

The development of a system for supporting the lifelong learner

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Abstract

Given the rapidly changing skills needs of 'post-industrial economies', lifelong learning forms an integral part of government policy within the UK and abroad. However, like the UK, most economies are faced with the problem of how to reach those sections of the community that have traditionally not embraced learning and educational opportunities. In this paper, the development and evaluation of a system designed to address this problem is described. The Lifelong Learning in London for All (L4All) project has investigated the concept of 'trails' as a way of organising lifelong learning opportunities. The L4All pilot system combines a set of web services to provide the functionality needed to support this central idea. The development process was outlined, and the findings of an empirical study were used to confirm proof of concept.

Introduction

Lifelong learning has been a prominent theme in UK policy since 1998 (Department for Education and Employment, 1998), a development echoed across Europe and beyond. Lifelong learning is seen as particularly important, given the rapidly changing needs of the post-industrial 'knowledge economies' (Department for Trade and Industry, 1998), with their attendant high-level skills needs. Within this context, the 'concept of career is fast changing from a linear model to a more holistic view of individuals' life and work experiences' (Hughes, 2004, p. 6), leading to the need for better and more timely careers guidance and advice.

This issue is echoed internationally. A recent Organisation for Economic Co-operation and Development (OECD) report has indicated the importance of careers guidance for supporting lifelong learning (OECD, 2004). However, as Bimrose, Barnes, Hughes and Orton (2004, p. 1) indicate, 'there is a lack of compelling evidence regarding the nature of effective guidance and its benefits. Despite this, the strategic and economic role of guidance has been emphasised, and in England, guidance provision for those under 19 years has been enhanced and "refocused" on social inclusion' (see also Taylor, Vasickova, Byrom & Dickson, 2005). In the UK, this approach is visible in the significant investment of public money of the information, advice and guidance services, to support the needs of the 'learning society' (Irving & Slater, 2002). In its recent white paper, *Skills: Getting on in Business, Getting on at Work*, the government proposes 'developing a clear ladder of progression':

To make a reality of lifelong learning, we must develop a package of support which encourages more people to see the value for them and their families of developing progressively higher level skills. (Department for Education and Skills (DfES), Department for Trade and Industry, HM Treasury & Department of Work and Pensions (DWP), 2005, p. 28)

The paper also acknowledges that 'information and guidance must be widely available for all adults who want it' (DfES *et al*, 2005, p. 17). Necessarily, the extended possibilities of lifelong learning imply the need for increasingly complex and timely careers guidance and support, and this extended requirement has implications both for providing useful guidance, coupled with a need for establishing better criteria for assessing need and learner requirements.

Although the statutory obligation to provide careers support for all those under 18 years of age is supported by the Employment and Training Act, 1973, face-to-face careers guidance and support has been found to be patchy and uneven (Bimrose & Hughes, 2006; Bimrose, Mulvey & La Gro, 2003). In part, this is due to a lack of continuity with government policy, which has changed with successive governments reflecting differing funding priorities and opportunities. For example, although currently a not-for-profit organisation, Prospects emerged from the privatisation of the careers service in 1995–96. Most recently, careers guidance provision has been focused upon those with lower skills levels (DfES *et al*, 2005), and has not been given as a legal entitlement to all young adults. To try to plug these serious gaps in provision that affect

not only widening participation but also workforce skills levels (and therefore have a significant impact upon productivity), there is a perceived need for greater cohesion across service provision. The government white paper on the subject (DfES *et al*) and subsequent white papers (eg, the white paper on further education [FE]; Department for Education and Skills, 2006) have attempted to address this substantial issue with a greater emphasis upon collaboration, which, although helpful, still does not guarantee legal entitlement for all, a prerequisite for supporting effective lifelong learning policy.

There are also benefits for higher education (HE) from the provision of effective careers guidance and support (eg, Dodgson & Bolam, 2002; OECD, 2004) such as a link between learner retention and good careers guidance, and this is based upon creating a correct balance of learner expectations in line with real-life experiences that students may have. In this context, good careers guidance involves correcting the false assumptions and replacing these with a more realistic picture of university or of their intended job, of methods of navigating the system and making the best use of opportunities. However, at present, overall careers support and guidance is found to be uneven within schools and colleges, universities and also in the workplace (Hughes, 2004). Uneven coverage—and gaps in provision (Bimrose & Hughes, 2006)—has led some to consider the role of online support as a valid form of careers guidance and support in situations in which face-to-face provision cannot be sustainably provided. Emerging evidence suggests that online provision and support may provide better reach for existing services (Taylor *et al*, 2005). It is envisaged that information and communication technology (ICT) could play a vital role in integrating the services that may be offered by different companies, including public and private partners (see Offer & Sampson, 1999; Taylor *et al*, 2005; Watts & Offer, 2006), as well as in providing ICT-facilitated guidance (eg, Cogoi, 2005). This indicates a need for flexible services that can be provided through portal systems and integrated with other ICT-based services.

