Univ Access Inf Soc (2005) 4: 16–23
DOI 10.1007/s10209-005-0111-8

LONG PAPER

Zaheer Osman · David Poulson · Colette Nicolle

Introducing computers and the Internet to older users: findings from the Care OnLine project

Published online: 24 May 2005

Abstract This paper reports the findings from a two-year pilot project called Care OnLine (COL). The COL project has introduced computers and the Internet into the homes of 50 elderly and vulnerable volunteers and provided shared Internet access at five shared schemes housing older people across the Market Harbrorough district of Leicestershire. A specific web portal was designed that was geared towards older and vulnerable people and provided information about the different services available to them, as well as links to a variety of websites. All the volunteers were provided with training in using computers and the Internet, and were interviewed regarding their experiences. Findings related to their attitudes towards, and experiences of, computers and the Internet are reported. The impact of having access to computers and the Internet on the volunteers' lives and some lessons learnt from providing such a scheme are also discussed.

Keywords Elderly · Attitudes · Computer · Internet · Internet scheme · Training and support

1 Introduction

People in modern day western society are living longer compared to their predecessors. This, coupled with sustained low fertility, is leading to an increased number of "Third Agers" (people 55 years and over). There were 19.8 million people aged 50 and over in the United Kingdom in 2002; this is a 24% increase over four decades, from 16.0 million in 1961 [9]. Coleman estimated that by the year 2020 almost half the adult population in the UK would be over 50 years of age [3]. If older people are not able to utilise the resources of computers and the Internet, then a large part of the population will clearly be excluded from what is deemed the world's largest public access information database [14]. The National Statistics Omnibus survey (April 1998 to March 2001), in which 1,700 households provided information every quarter, found that in July 2004, 37% of adults had never used the Internet [9]. Of these, 48% stated that they did not want to use, or had no need for, or no interest in the Internet; 37% had no Internet connection; and 32% felt they lacked knowledge or the confidence to use it. These adults were also asked which of four statements best described what they thought about using the Internet. Fifty-four per cent of non-users chose the statement 'I have not really considered using the Internet before and I am not likely to in the future'. This core group of non-Internet users represented 21% of all adults in Britain. The use of the Internet is dependent upon people having access to and knowledge of using computers effectively. Acquisition of equipment and training in using computers is therefore a very important factor in order for people to use the Internet, and in particular older, disabled and vulnerable people.

Older adults have significantly less computer, Internet and email experience [14]. Some older adults may also often experience negative age-related changes such as decreased physical and mental abilities, emotional isolation and social disconnection [8]. Zajicek states that the ageing process affects an individual's ability to function successfully with the standard graphical user interface. She further emphasises that the capabilities required for interaction with an interface are the ones that deteriorate most markedly with age [17]. Computers and the Internet have the potential to improve older peoples' quality of life by providing them access to interesting relevant and useful information as well as the opportunity to interact with other people. Generally, older people are willing to use computers but they often

Z. Osman (✉) · D. Poulson · C. Nicolle
Ergonomics and Safety Research Institute (ESRI),
Loughborough University, Holywell Building, Holywell Way,
Loughborough, Leics., LE11 3UZ, UK
E-mail: z.osman@lboro.ac.uk
Tel.: +44-1509-283300
Fax: +44-1509-283360
E-mail: d.f.poulson@lboro.ac.uk
E-mail: c.a.nicolle@lboro.ac.uk

experience difficulties in adopting new technology [6, 15]. It has been shown that resistance to computers can be overcome by direct experience but also by familiarity engendered by having computers in their environment used by others [6, 15]. Older adults may want to feel part of the modern world and welcome the opportunity that technology may offer to facilitate social contact with their family (e.g., children and grandchildren) who have made computers and the Internet an inherent part of their lives [12].

Many older people have not directly been involved in the evolving Internet age, as they have not extensively used computers or the Internet through their educational, working and/or personal lives. This lack of experience clearly acts as a deterrent in learning about computers. In addition to this, many older people do not have their own computers, either because they cannot afford them or they do not perceive any benefit that a computer may bring to them.

