particular information tool based on relevant criteria
- understand standard systems for the organisation of information
  - determine the index structure and access points of print or computerised information resources
- develop the capability to retrieve information from a variety of systems and in various formats
  - successfully navigate within the libraries they use

- describe the differences between controlled vocabularies and keywords and use both efficiently in their search strategy
- develop the capability to organise and manipulate information for various access and retrieval purposes
  - write correct bibliographic citations for book, journal articles and conference papers
  - use a bibliographic file management package to organise downloaded citations and personal files of references

A more recent exemplification of this approach is a Internet-based 'internet literacy tutorial', offered by Minneapolis Community and Technical College (MCTC 1999); this includes teaching materials, and self-assessment tests, in six areas: production of knowledge; organisation of knowledge; using and evaluating electronic resources; using and evaluating printed resources; citing sources; intellectual freedom, copyright and censorship.

Depuis (1997) advocates that information literacy programmes should not teach skills which are specific to any particular source or situation, but rather promote the learning of generalised processes and principles for selecting, searching and manipulating content. As against this, many information literacy programmes appear to be fairly straightforward extensions of library instruction programmes, with emphasis on specific sources of relevance to each student's studies, albeit taking the broader viewpoint, including research skills; good examples is given by Naito (1991), for students in a wide range of subjects, and by MacAdam (1990) for students of media and communications. In the latter case, although the programme was based in, and provided by, an academic library, many of the sources used came from sources outside the library - personal contacts, interviews, surveys, etc.

While some writers on information literacy, for example Depuis (1997), emphasise that an information literacy programme must include resources other than those in electronic form, this is by no means an universal approach. For example, Williams and Zald (1997) describe the Uwired programme of the University of Washington, a campus-wide initiative with the ultimate aim that information literacy should be a hallmark of a degree from that institution. The primary goal is to create 'an electronic community in which communication, collaboration, and information technologies are integral to teaching an learning'; the core skill areas are electronic mail, the Web and library databases. Presumably the latter implies access to non-electronic material, but the general approach is very much one of information literacy equating with effective use of new information and communication technologies, in a similar manner to Netherlands ICL concept, noted earlier.

The term 'critical thinking', or the largely equivalent 'critical analysis' has been used several times above, as being generally regarded as an important component of information literacy; see, for example, several of the papers in Oberman and Kimmage (1995), and the 'critical thinking and information literacy' curriculum of Bellvue Community College, Washington (Bellvue 1999). This term, as Gibson and Meade (1996) note, is 'sometimes overused, and not well understood'; often, it seems to be equated to a simple evaluation of sources, while actually implying much more. It is also often associated with overcoming the problems of information overload:
'Thanks to science and technology, access to factual knowledge of all kinds is rising exponentially while dropping in unit cost. It is destined to be global and democratic. Soon it will be available everywhere on television and computer screens. What then ? The answer is clear: synthesis. We are drowning in information, while starving for wisdom. The world henceforth will be run by synthesisers, people able to put together the right information at the right time, think critically about it, and make important choices wisely', (Wilson 1998A, p300).

Cheek and Doskatsch (1998), for example, discuss the need for nurses to develop information literacy skills, in order to cope with 'an information overabundant environment'.

There is not space here for a full discussion of the diverse meanings of this term; see, for example, Arp (1995). Here we will follow Gibson and Meade (1996) in suggesting that it is 'a disciplined process of:
- asking informed questions
- posing problems in various ways before attempting to solve them
- examining assumptions
- solving ill-structured, messy, 'real-world' problems
- evaluating sources of information

- assessing the quality of one's own thinking and problem-solving'

plus, crucially, the ability to create mental frameworks to give context to the mass of information which may be available on the subject at hand.

Ford (1991) also argues that one fundamental aspect of information literacy, at least in the sense of library education, will be of librarians helping users to develop frameworks in which information can be understood. Going beyond the information control of a specific discipline, this will deal with the structure of information *per se*, and will be, Ford suggests, particularly important with an increase in interdisciplinary information.

Brouwer (1997) sees information literacy as centred around a form of critical thinking, although, as noted above, he views information literacy itself as one of three components of an expansive vision of computer literacy: 'information literacy mean developing a critical approach to the use of information .. in essence, information literacy boils down to helping students as technology users to ask the right questions about information'. He sees this as involving five components, or competencies:

- distinguishing between information and knowledge
- asking key questions about information, what the source is and what assumptions are contained within information
- assessing the usefulness, timeliness, accuracy and integrity of information
- nor being content with the first six "hits" on a search
- questioning/checking answers provided by technology tools

Information literacy and information specialists

Murdock (1995) argues that the consensus view of information literacy as a means of empowering library users to identify information needs, and locate, evaluate and manage information is flawed, in that it places the onus for locating and managing information on the users, whereas Murdock believes that this is 'properly the province of information specialists, and can provide us with our most exciting professional challenge'. She argues that information literacy should be embodied in libraries' finding technology, so that they become truly user friendly - a view following Breivik's 1989 suggestion that 'we must .. insist on user-friendly information systems as opposed to library systems .. just as we must move beyond programs of library instruction to information literacy - and she '[envisions] information literacy redefined to mean the knowledge needed by information specialists to redesign information retrieval within libraries'.

Brouwer (1997) suggests that librarians have useful experience in information literacy instruction and can serve as valuable resources for this purpose, in promoting his broad concept of computer literacy.

Breivik (1989) makes an explicit link between information literacy and evidence-based practice suggesting that as information literacy becomes established one would hear 'fundamental questions that make information literacy so important: how do you know that - what evidence do you have for that - who says so - how can we find out'. Although this link is made in the specific context of the teaching of information literacy in colleges, it can equally be seen as relevant to the increasingly important role of information professionals in supporting evidence-based practice.