While the academic literature has often focused upon these policy-related issues (eg, Selwyn, Gorard & Williams, 2001), more recent work (eg, Koper & Tattersall, 2004; Koper *et al*, 2005) has explored the technical architecture, models and systems needed to underpin effective ICT-supported lifelong learning opportunities. While there has been some emphasis on the issue of social inclusion and widening participation, this has mainly reflected governmental policy initiatives (Gorard & Selwyn, 1999). However, through the UK Joint Information Systems Committee (JISC) Distributed e-Learning (DeL) programme (Davies, 2005) and the Higher Education Funding Council in England Lifelong Learning Networks, dedicated provision is being developed to support this agenda, ie, the development of models and systems to support lifelong learning.

Against a fast-changing digital environment, communications and collaborative e-tools—functionality associated with Web 2.0—are becoming more pervasive and are increasingly developing greater potential for exploitation in learning contexts (Cych, 2006). These e-tools provide greater opportunities for exploring the role that social networks and factors play in making effective career decisions and in supporting educational choices. Such tools also have the potential to facilitate personalised and tar-

geted support for lifelong learners in supported e-collaborative environments (de Freitas & Yapp, 2005).

With the intention of exploring existing e-collaborative support systems, we reviewed a range of UK ICT-based solutions to support lifelong learners in their career decisions and educational choices, including the University for Industry (Ufi) Learndirect service, the Universities and Colleges Admissions Service (UCAS) web service and commercial services such as Fast Tomato. The Fast Tomato system, developed by Morrisby (see <http://www.fasttomato.com>), was found to be particularly engaging, utilising a Flash-based interface. It is currently being used in a quarter of all schools in the UK (M. Larbalestier, interview, April 27, 2005), has recorded 15 million hits and has 125 000 registered users. It is currently the largest online careers service in the UK, and there are plans to develop a similar system for adults (I. Sharp, interview, May 18, 2005). The system brings together information from the UCAS database and the Ufi Learndirect system, which comprehensively lists UK courses. While these ICT-based systems are being widely used by lifelong learners (eg, the UCAS website has around 50 million page impressions per month; UCAS, 2006), no studies are available to indicate the potential impact of these systems upon educational choices and career decisions, and none of these systems utilise an e-mentoring or e-collaborative approach to support.

The need for better e-collaborative support (eg, from tutors, careers advisors and other learners) for pre-participating lifelong learners, the patchy provision of careers and educational support at critical points, and the potential of ICT systems to support these needs provided the rationale that underpinned the development of the Lifelong Learning in London for All (L4All) pilot system. This paper discusses the development of the L4All system, addressing the aims, methodology, technical approach and evaluation of the system.

The L4All project

The L4All project (<http://www.lkl.ac.uk/research/l4all/>), funded under the JISC DeL programme, has focused on supporting the independent lifelong learner, particularly those 16+ learners who traditionally have not participated in HE. L4All aims to provide lifelong learners in the London region with access to information and resources that facilitates their progression from secondary education to FE or from secondary education directly to HE.

The literature suggests that there are merits to the development of holistic approaches to the learner's experience throughout life, particularly in terms of the lifelong learner's *pathway* (McGivney, 2003; Tomkowicz & Bushnik, 2003), as evidenced by the growing adoption of e-portfolios and personal learning planning (Kimball, 2003; Ridgway *et al.*, 2003). To create a more holistic approach, we explored and extended the concept of the 'learner trail' or 'pathway' to provide a new way of looking at learning and professional development. This approach allowed us to engage non-participants in HE and to explore the potential of personalised approaches to the support of lifelong learning.

Previous models of learner choices in career and education, such as those instantiated in Learndirect or Fast Tomato, have been based upon rational and economic choices, and therefore were a poor match with the target learner community. Instead the approach adopted was based upon the early work of Vannevar Bush on trails, in which he described the 'memex' where users can create personalised trails linking different content (eg, text, photographs, entries from encyclopaedias, etc) together; importantly, these trails can then be referred to or shared with others (Bush, 1945). This concept has been further developed by colleagues involved in collaborative research between computer and social scientists at the London Knowledge Lab (eg, Keenoy *et al*, 2004a, b; Peterson & Levene, 2003). The concept has been developed further in the current project to provide the basis for modelling user behaviour and informing system designs. Our approach is based upon pathways of future learning opportunities as well as past episodes of work and learning, which we believed could provide a holistic view of learners' experience of life and greater continuity between their learning and work experiences.

