British Journal of Educational Technology *Vol 35 No 6 2004* 679–687

Interaction for lifelong learning

Norm Friesen and Terry Anderson

Norm Friesen has been working in the areas of international e-learning standards development and information management at the University of Alberta and Athabasca University since 1997. Terry Anderson is a professor and Canada Research Chair in Distance Education at Athabasca University. He has published widely in the area of distance education and educational technology. Address for correspondence: email: normf@athabascau.ca

Abstract

The term 'lifelong', as applied to education or learning, has been in circulation for more than a quarter of a century. It has played an important role in policy discussions, as well as in studies of the sociology and economics of education. The relationship of this term to the rapidly changing world of information and educational technologies, and to the various conceptions of interaction that are central to these technologies, however, has been considered much less frequently. This paper seeks to shed light on the relationship between lifelong learning and the interactive technologies that have become associated specifically with the Semantic Web. It begins by presenting a fictional narrative to illustrate a lifelong learning scenario in the context of the services and resources that the Semantic Web will be capable of providing. It then proceeds to isolate a number of general characteristics of lifelong learning as they are manifest in this scenario and in recent literature on the subject. The paper then explores how emergent, interactive technologies of the Semantic Web have the general potential to address many of the characteristics of lifelong learning, and hold out the promise of satisfying a wide variety of lifelong learning needs. It will conclude by considering some of the outstanding challenges presented by lifelong learning contexts, and mention some of the limitations of advanced technologies used to address these needs.

Sarah's lifelong learning experience

Sarah was in an excited panic. Her division director had just asked her to fill in for one of her supervisors, who was going on maternity leave. 'This is almost a promotion!' she thought to herself excitedly. It meant that she had earned the trust of her superiors in this small firm, and that her contributions were finally being affirmed. But it also meant more work and responsibility!

Above all, it meant that she would be responsible for the accounts for her unit. But Sarah had little experience in this area, and didn't know how to use her office's accounting package. She now knew she should have at least taken one accounting course in high school!

Published by Blackwell Publishing Ltd., 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA.

Since she now had to get up to speed on all of this over the next week or two, she started up her 'personal trainer' program or 'agent' on her handheld computer as she rode the elevator to her next meeting. Highlighting the next ten days on her calendar, she keyed in 'accounting' and the name of her office's accounting package. She authorized the 'anonymized' use of her professional development profile on which all of her education and training experience and preferences were recorded. This would ensure that her previous experiences, education and skills and her overall learning goals would be taken into account in identifying appropriate learning interactions.

Before everyone had arrived for the meeting, Sarah's computer was able to show her some recommended results: It provided a list of quick courses that were offered on different evenings and weekends at locations around her work and home, and that also fit well with her work and meeting schedules. It also showed some short online courses available from a local school board. These courses included one available as a set of free digital, educational resources or learning objects designed for self-paced, independent study. Her agent indicated that some people in her workplace had already taken this same short course, and two colleagues were just about to start. Although Sarah wasn't sure about all of the security and privacy implications, her software agent could arrange to reveal some of these names by negotiating with the software counterparts of 'trusted' colleagues. If appropriate, she could then invite these to collaborate with her in her learning experience.

This scenario depicts a number of aspects of lifelong learning that are familiar from the literature: its utility in present-day, high-pressure work situations, which are demanding more and more knowledge and flexibility from workers (Edwards, 1997); its tendency to be contextualised and driven by the changing demands of these situations (Fischer, 2001); and its propensity for crossing institutional and jurisdictional boundaries, from public to private provision, and from flexible adult learning to public school curricula (UNESCO, 2001).

This near-future scenario illustrates how emerging, interactive and web-based technologies may be able to directly and effectively address many of these characteristics: web services, semantically-rich mark-up, combined with artificially-intelligent agent technologies will be used to provide educational resources and services in ways that are much more flexible and responsive than is typically the case today (Koper, 2004). These technologies are together frequently identified as the 'Semantic Web'; and in terms of their potential to support educational needs and activities, they have been referred to more specifically as the 'Educational Semantic Web' (Anderson & Whitelock, 2004). Interaction is an indispensable part of these Semantic Web technologies; and this interaction takes place at least as frequently among computational and algorithmic entities as it does between system and users, or among users themselves.