Irizzary et al. [6] conducted a research based programme called 'bridging the gap' whose aim was to introduce concepts of modern technology and some Internet skills to people over 55 in Australia. In total 359 people had taken part in the programme at the end of March 2000 which consisted of older people attending general technology classes (four modules) and Internet usage classes (three 2 h sessions). The study found that older people were willing to learn about, and were interested in, computers and the Internet and could successfully become active users. Age was not a barrier to learning to use the Internet. It was recommended that for certain populations of older people with disadvantages (e.g., financial, physical) special outreach strategies to engage them in learning about computers and the Internet are needed [6]. The Care OnLine (COL) project aimed at achieving this objective.

2 The Care OnLine Project

2.1 Introduction

The COL project was a two-year project funded by the government's Invest to Save initiative, which explored innovative service delivery, finishing in June 2003. The COL project brought the services that older and vulnerable people may require to them, as opposed to older people having to go out to the services. The project was led by Leicestershire County Council and involved collaboration with other local authorities and research organisations. COL has explored the use of Internet-based technology to support care service delivery to the elderly and other vulnerable people in the Market Harborough district of Leicestershire. Over a two-year period, the COL project has gradually introduced computers into the homes of 39 volunteers and has also provided support to a further 11 volunteers who had their own computers. There were also an additional 26 older volunteers at five locations with shared computer access. A web portal was specifically designed for the volunteers, providing links to different services and information relevant to their needs [2]. All the volunteers were given training on the use of computers, the COL web portal and the Internet (including Email) until they were comfortable with using the different facilities.

2.2 The care online portal

The COL portal has been designed with the requirements of the end users in mind. The portal has been developed to follow high standards of accessibility. This has been largely achieved with the site exceeding the minimum W3C (World Wide Web Consortium conformance) conformance levels (level A) [16]. An iterative approach has been taken through feedback from users and experts leading to the portal's refinement throughout the life-cycle of the project. As a consequence, the portal has good accessibility features, such as large buttons and text, which make it easier to use for the elderly as well as other vulnerable user groups. The COL portal also provided a 'safe haven' for these users to develop their skills and further explore web surfing. However, the users were not restricted to just accessing the COL web portal; in fact the COL portal included numerous links to a variety of external websites, thus allowing the more confident users to visit and search for other websites on the Internet. The web page devoted to web sites and information for older people page is displayed in Fig. 1.

Figure 1 illustrates the design philosophy of having large control buttons and uncluttered screens, as well as simple navigation. In addition, browsing other external websites was facilitated by including a COL banner at the top of visited pages, allowing easy return to the COL site. The homepage of the COL portal had links and information listed under the categories of carers, disability, older people, life and leisure and online shopping. The portal provided a broad range of information and external website links from serious issues such as information on benefits entitlement to more 'fun' elements such as links to newspaper, radio, TV and magazine websites. According to the website statistics, the most frequently visited pages within the COL portal were under the 'life and leisure' category, which included information and website links on hobbies, entertainment, travel etc., followed by the 'help for adults' category. This diverse range of information and web links facilitated the retention of the volunteers' attention both in the COL portal and the Internet in general.

3 Methodology

An integral part of the project evaluation was to assess the success of the COL scheme and the impact it had on the volunteers. This involved the authors personally visiting the home (both set top box and PC users) and

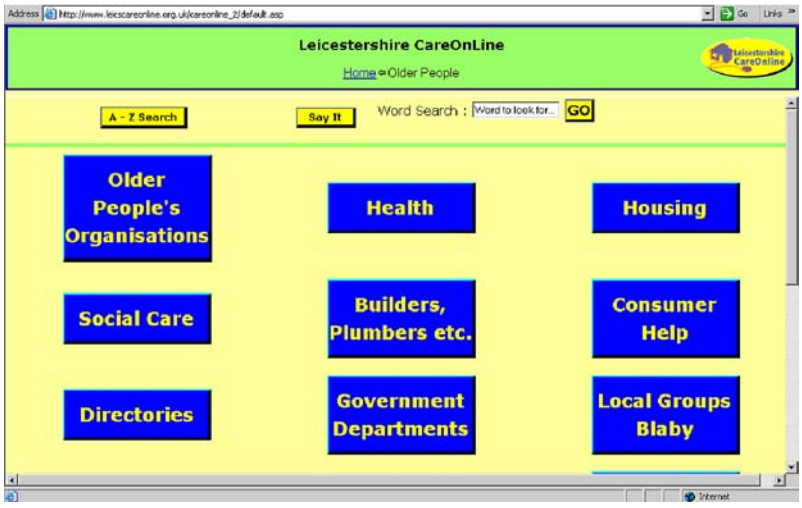

Fig. 1 'Older People' page on the COL web portal [2]