This approach is qualitatively different from those that have gone before in that the learning pathway integrates social factors, providing support throughout lifelong learning rather than compartmentalising learning into one stage or period. The approach is original and provides us with a tool to understand social as well as educational factors that may influence not only how we learn but also how external factors influence career decisions and educational choices made.

L4All allows tutors and learners to create learning pathways through courses and modules registered. As an aid to constructing their own learning pathways, learners are able to search for pathways provided by tutors and other learners using a variety of search criteria. This gives learners a repertoire of learning possibilities that they may not have otherwise considered, allowing sharing of successful learning pathways and presenting successful learners as role models to inspire confidence and a sense of opportunity amongst those previously excluded or underserved—as well as supporting widening participation to prospective learner groups.

Methodology

Three groups of participants were involved throughout the project: (1) FE college students completing Advanced (A) levels, Business and Technology Education Council and diplomas and considering progressing to further study; (2) HE students studying for a diploma in information technology (IT) applications or foundation degree in IT in order to open up possibilities for career development and/or further study in that area; and (3) HE learners returning after previous courses and/or professional experience to pursue a Postgraduate Certificate in Education (PGCE). These three groups were felt to provide a useful diversity of learners with whom to develop and evaluate the system.

The first stage of development involved user requirements elicitation. This was an exploratory phase of work; given the paucity of relevant literature, its purpose was to identify what parts of learners' experiences would need to be captured and to produce