At the same time, the story of Sarah reveals some of the realities associated with lifelong learning—and its provision through advanced information technology—that are somewhat less than ideal. Many of these issues have to do with workplace and employment practices and conditions, and with issues of privacy and control of both information and time. Such issues are as common and recognisable as evening and weekend work, the privacy of personal information accessible on the web, and ad hoc work arrangements that may sometimes be less than equitable.

In its exploration of interactive Semantic Web technology for lifelong learning, this paper will show how these advanced information and communication technologies can effectively address some important characteristics of lifelong learning needs, but will also consider problems that can be associated with this technology, and with the lifelong learning practices it can be used to support.

What is lifelong learning?

The term 'lifelong' as applied to education or learning is said to have first appeared in the 1973 UNESCO 'Report of the International Commission on the Development of Education' (also titled 'Learning to be', and often referred to simply as the 'Faure report' (Faure *et al*, 1972, p. 5)). Both in this classic report and in its subsequent use, the term has been closely allied with the concept of 'the learning society', or more broadly, with the 'knowledge economy' or the 'post-industrial society'. In one of its most frequently quoted passages, the Faure Report urges 'lifelong education' be understood as 'a master concept for educational policies in the years to come for both developed and developing countries' (Faure *et al*, 1972). Governments and non-governmental organisations around the world have been most responsive to this urging. A 2001 UNESCO report, 'Revisiting lifelong learning for the 21st century', emphasises: 'The European union, its members states, many Asian countries, the Organization of Economic Cooperation and Development, and the World Bank are among the entities "developing modern policy discourses on lifelong learning" and otherwise "advocating the need to learn throughout life"' (UNESCO, 2001).

Despite the widespread and growing importance of the word, lifelong learning has been characterised as an 'extra-ordinarily elastic term' (Smith, 2000), one that lacks 'any shared understanding of its usage at the global level' (UNESCO, 2001). However, a number of identifiable characteristics associated with the term 'lifelong learning' have begun to emerge in the recent literature. Many of these characteristics were also illustrated in the story of Sarah, above. Perhaps the most prominent of these is what could be labelled the 'eclecticism' of lifelong learning: the inclusion under this elastic term of the widest range of types of learning, extending from formal, 'age-segregated' manifestations to informal learning, and from learning that is planned, 'intentional' and curricular, to learning that is incidental and incorporated into real-time job aides, communities of practice, and leisure activities (Smith, 2000). In Sarah's story, she is able to choose from traditional, classroom-based short courses, virtual community courses and self-paced options that make use of specially-designed 'learning objects'. Moreover, she has the possibility of interacting with others at her workplace as unofficial mentors for ongoing guidance during and after her short learning programme.

This fundamental inclusivity of lifelong learning entails a further characteristic: what could be called its integrated and 'holistic' nature (UNESCO 2001): 'Lifelong learning', as the UK National Institute of Adult Continuing Education (NAICE, 2003) explains, 'requires an education system which connects the different levels of provision together into a coherent whole'. Such an interconnected system, the same source continues, requires integrated 'accreditation and certification mechanisms' such as standardised

portfolios and other records of lifelong learning. This characteristic figures prominently in the story in terms of the course providers available to Sarah, which are both public and private, high school and post-secondary. It also is apparent in terms of Sarah's use of a professional development profile on which all of her education and training experience is recorded.

Recent discussions of lifelong learning also emphasise its 'embedded' character, pointing to the increasing 'integration of working and learning' and the concomitant requirement for 'information contextualised to the task at hand' (Fischer, 2003). In order for learning to be embedded, contextualised and integrated with everyday tasks, it must also be flexible, and this flexibility must extend to its spatial and temporal dimension, accommodating learning, as is so often said, 'anywhere' and 'anytime' (eg, Selwyn & Gorard, 2003). Others extend this to the method and medium used in learning, saying that the medium should accommodate a multiplicity of learning and teaching methods, whether these be collaborative, constructivist, situated or otherwise. Such instruction, it is argued, should be available using manifold media, including text, video and multimedia. Thus, to the characteristics of 'anytime' and 'anywhere' is added 'anyhow' (Selwyn & Gorard, 2003, p. 78). These three broad characteristics of lifelong learning, of course, are featured prominently in the story. Sarah is offered a self-paced, online course (using learning objects) that could be taken anywhere and at anytime. She is also offered a range of modes of instruction and support, including options for classroom learning and collaborative learning.