Information literacy and the information society

As noted above, several authors have seen a connection between information literacy and active citizenship, dating from the earliest use of the term. This is put particularly clearly by librarian-turned-Congressman Major Owens (1976):

'Information literacy is needed to guarantee the survival of democratic institutions. All men are created equal, but voters with information resources are in a position to make more intelligent decisions than citizens who are information illiterates. The application of information resources to the process of decision-making to fulfill civic responsibilities is a vital necessity.'

Owens (1991) expanded upon essentially the same point some 15 years later.

Other authors make the same point in different ways: 'The goal of information literacy is to ensure that people understand how to, and why they need to, learn about sources in the information society. Some of these sources

will be in the library; others will be in the world at large' (Depuis 1997). 'Information literacy is a survival skill in the Information Age' (ALA 1989); 'essential for survival in the future' (Rader 1990). Education in information literacy will 'play an important role in keeping the society from fragmenting into a population of information "haves" and "have nots" (Tompkins, Perry and Lippincott 1998). 'Many people consider information literacy to be *the most important* skill for the 90s and for the 21st century' (Naito 1991) [my italics]. Oxbrow (1998) describes information literacy as 'the final key to an information society', and argues that promotion of information literacy within society as a whole is an essential step towards benefiting from a knowledge based society.

Information literacy and literacy per se; 'informacy'
A view expressed by a number of writers, and reviewed by Behrens (1994), is that information literacy, far from being another 'add-on' skill to literacy itself, should be seen rather as a factor causing a change in the nature of the parent concept: 'in the midst of the information explosion, the ability to access, retrieve and evaluate information should constitute a significant part of today's definition of literacy' (Ford 1991). (It was noted above that the same suggestion has been made for the more restricted concept of computer literacy.)

Olsen and Coons (1989) elucidate this clearly:
'We will have to acquire a new bundle of information skills, which will be fundamental to functioning in society ,, we will have to expand the traditional skills of literacy.. we are proposing that true literacy, in an era when information is a strategic global commodity, has to include information literacy .. In short, information literacy is a necessary expansion of the traditional notion of literacy'.

Similarly Kulthau (1987):
'What does it mean to be literate in an information society ? Information literacy is closely tied to functional literacy. It involves the ability to read and use information essential for everyday life'.

and Lanham (1995):
'The word "literacy", meaning the ability to read and write, has gradually extended its grasp in the digital age until it has come to mean the ability to understand information, however presented.'

and Lynch (1998)
'Information literacy .. goes far beyond the traditional textual literacy that has been considered part of a basic education'.

One practical illustration of this view is the trend for educational institutions, which may have made a writing component mandatory in every course, as a means of promoting traditional literacy, to include a similarly mandatory 'information literacy' component, either by adding an additional requirement or by combining the two; see, for example, MacAdam (1990) and Naito (1991).

The term 'informacy' has been used for this widened concept of literacy; see, for example, Neelameghan (1995) and Robson (1998).

Information literacy: criticisms of the concept
Despite the enthusiastic adoption of the term by library/information professionals, and many others, the usage of the phrase, and the concept itself, have not been without their critics, some of them severe. A variety of these criticisms are summarised, from a library viewpoint, by Snavely and Cooper (1997), who quote a particularly trenchant criticism for an anonymous colleague, to the effect that 'information literacy has a hollow sound. It is empty of content and has the connotation of being a fad'.

McCrank (1992), suggests that librarians are imitating the use of an earlier poorly conceived term - computer literacy - by increasingly using a phrase whose meaning is not generally accepted; in particular, he objects to the idea that information literacy in itself can be an educational goal. It is also worth noting that, as mentioned above, the former Bibliographic Instruction Section of the US Association of College and Research Libraries declined to

consider Information Literacy as a suitable new name, in view of its lack of general acceptance in the library community (Snavely and Cooper 1997).

Feinberg (1989), writing in the context of academic information literacy programmes, argues trenchantly that it is not sensible to attempt to teach students to become information literate for the long term, for four reasons:

- it has not been demonstrated that it will be necessary for most students to be information specialists to survive and prosper
- much of what is taught to students under the guise of information literacy has little relevance to their immediate needs, which are typically for a few books or articles in support of essays and projects
- there is no likelihood that most students will retain and use any skills which they may learn
- the information skills and concepts needed in the future are unknown at the present time; teaching information access skills for lifelong learning is therefore a contradiction in terms

Most of the other criticisms are essentially based on the difficulty of assessing, still less accurately measuring, information literacy. On this basis, White (1992) objected to the term, preferring 'information empowerment', which does not carry connotations of a measurable literacy.

Foster (1993) suggests that this is 'a phrase in quest of a meaning', contrasting the parent term literacy, which can be clearly defined, measured and quantitatively summarised, and which has a clear opposite - illiteracy - with a clear remedy. Arguing that the promotion of the information literacy concept is 'an exercise in public relations', Foster suggests that its purpose is essentially to exaggerate the importance of librarians, by inventing a social malady which they alone can cure. Miller (1992) is also troubled by the nature of information illiteracy, which presumably must exist if information literacy does, and implies that librarians are treating clients on a remedial level. Arp (1990) doubts whether the effectiveness of various forms of information seeking behaviour are well enough known to be measured with any accuracy, as would be necessary if some types of behaviour, and hence users, are to classed as information illiterate. She queries whether this label could reasonably be attached to an academic researcher who never uses electronic sources, but purchases their own subscription to a relevant specialised printed source; particularly if this person is also successful in attracting grants, publishing articles, etc. Though this particular example is somewhat dated - it would be difficult in the late 1990s to find a chemical researcher who ignored digital information - the general principle holds good. What may be regarded as essential for information literacy by the library/information specialist may be seen very differently from other professional perspectives. Bruce (1997A, 1997B) makes the same point, from a relational perspective on information literacy, showing how very differently it may be regarded, even by a seemingly fairly similar group of academics and academic librarians.