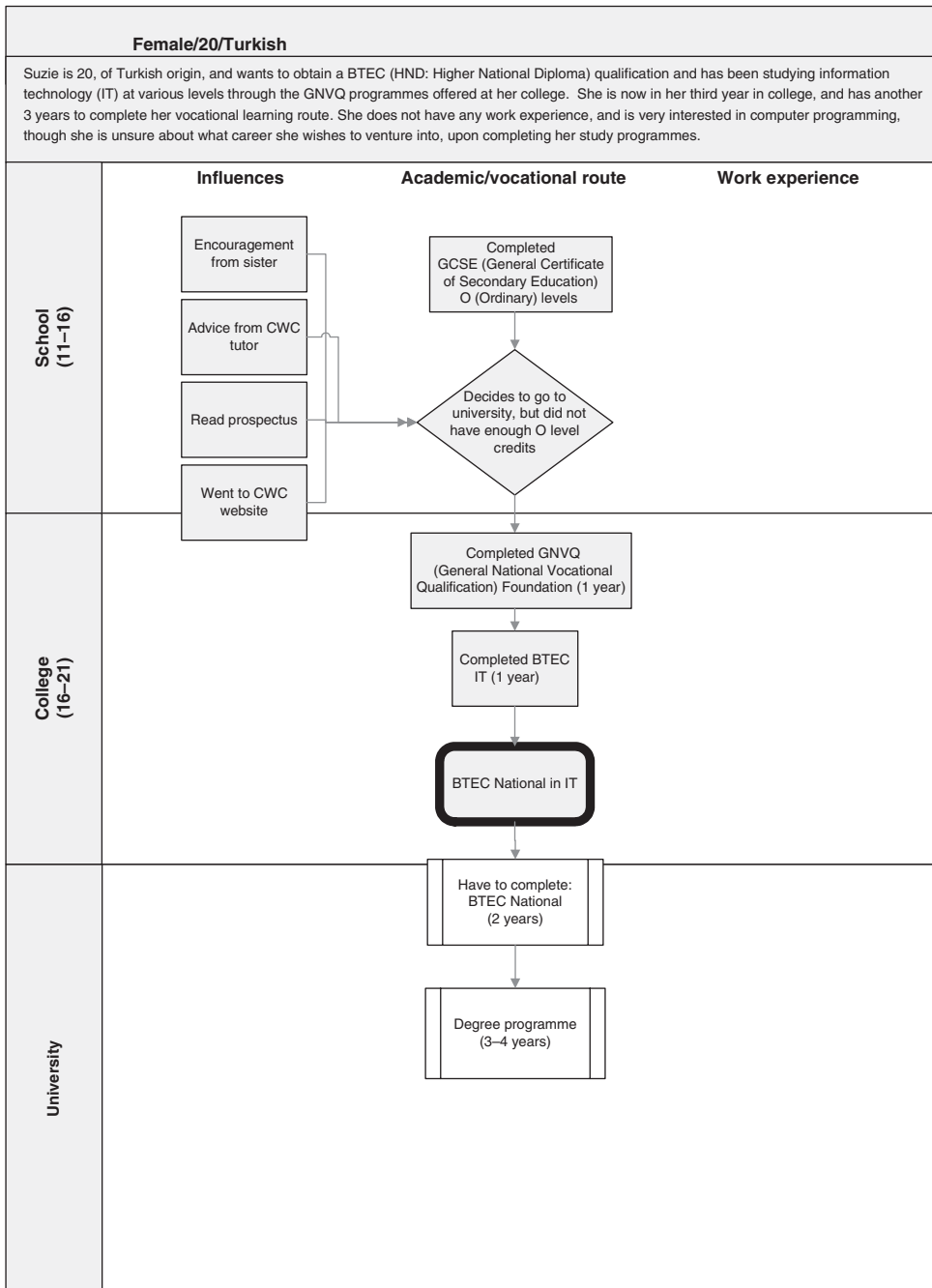


Figure 1: User pathway
BTEC, Business and Technology Education Council

a set of use cases that would be used to derive the user requirements. One-to-one structured interviews were conducted with 20 learners in order to elicit this information. The user requirements elicitation study identified key decision points in their careers and highlighted issues that the system might address in practice.

The data collected from the interviews were presented as decision graphs (see Figure 1; note that user data has been anonymised), which were compared and analysed to identify critical decision points or periods when lifelong learners would need additional support.

These studies served as starting points for developing usage scenarios for the L4All system, which were produced in conjunction with stakeholders, including widening participation officers, careers advisors and tutors in workshop sessions. The outputs of these sessions provided the basis of the user requirements and specification of the system. From these graphs, we produced usage scenarios (see Figure 2) from which key questions were distilled. These usage scenarios, key questions and decision points informed the subsequent formulation of the L4All user requirements and functional specification.

The case study depicted in Figure 2 illustrates one of the issues raised in the analysis. It was important to understand the different routes of study (eg, academic, occupational

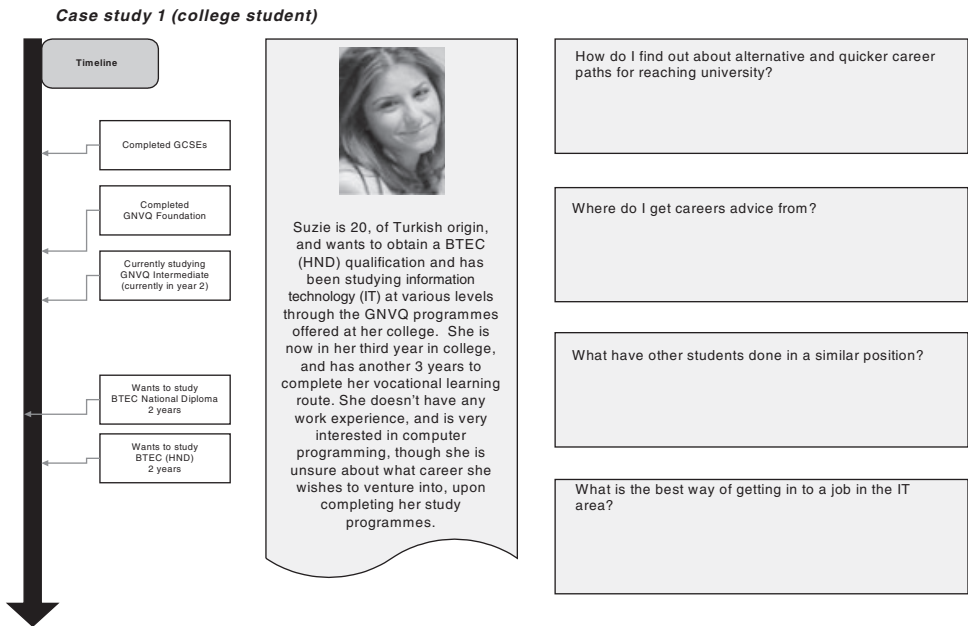


Figure 2: Case study 1: Further education learner BTEC, Business and Technology Education Council

and vocational) that individuals wished to pursue. Advice about which route a learner should take is not always clear, and the large number of different courses can be confusing particularly for young learners. Other learner pathways highlighted different issues, including language difficulties in one case that were so extreme that the learner could not locate the careers office in their college. The need to collate all careers advice in one place was also identified, as was the option for travel connections and transport maps to be made available.