To summarise, lifelong learning is characterised by a wide variety of types of learning opportunities, and these opportunities are often shaped significantly by learner-defined requirements and contexts. Optimally, such opportunities should also be available in multiple formats, anytime and at any place.

Lifelong learning and the Educational Semantic Web

Given the eclectic, holistic and flexible nature of lifelong learning outlined above, actually and effectively supporting this type of learning is, of course, no easy matter. It is unlikely that the protean and ubiquitous forms of learning associated with the term lifelong learning can be adequately addressed as a whole through any single technology, or public or private service. However, as indicated above, the Semantic Web can provide a set of technologies that may, when combined with services and practices, be of great help in addressing a significant number of these widely varying characteristics.

As Tim Berners-Lee, the inventor of the WWW, explains, the Semantic Web is an extension of today's web, but it differs in at least one important respect:

> Most of the Web's content today is designed for humans to read, not for computer programs to manipulate meaningfully. Computers can adeptly parse Web pages for layout and routine processing—here a header, there a link to another page—but in general, computers have no reliable way to process the semantics. (Berners-Lee, Hendler & Lassila, 2001)

But with the Semantic Web, these documents are structured or marked up such that they become ' "intelligent" Web pages' (Semaview, 2004), containing semantically 'tagged', self-explanatory, or 'smart data' (Daconta, Obrst & Smith, 2003). In this way, processable semantics are brought 'to the meaningful content of Web pages, creating an environment where software agents roaming from page to page can readily carry out sophisticated tasks for users' (Berners-Lee *et al*, 2001).

It is just such an agent that assists Sarah in addressing her personal lifelong learning needs. Using structured 'intelligent' or 'smart' content, this agent is able to identify potential education providers in Sarah's vicinity. It is also able to determine whether these providers have courses relevant to the accounting application she identified, to determine when and where these courses are offered, and whether they meet any constraints such as price or credentialling that may be noted in Sarah's personal learning record. Finally, it is able to relate these times and places to Sarah's schedule, and securely negotiate any registration details. Such a set of processes relies on inferential logic technologies operating upon information that is defined and tagged to a high level of detail using a number of interrelated descriptors, classifications or 'ontologies' (see Berners-Lee *et al*, 2001, for more detailed explanations of these technologies). It is important to note that similar Semantic Web technologies are being developed for a range of commercial and other applications that far exceed the scale of those envisioned here for the 'educational' Semantic Web.

It is important to note that in the Semantic Web technologies described in Sarah's story, the interaction that occurs does not fit in the traditional rubrics of 'student-student', 'student-content', and 'student-teacher' types of interaction identified in Moore's widely-cited editorial of 1989. Much of the interaction might fall under what Anderson and Garrison (1998) have more recently identified as 'content-content interaction', where content that is structured or 'self-aware'—whether algorithmic, database-driven or intelligent Web pages—interacts with other content: it 'retrieve[s other] information, operate[s] other programs, make[s] decisions, and monitor[s] resources on networks' (p. 109).

The interactive and functional characteristics of the Semantic Web also fit well with those characteristics of lifelong learning that constitute its 'eclectic' and 'holistic' nature. The Semantic Web provides mechanisms that are very well-suited to the integration of offerings and data of organisations, sectors and forms of educational provision that have traditionally remained separate in their delivery and administration, and also in their priorities and cultures. In terms of both the data infrastructure and the administrative and service aspects of these organisations, this separation has been recently (and with increasing frequency) been described in terms of 'silos' or 'stovepipes' 'that have many duplicated functions and are monolithic, non-extensible and non-interoperable' (eg, Daconta *et al*, 2003; Dorman, 2002). For a user today, the lack of this 'extensibility' and 'interoperability' translates into time and effort spent drilling down into a number of separate or 'stovepiped' database systems to retrieve course titles, subjects and dates and other details—and then working with each institutional

or provider system to register, and to later access course results, transcripts, and even credentialling as a whole. Daconta, Obrst and Smith emphasise, 'Breaking down stovepipe systems needs to occur on all tiers of enterprise information architectures; however, the Semantic Web technologies will be most effective in breaking down stovepiped database systems.' In this context, the Semantic Web is a necessary, but not a sufficient condition to make this sharing of data and services a reality. Such a reality, of course, entails not just technological solutions, but (perhaps most importantly) modifications in policy and priorities of educational institutions.