shared scheme users. Formal interviews using a tailored questionnaire were used to capture their attitudes and feelings towards the COL project, as well as towards computers and the Internet in general. Confidence, attitude, impact on quality of life, ease of use, clarity, usefulness, frequency of use, reliability and satisfaction were all measured using a five point scale, with 1 being the most positive and 5 being the most negative.

3.1 Set top boxes

A pilot study was conducted early in the project that aimed to assess the possibility of using television set-top boxes to access the Internet in the scheme. This study involved seven volunteers who were provided with, and trained in the use of, set-top boxes and wireless keyboards (with an integrated thumb operated mouse). Many technical problems were experienced over a period of 6 months that prevented the volunteers from using all the facilities successfully and reliably. The main problems that the volunteers experienced were not being able to send email, due to the system freezing, and there were also delays in loading the different COL pages due to slow Internet access. In addition to the technical problems, viewing web pages through the television led to poor picture quality, which in turn affected the readability of text and symbols on the screen. The set-top boxes also used non-standard operating systems and functionality which would not help volunteers in developing skills to use conventional PCs. Initial concerns that the thumb-operated mouse would prove to be difficult to use were unfounded, but some ergonomic problems were identified related to posture and seating distances from the screens. Some volunteers were forced to adopt poor postures whilst using the COL service because of the location of television and chairs in their rooms and the need to sit close to the television due to its poor text resolution. Keates and Clarkson found similar sensory problems with older users when assessing the accessibility of digital television set-top boxes [7]. It was therefore concluded that the technology used to access the Internet using set-top boxes was not suitable to implement on a larger scale within the scheme. Not withstanding these difficulties, the experience of taking part in the COL trials was almost uniformly positive. Access to the Internet and e-mail services were much appreciated, and the COL website was seen as a good integration of different resources that were relevant to both older and disabled groups. Information on disability and ageing was seen to be useful, but in addition information on 'life and leisure' and shopping were also favourite topics amongst the volunteers. COL was seen as a resource that allowed older and disabled people to communicate with each other and still feel part of the fast moving, modern day society around them. Six out of the seven volunteers were happy to convert to the conventional PCs in order to continue with the scheme. This was encouraging for the project, as early problems with technology clearly did not reduce the motivation of these volunteers to access the Internet.

3.2 Home users

In total there were 50 volunteers that accessed the COL services and were provided with Internet access, training and support in their own homes. A total of 39 of these volunteers were provided with computer equipment and relevant adaptations by the project. The remainder used their own computers. Where special adaptations were needed, additional training in the use of these devices was provided. The age of the volunteers ranged from 23 years to 90 years with an average age of 61 years. There were 19 male volunteers and 26 female volunteers in the sample. Out of the 50 volunteers, 45 were interviewed by the authors at the end of the project to evaluate its success. The interviews lasted for approximately an hour, but due to time constraints 10, of these volunteers were given a shorter interview of approximately 30 min.

3.3 Shared usage

The COL system was also made available at five sheltered housing schemes and residential homes for the elderly to provide shared access to the Internet and COL. Residents were trained in small groups by the COL project and the scheme managers also provided support to the residents. It is estimated that approximately 38 volunteers have been actively involved during the lifecycle of the project. By the end of the project, it was estimated that there were still approximately 26 users. The shared scheme volunteers were trained in groups rather than individually. A short questionnaire interview was carried out by the authors at two of the schemes with 12 volunteers, which provided an insight into the impact COL has had at the shared schemes and the differences between them.