Mutch (1997) is concerned about the 'alarming divorce of information from knowledge' in discussions of information literacy. He argues that information literacy needs a definition of information which recognises that it is not structured data, nor restricted to the printed word, nor only to formal sources - needs to include insights from varied disciplines, and has doubts about treating the concept as a subject in its own right: 'The quest for information literacy draws us inexorably into deeper questions about the nature of knowledge, pointing again to the need for it to be embedded in subject based thought, rather than being treated as a standalone specialism.' Though he concedes that the phrase 'has some value in expressing what might need to be done if the aims of information policies are to be made concrete', he stresses that this must involve a greater concentration on issues of meaning than is usually the case. Although Mutch does not make the specific connection, these arguments serve to show the potentially strong relations between information literacy and knowledge management. This is made explicit by Abell (1999) who argues that information literacy, as a part of the daily skill set for people across an organisation, is an important part underpinning skill for the introduction of knowledge management.

Information literacy; conclusions
Information literacy, as shown by the various definitions above, is a broader concept than the skills-based literacies described earlier, and, according to the viewpoint of the particular commentator, subsumes them or lies alongside them.

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While information literacy is generally taken to include an ability to deal with electronic sources, it has to some ears a somewhat dated ring; perhaps for this reason, variants of the concept of 'digital literacy' came in vogue during the 1990s, as will now be discussed.

Digital Literacies
In this section, we note the concept of digital literacy itself, and the related network, internet, multimedia- and hyper-literacies. The term 'e-literacy' has occasionally been used, by analogy with e-commerce etc., but its phonetic similarity to 'illiteracy' renders it an unsuitable term, at least in speech !

Digital Literacy or Digital Information Literacy
The term 'digital literacy' has been used by a number of authors throughout the 1990s, to refer to an ability to read and understand hypertextual and multimedia texts; see, for example, Lanham (1995), who treats the term as synonymous with 'multimedia literacy'. Arguing that 'literacy *per se*, in a digital age, means an ability to understand information however presented', and that digital literacy involves the skill of deciphering images, sounds, etc. as well as text, Lanham argues for a fundamental difference between print and digital literacy. The same digital source may generate sounds, images etc., as well as words and numbers, so that the medium of expression may be suited to the information being offered, and to the audience, in a way impossible with print; the digitally literate must be able to understand and assimilate these new forms of presentation.

The concept has been widely popularised, with an emphasis on information retrieval and information management, by Paul Gilster, with his book of the same title (Gilster 1997). Gilster does not attempt to provide structured lists of specific skills or components of digital literacy, which he defines generally as 'the ability to understand and use information in multiple formats from a wide variety of sources when it is presented via computers'. Indeed he specifically states that 'digital literacy is about mastering ideas, not keystrokes' distinguishing this concept, by implication, from more restricted views of computer/IT literacy. And 'digital literacy likewise extends the boundaries of definition. It is cognition of what you see on the computer screen when you use a networked medium. It places demands upon you that were always present, though less visible, in the analog media of newspaper and TV. At the same time, it conjures up a new set of challenges that require you to approach networked computers without preconceptions. Not only must you acquire the skill of finding things, you must also acquire the ability to use these things in your life'. Another fundamental aspect is an appreciation of the two-sided nature of the Internet, allowing both user to interact, communicate and publish, as well as access information. Indeed Gilster sees digital literacy - 'literacy in the Digital Age' - as being a current instantiation of the 'traditional' concept of literacy itself, which has always been seen as involving, at its simplest, both reading and writing.

However, he also gives a somewhat more restrictive definition of digital literacy: 'the ability to access networked computer resources and use them'. His book is firmly centred on the applications of the Internet, so much so that a casual reader might assume that digital literacy and Internet literacy are essentially identical. Indeed, Gilster implies as much in the introduction, setting the challenge of effective use of the Internet into the long sequence of information technologies which began with the inscribed clay tablets of the Sumerians. 'Technology demands of us, as it did of them, a sense of possibilities, a willingness to adapt our skills to an evocative new medium. And that is the heart of digital literacy. Our experience of the Internet will be determined by how we master its core competencies'. However, the understandable assumption from a skimmed reading that Gilster takes digital to equal Internet would be seriously mistaken. On a careful reading, it is clear that he does allow for other forms of input - 'the Internet should be considered one among many sources of ideas in a technological society' and 'no one is asking you to give up other sources of information just to use the Internet' - and emphasises that digital literacy involves an understanding of how to 'back-up traditional forms of content' with networking tools, giving various examples, including reference books in libraries, printed newspapers and magazines, television, and printed works of literature. In the context of 'knowledge assembly, which he regards as one of the core components of digital literacy, he specifically states that this requires 'evidence from multiple sources, not just the world wide web'. It would, therefore, be wrong to equate his conception of digital literacy with a more narrow 'Internet literacy', still less a 'web literacy'. (Lynch 1998 makes a similar point about information literacy - that it must take account of the fact that many important sources are not digital, and will not be for the forseeable future.)

Although, as noted earlier, Gilster does not follow other authors in presenting structured and itemised lists of components and competencies, he does note that 'acquiring digital literacy for the Internet involves mastering a set of core competencies'. These are presented in context throughout a somewhat impressionistic and anecdotal (or 'personal, evangelical and informal', as Nicholas and Williams (1998) put it), though persuasive and authoritive, account of digital literacy, and include:

- the ability to make informed judgements about what is found on-line, which he equates to 'the art of critical thinking', the key to which is 'forming a balanced assessment by distinguishing between content and its presentation',
- skills of reading and understanding in a dynamic and non-sequential hypertext environment
- knowledge assembly skills; building a 'reliable information horde' from diverse sources, with 'the ability to collect and evaluate both fact and opinion, ideally without bias'
- searching skills, essentially based in Internet search engines
- managing the 'multimedia flow', using information filters and agents
- creating a 'personal information strategy', with selection of sources and delivery mechanisms
- an awareness of other people and our expanded ability [through networks] to contact them to discuss issues and get help
- being able to understand a problem and develop a set of questions that will solve that information need
- understanding of backing up traditional forms of content with networked tools
- wariness in judging validity and completeness of material referenced by hypertext links

Various competence-based interpretations of Gilster's work have appeared, typical being the list provided by Larsson (2000).