E-portfolios, although not typically conceptualised as a part of the Semantic Web, play an important role in realising the kind of seamless integration and provision that are a part of the fictional lifelong learning scenario described earlier. E-portfolios have been envisioned (and are being realized, eg, CRA, 2004) as electronic transcripts, records of learning achievement, products and goals that can constitute 'a lifelong work in progress' (NLII, 2003). As such, they represent the kind of data that is structured or smart data, and can therefore be integrated with the ontologies and inferential processing systems of the Semantic Web. The type of structured data that these e-portfolios contain can be as specific and detailed as to cover the competencies and training that are part of a particular professional development 'paths' of specific roles and positions in a given organisation. This same, structured e-portfolio data can also be so general as to include transcript information that can be passed between and recognised by credentialling institutions (Ittelson, 2001). Furthermore, this type of data could be supplemented by information that is being explored under the rubrics of 'personalisation, or user modelling'. Such information would focus on the learner's preferences and particular (dis)abilities (eg, Kay, 2001).

The profound flexibility associated with lifelong learning—the need for it to take place 'anywhere', 'anytime', and 'anyhow'—can also be addressed with the help of Semantic Web technologies. However, the lifelong learning narrative provided above indicates that it may not be a question of the Semantic Web somehow providing learning opportunities simply without temporal, spatial or methodological condition or restriction. Rather, the inferential power and structured content of the Educational Semantic Web is able to provide Sarah with choices between different temporal, spatial and methodological *restrictions* and *constraints*: she is able to choose, for example, between places of provision if she is inclined towards traditional classroom educational methodologies; she is also provided with persons available if she selects a more informal, collaborative or mentored approach. Finally, if she chooses learning that can occur relatively free of place and time, she would be obliged to utilise a self-paced approach that makes use of 'learning objects' designed for independent study. While the Semantic Web, in all of these eventualities, does not eliminate restrictions of time and place, it reduces the constraining influence of these factors, and greatly assists in choosing between the relative advantages presented by different learning opportunities.

Challenges presented by lifelong learning and the Semantic Web

There are aspects of the lifelong learning scenario considered at the beginning of this paper that, of course, are clearly less than ideal. Perhaps the most prominent of these is the issue of privacy. This issue seems most evident in the process of compiling and being bound to a 'lifelong learning record' in the form of an e-portfolio. In exploring the possibility of a 'universal repository' of these kinds of academic records, Ittelson admits that 'such a universal academic electronic-identity (e-identity) clearinghouse might look much like a credit bureau'—a type of organisation which he acknowledges is 'almost universally hated by the general public' (2001). Ittelson also admits that creating such an e-portfolio 'clearinghouse' with 'adequate security' and sufficient ease of use would be a 'formidable task' (2001). The notion of educational institutions dissolving their 'stovepiped' data management in the context of the Semantic Web presents further concerns related to privacy and security. It also presents administrative and policy challenges that organisations with investments and cultures embedded in older education provision models will find problematic. It is perhaps no coincidence that this language of 'stovepipes', and the need to break them down, is one that is also associated with the American Patriot Act, and the multiple invasions of personal privacy that many see it as enabling (eg, Wortzel, 2002). Semantic Web technologies of ontologies and machine inference have been seen as key to closer monitoring of public, individual financial and other transactions for the purposes of greater 'homeland security' (DARPA, 2002).