4 Interview Results

4.1 Home user volunteers

Problems of mobility were the most common functional disability for the volunteers, with 74% of volunteers reporting problems in this area. Other types of disability were less common, with 14% reporting a sensory impairment and very few volunteers reporting a communication impairment (6%) or mental health difficulties (3%). The findings also revealed a positive correlation between increases in age with an increase in functional disability within this sample.

For the majority of users (85%) COL was their first experience of using the Internet and email services. It was also clear from the interviews that in many cases prior computer use had been limited in this group, with over half the sample having no prior experience with computers.

Throughout the trials volunteers were trained in their own homes by a full-time trainer. The support provided for volunteers was on a one-to-one basis. The training required by the volunteers varied, with some volunteers only requiring one or two sessions lasting approximately an hour, and some other volunteers requiring many more. Conservative estimates are that an average of 12 h was needed for training each volunteer with a maximum of 45 h required by one volunteer. This demonstrates the diverse support requirements of the volunteers within the COL project.

Volunteers with more special needs resulting from higher levels of disability also received more specialised training from outside sources, as it was acknowledged that specialist services were needed to support those with severe disability. There were four users with severe visual impairments and one user with severe physical disability. Thirteen (22%) of the volunteers were given some form of equipment adaptation(s) to overcome barriers that were caused by their health condition to allow successful and easy access to the computer and its facilities. The special adaptations included; trackerball (11 volunteers), big keys keyboard (7 volunteers), keyboard guard (3 volunteers), joystick (2 volunteers), Clicker^{TM} (4 volunteers), a Writing support tool (4 volunteers) and wireless keyboard (1 volunteer). Some of these volunteers also received multiple adaptations.

Volunteers were asked how confident they felt in using computers at the end of the COL project using a five-point scale, with 1 being very confident and 5 being very unconfident. The majority of the volunteers were confident (71%), but a minority (11%) still somewhat lacked confidence in using computers at the end of the project. This demonstrates that novice elderly computer users can gain confidence in using computers with the correct support and training, but a minority are likely to have continuing support needs. The reported reasons as to why some of the users lacked confidence in using computers were: not being comfortable with the Internet, poor memory, basic numeracy and literacy problems, and lack of motivation.

Volunteers were asked to assess their current frequency of use for email, Internet and the COL portal. Just over 50% of volunteers said that they used the Internet almost everyday, and just under 50% of volunteers said that they used email almost everyday. Only 18% of volunteers said that they used COL everyday but the majority (45%) did use COL more than once a week. This finding demonstrates that the general computing skills acquired from the COL scheme have facilitated the task of exploring the Internet on a daily basis for over half of the volunteers.

The majority of volunteers (91%) had a favourable attitude towards computers at the end of the COL project. The majority of volunteers (69%) confirmed that they had had no prior intention to connect to the Internet, and would have not got connected if it were not for the COL project. This finding reveals the importance of such schemes for older people to learn to use computers. Providing access to computers and high levels of support allows the users to explore the value of such technology without financial penalty, and in a safe and supportive environment. All except one volunteer intended to continue using their computers beyond the COL project and this was further reflected by the majority of users (86%) willing to pay for their Internet connection.

The COL project removed the initial costs of purchasing a computer and paying for Internet connection. The volunteers were allowed to retain the computers installed beyond the COL project but had to pay for Internet connection. This again demonstrates that when the elderly are given the opportunity to experience the benefits of the Internet and email they will value the services they receive and are prepared to pay for them.

The effect that access to the Internet and email had on the volunteers' quality of life was an important consideration. The majority of volunteers (82%) felt that having access to the Internet and email had a significant positive effect on their quality of life. At the end

of the COL project, many of the users had made using a computer a part of their everyday lives, and many users described the Internet and email as a 'window on the outside world'. Access to the Internet and email also reduced their isolation and in many cases enhanced their social interactions. For many of the volunteers it was their first opportunity to have information at their fingertips at a crucial stage in their lives where they had increasingly felt helpless. However, there were a minority of volunteers (13%) who felt that having access to the Internet and email had little effect on their quality of life and the reasons for this were: limited use through lack of interest, volunteers still being in the process of learning to use the facilities, and the limited perceived benefits.