Gilster's wide-ranging exposition of his topic, which extends to considerations of the future of digital information as well as present practicalities, is such that the reader may find a degree of confusion as to the relative importance of these competencies, and indeed which are truly core to digital literacy. (Indeed, Nicholas and Williams (1998) criticise his book as 'not organised very well or very logically'.) At various points, he refers to the first of them, content evaluation and critical thinking about on-line information, as the 'most essential', 'most significant' and 'overarching' competence, such that if it is mastered 'the other skills will fall into place', and that it 'remains decisive'. [This reflects the attitudes of other authors, such as Landow (1992) and Provenzo (1992), who suggest that critical thinking is changed in its nature, and gains importance, in a digital environment, especially one based around hypertext.] However, Gilster elsewhere suggests the second competence, dealing with dynamic, non-sequential information, as the basis for the concept itself: '[digital literacy] refers to a way of reading and understanding information that differs from what we do when we sit down to read a book or a newspaper. The differences are inherent in the medium itself, and digital literacy involves mastering them'. In another section, he suggests that there are four core competencies of digital literacy, invariant to technology changes:

- knowledge assembly
- Internet searching
- hypertextual navigation
- content evaluation

Gilster, as do other authors, suggests this new literacy has to be seen as an essential life skill - 'becoming as necessary as a driver's licence' - or even (presumably metaphorically) as a 'survival skill'. This, for Gilster, primarily reflects the significance of the Internet, which, if it will not overwhelm each person's life overnight 'will change it, subtly, continually, and with irresistible force'.

Depuis (1997) uses the term Digital Information Literacy, in describing an Office and programme with that name at the library of the University of Texas at Austin. The goal of this programme is to 'enable students, faculty and staff to find, evaluate, and make effective use of digital information', by creating, running and monitoring training programmes and materials for electronic information services; this appears to centre on, while not being restricted to, the Internet. Depuis notes that this Office, while by definition emphasising electronic resources, works with other librarians to ensure that students, in particular, are educated about the complete range of information resources available, including formats other than electronic. Wilson (1998B) uses the term to refer to an ability to evaluate Internet resources, which differs qualitatively and quantitatively from the evaluative skills required for printed material. Digital literacy has also been used to describe specifically the form of literacy needed to deal with

multimedia information (Gritsenko and Dovgiallo 1997), while the term 'mediacy' has been used to express the form of literacy needed to access digital information in various media (Carbo 1997, Inoue, Naito and Koshizuka 1997).

Quite how novel the digital literacy concept is, may be open to debate. Nicholas and Williams (1998) have described Gilster's ideas as limited and well-known; while this may well be so within the library-information community, it seems clear that they have had a considerable impact in the wider sphere.

Digital literacies: network literacy, internet literacy, hyper-literacy, and multimedia literacy
The term 'network literacy' was introduced in McClure (1994), who defined it as 'the ability to identify, access and use electronic information from the network'. It seems little different from the concept of Internet literacy.

Maclure suggests that the basic components of network literacy include:
knowledge:
• an awareness of the range and uses of networked resources
• an understanding of the role and uses of networked information in problem solving and 'basic life activities'
• an understanding of the system by which networked information is generated, managed and made available
skills:
• retrieval of specific types of information from networks
• manipulation of networked information; combining, enhancing, adding value
• use of networked information to help make work-related and personal decision

He notes that these competencies are not 'add ons' to traditional literacy, but rather part of a wider notion of literacy in an electronic society (see, for example, Papert 1993, Tuman 1992), and will require other literacies to be in place. McLure places this literacy, along with traditional literacy, computer literacy and media literacy as four inter-related sets of competencies, within a broader set of 'information problem-solving skills, with information literacy as the intersection of the four.

Devlin (1997) uses the term in the context of instructing students in when to use the Internet as a source on information, and on optimal search strategies.

The term 'networked learner support' has been used to denote a kind of updating of the library/information skills education paradigm, to encompass the broader range of networked sources (see, for example, the papers in *International Journal of Electronic Library Research*, 1(3), 1997, and the editorial in that issue by P Levy). It has also been seen as a specific form of information (or perhaps IT) literacy: 'Entering the information age, the focus has been on information literacy and preparing students for lifelong learning. Networked learning represents a particular form of information technology support to enhance this development' (Schreiber and Moring 1997).

Ohles and Maritz (1998) identify four particular skills for promotion of life-long learning, all relating to use of networked information: use of e-mail, and of professional electronic mailing lists (listservs), searching online databases, and searching the World Wide Web: eschewing the term network literacy, or anything similar, they describe these simply as 'core information competencies'.

The term 'internet literacy', though quite often used informally since 1995, has appeared little in print. It is used as the title of a volume of individual papers (Martin 1997), given the sub-title 'the instruction-web convergence', and covering the twin perspectives of the use of the Internet for teaching, and teaching of the use of the Internet, with some slant towards the perspectives and contribution of the librarian. It appears to denote essentially the same as 'network literacy', and, to a large extent, 'digital literacy'.

'Hyper-literacy' has been used to denote a form of knowledge gathering made possible by the existence of large volumes of text in hypertext (specifically HTML) form (Fillmore 1995). The key concept of this notion is an ability to understand 'how the author's text is accessed, by whom and to what end, and also how the meaning of an author's text changes colour when it is contextualised through juxtapositional linking'. The last point may be understood to mean a consideration of other works to which it is linked, implicitly or explicitly.