The next step involved the production of a first version of the L4All system. The funding programme mandated a number of technical requirements; eg, that system functionality would be provided, as much as possible, by existing e-tools and services compliant with the JISC E-Learning Framework and service-oriented architecture (http://www.jisc.ac.uk/index.cfm?name=elearning_framework). The first version of the system was used to provide formative feedback on usability, user requirements and usage scenarios by examining how different users interacted with the system. Two observational studies were undertaken; each involved user trials of the software, with a set of tasks for users to complete. A talk-aloud protocol was adopted, and the sessions were video recorded.

Following this, a second version of the system was developed. The evaluation of this second version sought to establish its potential to influence users' decision making about lifelong learning opportunities. This involved six users from each of the three groups using the system to create their own learning pathways and to search for suitable learning opportunities. This second phase of evaluation adopted heuristic evaluation methods focusing upon usability issues, as defined by Nielsen (2006) and Nielsen and Loranger (2006). To ensure that the final pilot was robust enough to cope with real-world use, it was imperative that users evaluate it to assess their acceptance, behaviour and performance, and to determine if the user requirements had been fully met. These sessions were observed, and structured feedback was gathered using an online questionnaire.

Technical specification

The L4All system consists of a set of web-based components and services designed to support the lifelong learner's requirements from a range of different formal and informal learning contexts. To facilitate this end, the architecture comprises two parts: (1) the back-end and (2) the user interface (see Figure 3). The user interface comprises two parts: a web portal that serves as a platform for the user interaction components to be built upon, and a Flash application that interacts with the back-end and presents to the user the L4All functionality relating to the creation of personal timelines, searching the available courses, metadata, searching for other users and other timelines, and obtaining recommendations regarding future learning. The backend connects with resource description framework repositories for storing, retrieving and modifying metadata describing users, courses and timelines. It also calls three external services: the Distributed e-Learning Tool and Resource Architecture metadata search service (<http://www.essex.ac.uk/chimera/delta/index.html>), the Integrated Simple Sequencing (ISIS)

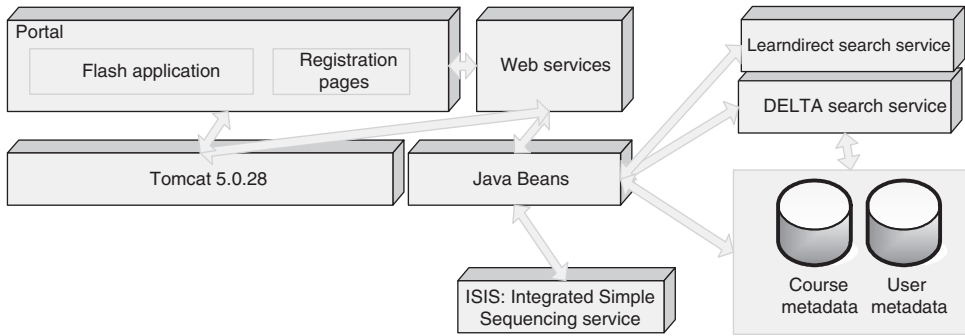


Figure 3: Lifelong Learning in London for All version 2 architecture DELTA, Distributed e-Learning Tool and Resource Architecture