There are also a variety of institutional and other challenges that must be addressed before some of the more *positive* aspects of the scenario described above can be realised. It will be necessary to change patterns of interaction and cooperation between public and private educational institutions, and for these institutions to change their own, internal policies and practices of provision and information management. It will also be necessary to continue to develop sophisticated Internet technologies such as those associated with the Semantic Web. Although technological progress of this kind is sometimes made to appear inevitable, the practicality and plausibility of a number of the technologies associated with the Semantic Web have been subject to some doubt. Some, for example, have questioned the practical and cost considerations entailed by the detailed tagging of courses, services, and learner records that is a necessary precondition of the successful operation of an educational sub-domain of the Semantic Web (eg, Downes, 2004). Others have pointed out that the Semantic Web appears to resurrect technologies and approaches associated with the earlier 'failed experiments' of Artificial Intelligence (see Berners-Lee, 1998; Dreyfus, 1992). They put into question, in other words, the capability of software agents to inferentially process structured but heterogeneous web data—or as Anderson and Garrison would put it, they question the ability of 'content' to 'interact' in an educationally meaningful way with other 'content' (1998).

Conclusion

In a recent online discussion of the educational Semantic Web, one participant noted that these technologies are 'still largely pie in the sky, but falling rapidly enough to keep

an eye on' (Headshift Blogger, 2004). The intention of this paper has been to highlight the positive potential of the Semantic Web for lifelong learning, while keeping an eye on where it might 'land' as it moves from vision to reality.

In the interests of realising the positive potential of the emerging Semantic Web for lifelong learning, the authors of this paper would like to conclude by suggesting directions for ongoing and upcoming research and development in this area. One area of ongoing research and development has developed out of work related to learning objects and learning object metadata. The potential of learning objects to provide flexible, self-directed learning experiences has already been mentioned in this paper. The fact that many collections of learning objects have already been provided with detailed descriptive tagging or meta-data, and have been developed as a part of interoperable, standards-based architectures, makes them fertile ground for nascent Semantic Web development. It is no coincidence that writing and presentations highlighting the possible connections between these two areas are not uncommon (eg, Allert, Richter & Neidl, 2003; Nilsson, Palmér & Naeve, 2002).

A second direction for research and development that also received mention earlier in this paper is connected with e-portfolios. There are, of course, a number of serious security and administrative issues entailed by the sharing of lifelong learning e-portfolio information. Such issues, however, are being tackled with some success in the context of an ambitious programme in the United Kingdom (CRA, 2004), and similarly ambitious visions are being articulated in the North American context (eg, Ittelson, 2001). In the case of both policy environments, one important factor that would assist with the secure and controlled interchange of e-portfolio information is the implementation of technical standards not only for e-learning information systems, but for the mark-up or tagging of e-portfolio data itself. The use of such standards also have the potential to assist and accelerate the integration of this data with the services and technologies of the Semantic Web, and it is in this context that the authors of this paper suggest that further research and development work would also be most effective.

References

Allert, H., Richter, C. & Nejdl, W. (2003). *Learning objects on the semantic web explicitly modelling instructional theories and paradigms*. Retrieved online at: http://projekte.learninglab.unihannover.de/pub/bscw.cgi/d11411/Learning%20Objects%20and%20the%20Semantic%20Web%20-%20Explicitly%20Modelling%20Instructional%20Theories%20and%20Paradigms

Anderson, T. & Garrison, D. R. (1998). Learning in a networked world: new roles and responsibilities. In C. Gibson (Ed.), *Distance learners in higher education* (pp. 97–112). Madison, WI: Atwood Publishing.

Anderson, T. & Whitelock, D. (2004). The educational semantic web: visioning and practicing the future of education. *Journal of Interactive Media in Education 1*. Retrieved online 24 April at: http://www-jime.open.ac.uk/2004/1

Berners-Lee, T. (1998). What the semantic web can represent. *Design issues: architectural and philosophical points*. W3C. http://www.w3.org/DesignIssues/RDFnot.html

Berners-Lee, T., Hendler, J. & Lassila, O. (2001). The semantic web. *Scientific American, 284*, 5. Retrieved online at: http://www.sciam.com/2001/0501issue/0501berners-lee.html

CRA (2004). *The Centre for Recording Achievement*. Retrieved online at: http://www.recordingachievement.org/

Daconta, M. C., Obrst, L. J. & Smith, K. T. (2003). *The semantic web—a guide to the future of XML, web services, and knowledge management*. New York: Wiley.