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It should be said that the effects of having material available in hypertext form, and indeed the novelty of hypertext itself, have been questioned by some commentators, for example, Lee (1999, p21):
'Despite claims to the contrary by some theorists, hypertext is neither new nor innovative. In nearly all cases .. it is simply providing links .. guiding [users] to other explanatory information or to supplementary material. In other words, exactly the same type of thing good teachers have been doing for centuries, or an imitation of the function of notes in good teaching texts'

The ideas noted above are also those underlying the concept of 'multimedia literacy', used apparently synonymously with 'digital literacy' by Lanham (1995), which, by allowing information to be presented in alternative media, and examined interactively, 'couples fixity and novelty in a fertile oscillation', and 'recaptures the expressivity of oral cultures'.

Naturally, this will imply a clear understanding of the relative value, applicability and best use of printed (sequential) and digital (hyperlinked) texts, and associated multimedia. This form of literacy clearly becomes of more importance as larger volumes of text appear as linked hypertext, leading to Vannevar Bush's concept of the 'enormous mass of the common record', a flexible and continuously increasing corpus of inter-linked human knowledge (Bush 1945). In its emphasis on reading and understanding of texts, these terms seem to have more in common with literacy *per se*, than with the other concepts discussed in this section. As Lanham (1995) puts it ' to be deeply literate in the digital world means being skilled at deciphering complex images and sounds as well as syntactical subtlties of words. Above all, it means being at home in a shifting mixture of words, images and sounds.'

Conclusions

Information literacy and digital literacy are central topics for the information sciences. They are associated with issues as varied as information overload, lifelong learning, knowledge management, and the growth of the information society.

Naturally, they been much discussed in the literature, but not, perhaps, as much as their importance deserves; in particular, they have not impinged much on the practitioner. Practical implementation of, and support for, these sets of skills, understandings and attitudes, apart from the library instruction setting, has been patchy at best This may in part be due to the confusion caused by the varied terminologies and meanings discussed in this review.

The discussion above is intended to clarify the subject area, and hopefully lead to greater take-up of these ideas. Two main points emerge.

First, it is possible, and clearly appealing, for those interested in this area to spend a great deal of time discussing the finer points of, usually mutually contradictory, definitions. The best antidote to this is to adopt a Popperian position of explaining, rather than defining, terms. The labels attached to these concepts do not matter; the concepts themselves, and their significance for practice, do.

Second, it is tempting, again as is clear from the discussion, to express these ideas in terms of sets of particular skills to be learnt, and competences to be demonstrated. While this may be valid for some limited purposes, it is too restrictive overall; even in the supposed skill-based literacies, broader considerations soon intrude.

To deal with the complexities of the current information environment, a complex and broad from of literacy is required. It must subsume all the skill-based literacies, but cannot be restricted to them, nor can it be restricted to any particular technology or set of technologies. Understanding, meaning and context must be central to it. It is not of importance whether this is called information literacy, digital literacy, or simply literacy for an information age. What is important is that it be actively promoted, as a central core of principles and practice of the information sciences.

Acknowledgements

References

A Abell (1999), Investigation of the underpinning skills for knowledge management: underlying implications, paper presented at a meeting on Skills for the Knowledge Economy, TFPL, London, 5 July 1999.

ALA (1989), Final Report, American Library Association Presidential Commission on Information Literacy, Chicago IL [reprinted in full in Coping with information illiteracy: bibliographic instruction for the information age, GE Mensching and TB Mensching (eds.), Pieran Press, Ann Arbor MI, pp 156-171]

L Arp (1995), In search of a definition of critical thinking, in Russian American seminar on critical thinking and the library, C Oberman and D Kimmage (eds.), Graduate School of Library and Information Science, University of Illinois, Occasional papers 200/201, Urbana-Champaign IL, pp 57-67

L Arp (1990), Information literacy or bibliographic instruction: semantics or philosophy, RQ, 30(1), 46-49

P Aufderheide and CM Firestone (1993), Media literacy: a report of the national leadership conference on media literacy, Aspen Institute, Washington DC

DA Barclay (1995), Teaching electronic information literacy, Neal-Schuman, New York NY

SJ Behrens (1994), A conceptual analysis and historical overview of information literacy, College and Research Libraries, 55(4), 309-322

Bellvue (1999), Critical Thinking and Information Literacy, Bellvue Community College, Washington, URL:ir.bcc.ctc.edu/library/ilac/overview, accessed 14/9/99

HS Bhola (1997), Literacy, in International Encyclopedia of Information and Library Science, J Feather and P Sturges (eds.), Routledge, London, pp 277-280

PS Breivik (1991), Literacy in an information society, Information Reports and Bibliographies, 20, 13

PS Breivik (1989), Information literacy: revolution in education, in Coping with information illiteracy: bibliographic instruction for the information age, GE Mensching and TB Mensching (eds.), Pieran Press, Ann Arbor MI, pp 1-6

PS Breivik and BJ Ford (1993), Promoting learning in libraries through information literacy', American Libraries, 24, 98, 101-102

PS Brevik and EG Gee (1989), Information literacy: revolution in the library, Macmillan. New York NY

PS Brouwer (1997), Critical thinking in the information age, Journal of Educational Technology Systems, 25(2), 189-197

C Bruce (1994), Portrait of an information literate person, HERDSA News, 16(3), November, 9-11

C Bruce (1997A), The relational approach: a new model for information literacy, The New Review of Information and Library Research, 3, 1-22.