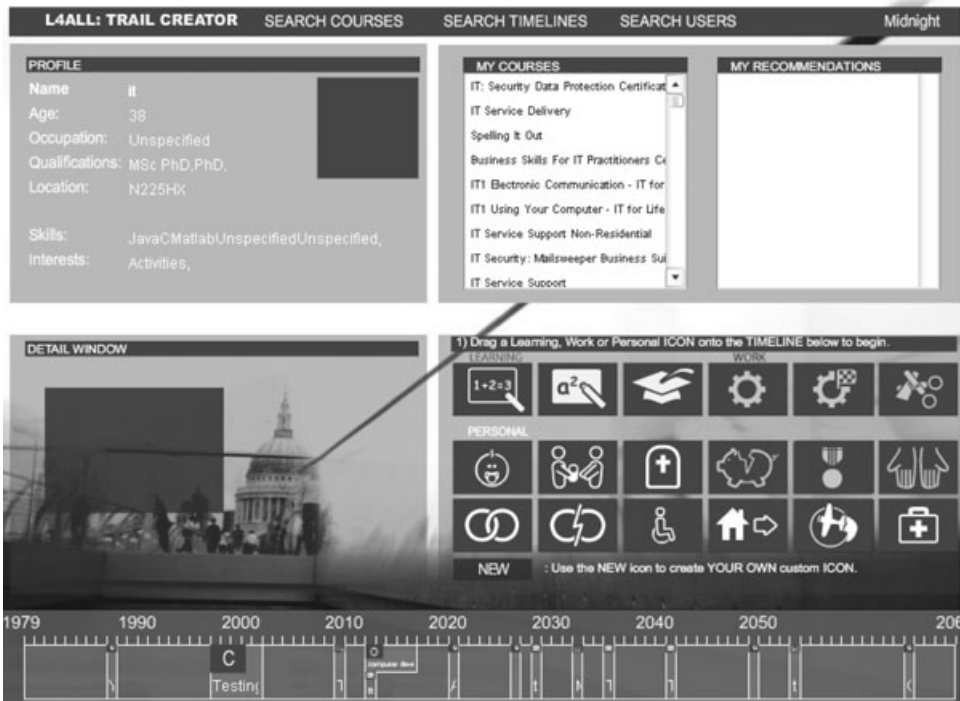


Figure 4: Screen shot from 'dashboard' of Lifelong Learning in London for All system

sequencing service (<http://www.hull.ac.uk/esig/isis.html>) and a service for search and retrieving information about courses in the Ufi Learnirect database (<http://www.learnirect.co.uk/>). Figure 3 illustrates the overall architecture and its major components, while Figure 4 shows the main screen for timeline creation, search and

management. Further technical details of the L4All system are given in Deliverable 6.2 of the project, available at <http://www.lkl.ac.uk/research/l4all/>.

Evaluation

The evaluation activities were designed to inform both design parameters (are these the right tools to develop?) and usability issues and concerns, including accessibility (can learners use them effectively?).

The evaluation included testing a total of 34 students, including 28 students who completed the online survey. This testing included 6 students from the Community College Hackney, 16 students from Birkbeck's Diploma in IT Applications and 12 students training on the Institute of Education PGCE in ICT. Six students did not complete the online survey but responded to discussions undertaken. The survey was undertaken by 6 learners from the Community College Hackney, 13 learners from Birkbeck College and 9 learners from the Institute of Education. The evaluation process was formative and utilised a range of different methodologies including heuristic and educational observational methods and protocols (Nielsen, 2006; Nielsen & Loranger, 2006; Oliver, MacBean, Conole & Harvey 2002). The overall approach aimed to incorporate user requirements and use of the system to inform the iterative design and development of later versions of the system.

This evaluation allowed the identification of problems with the system. Usability errors and failed functionality were recorded and fed back to the development team. These errors included, eg, problems executing searches and a failure to understand terminology (eg, 'trails', the term originally used in the system, which was drawn from the research literature but was meaningless to users, was replaced with the term 'timeline'). Users' comments and post-session debriefing interviews also identified additional desired functionality (eg, journal facility, delivery to mobile phones, asynchronous email facility), which was recorded and will be fed into the specification of future versions of the system.

This second usability evaluation was divided into four sections: aesthetics/navigation and general user experience, timeline creation, search and expectation and quality of user support. This study led to a number of small modifications to improve the usability of the system. For example, one of the issues arising from the heuristic survey and interviews was the need for better guidance and help with using the system.

The final phase of evaluation aimed to establish whether proof-of-concept had been established. Feedback from users focused upon how selected user groups used the pilot system. It involved exploring whether use of the system was perceived to have had an impact on choices about lifelong learning opportunities. Users were invited to complete a range of tasks using the system. Data were gathered in order to evaluate the way in which the system was perceived to have helped them make choices. Specifically, the users were asked to use the main areas of functionality by registering and using the interaction tool to search courses and other users' timelines (as a source of inspiration

for making their own choices). After completing the tasks (eg, registering on the system, searching for courses, creating timelines, accessing resources), users were asked to reflect upon these activities as part of an online survey. The survey was structured according to the project aims and objectives.

A recurrent feature in the feedback from users concerned the moment of ‘crystallisation’, when they realised that their educational and work experiences were deeply interrelated, and that their dream job or area of research was achievable—although in need of planning over quite a long period of their lives. That this reflective experience arose from use of the system was probably the most striking and promising aspect emerging from this study. It demonstrates the value of the tool for helping learners identify what they would like to do as a career and for allowing them to visualise that process (in some cases for the first time) more accurately.

The studies also highlighted important issues about how the tool could be used in practice to support these learners and prospective learners. The studies suggest that the tool could be used in a number of ways: in group careers sessions facilitated by a careers specialist, in one-to-one sessions with a careers advisor, in personal tutorial sessions, collaboratively with one or more other learners, in a classroom session with a tutor, over the Internet from home with parents or friends and over the Internet without assistance. The tool has opportunities for e-collaborative support at critical decision points and may support non-participants to widen their horizons and plan for extended study. The flexibility of the potential usage of the tool implies that it could be provided via a college Intranet or over the Internet. Additionally, it would be desirable to have the information accessible via mobile devices as well. Full details of the evaluation of L4All are given in Deliverable 7.2 on the project website, available at <http://www.lkl.ac.uk/research/l4all/>.