DARPA (2002). *Total Information Awareness Program (TIA) System Description Document (SDD) Version*. Retrieved online at: http://www.epic.org/privacy/profiling/tia/tiasystemdescription.pdf

Dorman, R. (2002). *Interoperability challenges*. In the US D.o.D. Interoperability Summit, 2002. Retrieved online at: http://www.omg.org/interop/presentations/2002/Ron_Dorman.pdf

Downes, S. (2004). *Whither the semantic web*. Stephen's Web. Accessed from the WWW September 1, 2004: http://www.downes.ca/cgi-bin/website/view.cgi?dbs=Article&key=1087499522

Dreyfus, H. L. (1992). *What computers still can't do: a critique of artificial reason*. Cambridge, MA: MIT Press.

Edwards, R. (1997). *Changing places? Flexibility, lifelong learning and a learning society*. London: Routledge.

Faure, E., Herrera, F., Kaddoura, A.-R., Lopos, H., Petrovsky, A. V., Rahnema, M. & Ward, F. C. (1972). *Learning to be: the world of education today and tomorrow*. Paris: UNESCO. URL: http://www.downes.ca/cgi-bin/website/view.cgi?dbs=Article&key=1087499522 (June 17, 2004).

Fischer, G. (2001). Lifelong learning and its support with new nedia. In N. J. Smelser & P. B. Baltes (Eds), *International encyclopedia of social and behavioral sciences*. Amsterdam: Elsevier.

Fischer, G. (2003). Making learning a part of life. *The Learning Citizen Cluster Newsletter*, November, 12–13.

Headshift Blogger (2004). *Some papers on the educational semantic web*. Retrieved online 12 June at http://www.headshift.com/archives/001644.cfm

Ittelson, J. C. (2001). Building an e-dentity for each student. *EDUCAUSE Quarterly*, *24*, 4. Retrieved online at: http://www.educause.edu/ir/library/pdf/EQM0147.pdf

Kay, J. (2001). User modeling and user-adapted interaction. *The Journal of Personalization Research*, *11*, 1/2, 111–127.

Koper, R. (2004). Use of the semantic web to solve some basic problems in education: increase flexible, distributed lifelong learning, decrease teacher's workload. *Journal of Interactive Media in Education, 1*. Retrieved online April 24, 2004 at: http://www-jime.open.ac.uk/2004/6

Moore, M. (1989). Three types of interaction. *American Journal of Distance Education*, *3*, 2, 1–6.

NAICE (2003). *What is lifelong learning?* National Institute of Adult Continuing Education. Retrieved online at: http://www.niace.org.uk/Information/Lifelong_Learning/Lifelong_learning.htm

Nilsson, M., Palmér, M. & Naeve, A. (2002). Semantic web metadata for e-learning—some architectural guidelines. *WWW2002 Conference*. Retrieved online at: http://www2002.org/CDROM/alternate/744/

NLII (2003). The digital me. *NLII Annual Review: The Digital Academy*. Retrieved online at: http://www.educause.edu/nlii/annual_review/2003/digitalme.asp.

Smith, M. K. (2000). The theory and rhetoric of the learning society. *The encyclopedia of informal education*. Retrieved online at: www.infed.org/lifelonglearning/b-lrnsoc.htm

Selwyn, N. & Gorard, S. (2003). Exploring the 'new' imperatives of technology-based lifelong learning. *Research in Post-Compulsory Education*, *8*, 1, 73–92.

Semaview Corporation (2004). *Bootstrapping the semantic web with intelligent calendars*. Retrieved online at: http://www.semaview.com/resources/semweb.html

UNESCO (2001). *Revisiting lifelong learning for the 21st century*. UNESCO Institute for Education. Retrieved online at: http://www.unesco.org/education/uie/pdf/revisitingLLL.pdf

Wortzel, L. M. (2002). *Creating an intelligent Department of Homeland Security*. Executive Memorandum #828 The Heritage Foundation. Retrieved online at: http://www.heritage.org/Research/HomelandDefense/EM828.cfm