C Bruce (1997B), The seven faces of information literacy, Auslib Press, Adelaide

C Bruce (1999), Workplace experiences of information literacy, International Journal of Information Management, 19(1), 33-47

LG Burchinall (1976), The Communications Revolution: America's third century challenge', in The Future of Organising Knowledge, Texas A&M University Library, College Station TX

V Bush (1945), As we may think, Atlantic Monthly, 176, 101-108

B Campbell (1990), What is literacy ? Acquiring and using literacy skills, Australasian Public Libraries and Information Services, 3, 149-152

PC Candy, G Crebert and J O'Leary (1994), Developing lifelong learners through undergraduate education, Report No 28, National Board of Employment, Education and Training, Australian Government Publishing Service, Canberra

T Carbo (1997), Mediacy: knowledge and skills to navigate the information superhighway, Proceedings of the Infoethics Conference, Monte Carlo, 10-12 March 1997, UNESCO, Paris

J Cheek and I Doskatsch (1998), Information literacy: a resource for nurses as lifelong learners, Nurse Education Today, 18(3), 243-250

GJ Clifford (1984), Buch und lesen: historical perspectives on literacy and schooling, Review of Educational Research, 54(4), 472-500

C Coles (1998), IT in public libraries: seeking out the user's perspective, Library and Information Research News, 22(no. 70), 35-42

Committee on Information Technology Literacy (1999), Being Fluent with information Technology, http://books.nap.edu/html/being fluent

C Curran (1991), Dealing with user behaviour: a prerequistite for librarian involvment in the information literacy movement, in Information literacy: learning how to learn, J Varlejs (ed.), Mcfarland, Jefferson NC, pp 40-47

NC Daniels (1994), Information technology, the management challenge, Addison Wesley, Reading MA, p67

W Demo (1986), The idea of 'information literacy' in the age of high-tech, Tomkins Cortland Community College, New York NY

HM Dess (1991), Information literacy: a subject source survey and annotated bibliography, in Information literacy: learning how to learn, J Varlejs (ed.), Mcfarland, Jefferson NC, pp 63-82

B Devlin (1997), Conceptual models for network literacy, Electronic Library, 15(5), 363-368

J Dilevko and K Grewal (1998), Neutrality and media literacy at the reference desk, Journal of Academic Librarianship, 24(1), 21-32

CS Doyle (1994), Information literacy in an information society: a concept for the information age, ERIC Clearinghouse, ED 372763, Syracuse NY)

CS Doyle (1992), Outcome measures for information literacy, Final report to the National forum on Information Literacy, ERIC Clearinghouse, ED 351033, Syracuse NY)

P Drucker (1994), Infoliteracy, Forbes ASAP. August 29 1994, 104-109

EA Dupuis (1997), The information literacy challenge: addressing the changing needs of our students through our programs, Internet Reference Services Quarterly, 2(2/3), 93-111. Reprinted in LEM Martin (ed), The challenge of Internet literacy, Haworth Press, Binghampton NY,1997, pp 93-111.

C Dusenbury (1989), Library literacy and lifelong learning, , in Coping with information illiteracy: bibliographic instruction for the information age, GE Mensching and TB Mensching (eds.), Pieran Press, Ann Arbor MI, pp 87-90

JB Fatzer (1987), Library literacy, RQ 26(3), 313-314

R Feinberg (1989), Shorting-out on long-term goals: a different perspective on bibliographic instruction and information literacy, in Coping with information illiteracy: bibliographic instruction for the information age, GE Mensching and TB Mensching (eds.), Pieran Press, Ann Arbor MI, pp 83-85

L Fillmore (1995), EDMedia conference speech, reprinted in revised form in On the Internet, September/October 1995, 37

BJ Ford (1991), Information literacy as a barrier, IFLA Journal, 21(2), 99-101

S Foster (1993), Information literacy: some misgivings, American Libraries, 24 (April), 344

E Garfield (1979), 2001: an information society ?, Journal of Information Science, 1, 209-215

C Gibson and J Meade (1996), Internet resource discovery: the role of critical thinking, in LOEX of the West: Teaching and learning in a climate of constant change, TW Leonhardt (ed.), JAI Press, Greenwich CT, pp 137-146

P Gilster (1997), Digital literacy, Wiley, New York NY

H Graff (1994), The legacies of literacy, in Language and literacy in social practice, J Maybin (ed.), Multilingual Matters, Clevedon Avon, pp 151-167

S-C Graham, D Bawden and D Nicholas, Health information provision in men and women's magazines, Aslib Proceedings, 1997, 49(5), 117-148

WS Grey (1956), The teaching of reading and writing, Unesco, Paris

V Gritsenko and A Dovgiallo (1997), Planning our societies for the multimedia environment: Ukranian experience and the need for international co-operation in digital literacy, International Information and Library Review, 29(3/4), 341-345

RW Haigh (1983), Planning for computer literacy, Journal of Higher Education, 56(2), 161-171

C Hamelink (1976), An alternative to news, Journal of Communication, 26(autumn 1976), 122

T Harris (1993), The post-capitalist executive: an interview with Peter F Drucker, Harvard Business Review, May/June 1993, 115-122

EA Havelock (1986), The muse learns to write, Yale University Press, New Haven CO

J Henri (1997), Information technology literacy in schools, Schools Libraries Worldwide, 3(1), 31-38

R Hillrich (1976), Towards an acceptable definition of literacy, English Journal, 65, 50-55

ED Hirsch (1987), Cultural literacy, Houghton Mifflin, Boston Mass

FW Horton (1985), The knowledge center, Information Management, 19 (February 1985), 20, 22

FW Horton (1983), Information literacy vs. computer literacy, Bulletin of the American Society for Information Science, 9(4), 14-16

Hunter B (1985), My students use computers: learning activities for computer literacy, Reston Publishing, Reston CT

T Husen and TN Postlethwaite (1985), International Encyclopedia of Education, vol. 2C, Pergamon Press, Oxford, p 937

H Inoue, E Naito and M Koshizuka (1997), Mediacy: what is it ?, International Information and Library Review, 29(3/4), 403-413