Discussion

In our consideration of how to engage learner groups to participate in HE and further professional development, our user studies indicated that social networks (eg, parental influence, advice from friends and other learners) were extremely important for helping learners to make their educational choices and career decisions. This factor became increasingly important where there was an absence of tutorial or careers advice and support. This project therefore aimed to provide e-collaborative support for these informal social networks through online support and open access to communities of learners and practitioners, through sharing learning pathways and the potential for e-mentoring, which will be further explored in the next phase of development (Wenger, 1998).

The study also indicated that there were critical decision points or periods when the learners needed increased guidance support particularly while making decisions about future education and careers, and at transitional stages such as leaving school or between FE and HE. While a number of assessment tools have been developed to identify this stage in career progression, there needs to be a better understanding about how

support targeted at these critical periods can influence overall career development and educational choices. Self-review tools may prove more useful in the longer term, reflecting the variety of options in the lifelong learner's life. Clearly, there is a broad evidence base for research in the field as previously discussed; however, work centring on the use of ICT to support learners is rather smaller in scope and depth, and is very rarely longitudinal, presenting a partial picture of how social networks and critical decision points can be best supported. Such work also tends to lack holistic understanding of the lifelong learner's pathway.

We are aware that the potential significance of this approach is a long-term one, involving the identification and sharing of successful educational pathways and the impact of this on learner choice. Such impact can only be studied longitudinally, making it feasible as part of the operation of a funded service but difficult to achieve within a pilot. Our further evaluation, effort will focus primarily on evaluating acceptance, usability and perceived impact. The evaluative study will continue into the next JISC-funded MyPlan project in order to provide more longitudinal findings as to the impact of the system upon career choices and educational decisions. The L4All system will also be further developed to support the activities of the Birkbeck-led Linking London Lifelong Learning Network (L4N) over the next four years.

Conclusions

This project has produced a pilot system for supporting the education choices and career decisions of lifelong learners, providing tools to facilitate support for those who have traditionally not participated in HE. The project has explored learners' choices about lifelong learning opportunities. To address the recognised gaps of support in this process, the L4All pilot system has demonstrated its potential value. The emphasis on social processes for decision making, rather than on purely economic or rational ones, has resulted in a novel system design that users felt was constructive and credible.

This study has also indicated the importance of forming partnerships between different learning providers, careers advisors and adult learning organisations (eg, Learndirect and Prospects) in order to offer a more connected and holistic approach to the learner's educational and career needs, and for developing a more effective and integrated pilot system. Gaps in provision can provide significant stumbling blocks for career progression and successful lifelong learning pathways; through working together as a community, it is more likely that these gaps can be avoided.

References

- Bimrose, J. & Hughes, D. (2006). IAG provision and higher education IAG review: research and analysis phase. Briefing paper for DfES. Coventry, University of Warwick.
- Bimrose, J., Barnes, S.-A., Hughes, D. & Orton, M. (2004). What is effective guidance? Evidence from longitudinal studies in England. Retrieved 15 September 2006, from <http://www2.warwick.ac.uk/fac/soc/ier/publications/bydate/egr2004.pdf>.
- Bimrose, J., Mulvey, M. R. & La Gro, N. (2003). Careers guidance. In R. Bayne & I. Horton (Eds), *Applied psychology* (pp. 94–103). London: Sage.