R Jackson (1989), Transforming the ACRL Model Statement of Objectives into a working tool, , in Coping with information illiteracy: bibliographic instruction for the information age, GE Mensching and TB Mensching (eds.), Pieran Press, Ann Arbor MI, pp 61-80

DW Johnson (1986), Evaluation of library literacy projects, Library Trends, 35(2), 311-326

J Johnson (1985), Information literacy: academic skills for a new age (Report ED 270042), University of Michigan Institute for Social Work, Ann Arbor MD

B Johnston and S Webber (1999), Information literacy as an academic discipline;, paper presented at the 3rd British-Nordic conference on Library and Information Studies, Swedish School of Library and Information Science, University of Boras, Sweden, April 1999

J Kanter (1996), Guidelines for attaining information literacy, Information Strategy, 12(3), 6-11

J Kanter (1992), Managing with information, Prentice Hall, Englewood Cliffs NJ

J Kanter (1988), information literacy for the CEO, Journal of Information Systems Management, 5 (Winter 1988), 52-57

ER Kintgen, BM Kroll and M Rose (eds.) (1988), Perspectives on literacy, Southern Illinois University Press, Carbondale IL

R Kubey (ed.) (1997), Media literacy in the information age: current perspectives, Transaction Publishers, New Brunswick NJ

CC Kulthau (1987), Information skills for an information society (Report ED 297740), ERIC Clearinghouse on Educational Resources, Syracuse NY

GP Landow (1992), Hypertext, metatext and the English canon, in MC Tuman (ed.) (1992), Literacy online, University of Pittsburgh Press, Pittsburgh PA, pp 67-94

RA Lanham (1995), Digital literacy, Scientific American, 273(3), 160-161

L Larsson (2000), Digital Literacy Checklist, Health Services, University of Washington, http://depts.washington.edu/hserv/teaching/diglit/diglit.htm

S Lee (1999), Forging links: the virtual seminars for teaching literature project', in Teaching European literature and culture with communication and information technologies, S Porter and S Sutherland (eds.). CTI Centre for Textual Studies Occasional Series Number 3, Oxford, pp 19-23

KE Lowell (1997), Computer literacy as a formal requirement in library science education, Journal of Education for Library and Information Science, 38(3), 191-199

MF Lenox and ML Walker (1992), Information literacy: challenge for the future, International Journal of Information and Library Research, 4(1), 1-18

C Lynch (1998), Information literacy and information technology literacy: new components in the curriculum for a digital culture, http://staff.cni.org/~clifford/papers/cni-info-it-lit.html

B MacAdam (1990), Information literacy: models for the curriculum, College and Research Libraries News, 51(10), 948-951

C Maguire, EJ Kazlauskas, and AD Weir (1994), Information Services for Innovative Organisations, Academic Press, San Diego CA

L Main and C Whitaker (1991), Automating literacy, Greenwood Press, New York NY

LEM Martin (ed) (1997), The challenge of Internet literacy, Haworth Press, Binghampton NY

CR McClure (1994), Network literacy: a role for libraries, Information Technology and Libraries, 13, 115-125

LJ McCrank (1992), Academic programs for information literacy: theory and structure, RQ, 31 (Summer 1992), 485-497

K McGarry (1994), Definitions and meanings of literacy, in Skills for life: the value and meaning of literacy, K Barker and R Lonsdale (eds.), Taylor Graham, London, pp 3-17

K McGarry (1993), The changing context of information (2nd edn.), Library Association Publishing, London

K McGarry (1991A), Literacy, communication and libraries, Library Association Publishing, London

K McGarry (1991B), Differing views of knowledge, in Knowledge and communication; essays on the information chain, AJ Meadows (ed.), Library Association Publishing, London

MCTC (1999), Internet Literacy Tutorial, Minneapolis Community and Technical College, URL:www.mctc.mnscu,edu/acad/library/tutorials/infolit/home.htm, accessed 21/6/99

M Meek (1991), On being literate, Bodley Head, London

GE Mensching and TB Mensching (eds.) (1989), Information literacy: revolution in education, in Coping with information illiteracy: bibliographic instruction for the information age, , Pieran Press, Ann Arbor MI

W Miller (1992), The future of bibliographic instruction and information literacy for the academic librarian, in The evolving educational mission of the library, B Baker and ME Litzinger (eds.), American Library Association, Chicago IL, pp 144-150

PA Mosley (1998), Creating a library assignment workshop for university faculty, Journal of Academic Librarianship, 24(1), 33-41

EL Morgan (1998), Computer literacy for librarians, Computers in Libraries, 18(1), 39-40

J Murdock (1995), Re-engineering bibliographic instruction: the real task of information literacy, Bulletin of the American Society for Information Science, 21(3), 26-27

A Mutch (1997), Information literacy: an exploration, International Journal of Information Management, 17(5), 377-386

M Naito, An information literacy curriculum: a proposal, RQ, 52(5), 293-296

National Commission on Excellence in Education (1983), A nation at risk: the imperative for educational reform, US Department of Education, Washington DC

National Literacy Act (1991), United States of America, National Literacy Act, section 3

A Neelameghan (1995), Literacy, numeracy .. informacy, Information Studies, 1995, 1(4), 239-249

D Nicholas and P Williams (1998), P Gilster, Digital Literacy (Book review), Journal of Documentation, 54(3), 360-362

C Oberman and D Kimmage (eds.) (1995), Russian American seminar on critical thinking and the library, , Graduate School of Library and Information Science, University of Illinois, Occasional papers 200/201, Urbana-Champaign IL

M Ochs et. al. (1991), Assessing the value of an information literacy program, ERIC Clearinghouse, ED 340385

JA Ohles and CA Maritz (1998), Integrating core information competencies into a traditional curriculum, Medical Reference Services Quarterly, 17(3), 13-24

JK Olsen and B Coons (1989), Cornell University's information literacy program, in Coping with information illiteracy: bibliographic instruction for the information age, GE Mensching and TB Mensching (eds.), Pieran Press, Ann Arbor MI, pp 7-20

WJ Ong (1982), Orality and literacy, Methuen, London

CSH Ovens (1991), Computer Literacy and libraries, Electronic Library, 9(2), 85-89

MR Owens (1991), Towards an information literate society, in Information literacy: learning how to learn, J Varlejs (ed.), Mcfarland, Jefferson NC, pp 48-57

MR Owens (1976), State, government and libraries, Library Journal, 101(1), 27

N Oxbrow (1998), Information literacy - the final key to an information society, The Electronic Library, 16(6), 359-360

J Oxenham (1980), Literacy, writing, reading and social organisation, Routledge and Kegan Paul, London

S Papert (1993), Obsolete skill set: the 3Rs; literacy and letteracy in the media ages, Wired (May-June 1993), 50

S Pinfield (1998), The use of BIDS ISI in a research university: a case study of the University of Birmingham, Program, 32(3), 225-240

EF Provenzo (1992), The electronic Panopticon, in MC Tuman (ed.) (1992), Literacy online, University of Pittsburgh Press, Pittsburgh PA, pp 167-188

KT Quinn (1991), Information literacy in the workplace, in Information literacy: learning how to learn, J Varlejs (ed.), Mcfarland, Jefferson NC, pp 13-22

H Rader (1991), Bibliographic instruction or information literacy, College and Research Libraries News, 51(1), 18-20

H Rader (1990), Information literacy: a revolution in the library, RQ 31 (Fall 1991), 25-29

H Rader and W Coons (1992), Information literacy: one response to the new decade, in The evolving educational mission of the library, B Baker and ME Litzinger (eds.), American Library Association, Chicago IL, pp 118-128

V Raskin (1992), Naturalizing the computer, in MC Tuman (ed.) (1992), University of Pittsburgh Press, Pittsburgh PA, pp 189-209

M Reichel (1991), Library literacy, RQ 31(1), 25

M Reichel (1990), Library literacy, RQ 30(1), 46

T Ridgeway (1990), Information literacy: an introductory reading list, College and Research Libraries News, 51(7), 645-648

J Robson (1998), Say informacy, Library Journal, 123(18), 8

RSA (1993), RSA computer literacy and information technology (2nd edn.), Heinemann Educational, Oxford.

J Rudolph, PM Smith and RS Argall (1996), The Library Literate, Kendall Hunt Publishing Company, Dubuque, IO

T Schrieber and C Moring (1997), Communicative and organisational competencies of the librarian in networked learner support, International Journal of Electronic Library Research, 1(3), 299-310

HJ Schwartz (1992), Computers as cultural artifacts, in MC Tuman (ed.) (1992), Literacy online, University of Pittsburgh Press, Pittsburgh PA, pp 95-108

JJ Shapiro and SK Hughes (1996), Information technology as a liberal art: enlightenment proposals for a new curriculum, Educom Review, 31(2), March/April

ED Sheppard and D Bawden, More news, less knowledge ? An information content analysis of television and newspaper coverage of the Gulf War, International Journal of Information Management, 1997, 17(3), 211-228

L Siitonen (1996), Information literacy: gaps between concept and application, in 62nd IFLA General Conference Proceedings, August 25-31 1996, IFLA, Den Hague

L Snavely and N Cooper (1997), The information literacy debate, Journal of Academic Librarianship, 23(1), 9-20

L Stone (1969), Literacy and education in England, Past and Present (number 42), 120-121

B Street (1984), Literacy in theory and practice, Cambridge University Press, Cambridge

P Synge (1990), The fifth discipline: the art and practice of the learning organisation, Doubleday, new York NY

RS Taylor (1986), Value-added processes in information systems, Ablex Publishing Corp., Norwood NJ

RS Taylor (1979), Reminiscing about the future, Library Journal, 104, 1871-1875

P Tompkins, S Perry JK Lippincott (1998), New Learning Communities: collaboration, networking, and information literacy, Information Technology and Libraries, 17(2), 100-106

HW Tuckett (1989), Computer literacy, information literacy and the role of the instruction librarian, in Coping with information illiteracy: bibliographic instruction for the information age, GE Mensching and TB Mensching (eds.), Pieran Press, Ann Arbor MI, pp 21-31

MC Tuman (ed.) (1992), Literacy online; the promise (and peril) of reading and writing with computers, University of Pittsburgh Press, Pittsburgh PA

UNESCO (1986), Revised recommendations concerning the international standardization of educational statistics, UNESCO's standard-setting instruments, V3 B4, Unesco, Paris

B van Weering and T Plomp (1991), Information literacy in secondary education in the Netherlands, Computers and Education, 16, 17-21

D Vincent (1989), Literacy and popular culture in England 1750-1914, Cambridge University Press, Cambridge

HS White (1992), Bibliographic instruction, information literacy and information empowerment, Library Journal, 117 (1), 76

H Williams and A Zald (1997), Redefining roles: librarians as partners in information literacy education, International Journal of Electronic Library Research, 1(3), 253-265.

EO Wilson (1998A), Consilience; the unity of knowledge, Little, Brown and Co., London

MC Wilson (1998B), To dissect a frog or design an elephant: teaching digital information literacy through the library gateway, Inspel, 32(3), 189-195

LJ Wilson (1989), A graduate course in information literacy, , in Coping with information illiteracy: bibliographic instruction for the information age, GE Mensching and TB Mensching (eds.), Pieran Press, Ann Arbor MI, pp 114-115

P Zurkowski (1974), The information service environment: relationships and priorities (Report ED 100391), National Commission on Libraries and Information Science, Washington DC.