- Bush, V. (1945). As we may think. *Atlantic Monthly*, 176, 101–108.
- Cogoi, C. (Ed.) (2005). Using ICT in guidance: practitioner competencies and training. Report of an EC Leonardo project on ICT Skills for Guidance Counsellors. Bologna: Outline Edizione.
- Cych, L. (2006). 'Social Networks' in *Emerging Technologies for Learning* Coventry (pp. 32–40). Bristol: Becta.
- Davies, S. (2005). Personal learning tools and environments: their role in supporting the independent lifelong learner. In S. de Freitas & C. Yapp (Eds), *Personalized learning in the 21st Century* (pp. 63–65). Stafford: Network Continuum Press.
- Department for Education and Employment (1998). *The learning age: a renaissance for a new Britain*. Retrieved 15 September 2006, from <http://www.lifelonglearning.co.uk/greenpaper/>
- Department for Education and Skills (2006). *Further education: raising skills, improving life chances*. London: Stationery Office.
- Department for Education and Skills (DfES), Department for Trade and Industry (DTI), Her Majesty's Treasury & Department for Work and Pensions (DWP) (2005). *Skills: getting on in business, getting on at work. White paper*. Norwich: HMSO.
- Department for Trade and Industry (1998). *Our competitive future: building the knowledge driven economy*. London: Stationery Office.
- Dodgson, R. & Bolam, H. (2002). *Student retention, support and widening participation in the North East of England*. Sunderland: Universities for the Northeast of England.
- de Freitas, S. & Yapp, C. (Eds) (2005). *Personalizing learning in the 21st century*. Stafford: Network Continuum Press.
- Gorard, S. & Selwyn, N. (1999). Switching on the learning society?—questioning the role of technology in widening participation in lifelong learning. *Journal of Education Policy*, 14, 5, 523–534.
- Hughes, D. M. (2004). *Investing in career: prosperity for citizens, windfalls for government*. Winchester: Guidance Council.
- Irving, P. & Slater, A. (2002). Evaluation of information, advice and guidance partnerships. DfES Research Report 359. London: Department for Education and Skills.
- Keenoy, K., Levene, M., de Freitas, S., Montandon, L., Emans, B., Schoonenboom, J. *et al* (2004a). Collaborative trails and group profiling within an e-learning environment. EU Kaleidoscope Trails Deliverable 22.4.2. Retrieved 15 September 2006, from <http://www-kaleidoscope.imag.fr/pub/trails>
- Keenoy, K., Levene, M., de Freitas, S., Montandon, L., Pernin, J.-P., Eyssautier, C. *et al* (2004b). Personalised trails and learner profiling in an e-learning environment. EU Kaleidoscope Trails Deliverable 22.4.1. Retrieved 15 September 2006, from <http://www-kaleidoscope.imag.fr/pub/trails>
- Kimball, M. (2003). *The web portfolio guide: creating electronic portfolios for the Web*. New York: Longman.
- Koper, R. & Tattersall, C. (2004). New directions for lifelong learning using network technologies. *British Journal of Educational Technology*, 35, 689–700.
- Koper, R., Giesbers, B., van Rosmalen, P., Sloep, P., Van Bruggen, J., Tattersall, C. *et al* (2005). A design model for lifelong learning networks. *Interactive Learning Environments*, 13, 1/2, 71–92.
- McGivney, V. (2003). *Adult learning pathways—through routes or cul-de-sacs?* Leicester: NIACE.
- Nielsen, J. (2006). Ten usability points. Retrieved 10 March 2006, from <http://www.useit.com/>.
- Nielsen, J. & Loranger, H. (2006). *Prioritizing web usability*. Berkeley: New Riders Press.
- Offer, M. & Sampson, J. P. (1999). Quality in the content and use of information and communications technology in guidance. *British Journal of Guidance and Counselling*, 27, 4, 501–516.
- Oliver, M., MacBean, J., Conole, G. & Harvey, J. (2002). Using a toolkit to support the evaluation of learning. *Journal of Computer Assisted Learning*, 18, 2, 199–208.
- Organisation for Economic Co-operation and Development (OECD) (2004). *Career guidance and public policy: bridging the gap*. Paris: OECD.

- Peterson, D. & Levene, M. (2003). Trail records and navigational learning. *London Review of Education*, 1, 207–216.
- Ridgway, J., McCusker, S. & Pead, D. (2003). Report 10: literature review of e-assessment. Bristol: Nesta Futurelab. Retrieved 17 September 2006, from http://www.futurelab.org.uk/research/reviews/10_01.htm
- Selwyn, N., Gorard, N. & Williams, S. (2001). The role of the 'technical fix' in UK lifelong education policy. *International Journal of Lifelong Education*, 20, 4, 255–271.
- Taylor, J., Vasickova, D., Byrom, A. & Dickson, J. (2005). *Demand for, and perceptions of, information, advice and guidance*. Winchester: Guidance Council.
- Tomkowicz, J. & Bushnik, T. (2003). *Who goes to post-secondary education and when: pathways chosen by 20 year olds*. Ottawa: Ministry of Information.
- UCAS. (2006). UCAS website. Retrieved May 10, 2006, from <http://www.ucas.com/new/press/news070605.html>
- Watts, A. G. & Offer, M. (2006). The current and potential role of ICT in delivering information, advice and guidance. IAG Review: Research and Analysis Phase. Briefing Paper IAGW6. Derby: University of Derby
- Wenger, E. (1998). *Communities of practice: learning, meaning and identity*. Cambridge: University of Cambridge Press.