The majority of volunteers (89%) found the COL portal easy to use and only one person found the portal difficult to use. The iterative process adopted with the design of the portal and involving end users from an early stage is a major factor contributing to the ease of use of the web portal. The majority of volunteers (84%) found the COL services to be useful. Volunteers also made suggestions on what additional services they would like to see and these largely included interactive services, e.g., ordering repeat prescriptions and communicating with others through chat rooms.

The majority of volunteers (76%) reported that the COL portal had made a difference to their daily lives. Some of the reasons reported for this were:

- It provides access to a lot of useful information and makes users feel secure and independent
- It provides an excellent hobby and interest—particularly for users with mobility problems
- It allows social interaction—users have made new friends and met new people through COL and the Internet
- It allows users to keep up to date—many of the older volunteers felt that knowing about the Internet and information through COL has made them feel like they have something in common with the younger generation (e.g., grandchildren)
- It enhances communication—users can write both via email and using a word processor
- It increases motivation—for users who live alone, COL has proved to be a lifeline.

Not only did COL have an impact directly on the volunteers, but a significant proportion (58%) reported that COL also had an impact on people close to them (spouse, children, friends and other relatives) for the following reasons:

- Carers and relatives were happy to see that the volunteer has another interest and is doing something positive
- Children and other relatives/friends feel reassured as the volunteer can contact them through email easily and efficiently
- Volunteers were able to help find information for other people which in turn made the volunteers feel valued
- Younger generation can communicate with volunteers and can discuss new technology as well as keep in contact through email
- Volunteers being well informed has a positive effect on the welfare of all their family members and friends.

4.2 Shared scheme volunteers

Computers were also introduced at five locations to allow shared usage of the Internet and COL services. Usage at these schemes was less clear-cut than for individual users, with some schemes adopting the technology better than others. Reasons for these differences included:

- Early difficulties with location of equipment and reliability
- Differences in motivation of users at different schemes and some degree of apathy regarding technology
- Differences in the type of support provided at the different schemes (trainers, size of groups)
- Diversity of user needs (users at some schemes having high levels of disability and the need for specialised training and support that could not always be provided).

The COL project had a relatively low uptake at all shared schemes compared to home user volunteers. The reasons for this are unclear but are likely to include low motivation of volunteers, differences in support provision and the dynamics of shared usage.

Group training also meant that each person had limited opportunities for practice, and the infrequent training sessions (one per week) also meant that the materials taught were forgotten. The training was also not always provided by the same trainer due to lack of resources, and this may have been a factor contributing to the inconsistency of training provided at the different shared schemes. It is estimated that on an average, the volunteers at shared schemes received 4 h of trainer support compared to 12 h for home user volunteers.

The dynamics of shared usage were also more complicated than individual use. Volunteers in shared schemes had less choice over when and where they could gain access to using the COL computers and would have to make more of an effort to plan usage around other people. The computers in the shared schemes were also located in public areas thereby reducing the privacy of the users.

Notwithstanding these difficulties, the majority of the volunteers at the five schemes have viewed the COL project favourably. Even though usage has not been particularly high during the life of the project, the computer has become a valued additional resource and in no case was it requested that the computers be removed.

5 Discussion

This successful involvement and adoption of the computers and Internet by the volunteers involved in the COL project has been due to a combination of interrelated factors displayed in Fig. 2.

All these factors play an important role in assuring that particularly the older users successfully adopt the use of the Internet and email into their lives successfully. It is useful to see how COL successfully addressed these factors for both the home users and the shared scheme users, as any lessons learnt from this experience would prove beneficial for other similar schemes aimed at older and vulnerable people.

5.1 The user

Above all, the users involved in a scheme like COL need to have some motivation to learn the potential benefits of the computer and the Internet. If the users are not in the slightest interested, then it is difficult to get them to appreciate the benefits of computers and the Internet. All the participants within the COL project volunteered themselves; this displayed a level of motivation which was critical to successful active participation. The training and support available to the users does affect their motivation. This was confirmed by the relatively lower motivation of the volunteers at the shared schemes, who were somewhat affected by the type and quality of training given, compared to the home user volunteers.

The capabilities of the users within the COL scheme was a good predictor of the level of support and training that may be required by each individual and the time it may take for a user to become competent in using the computer and the Internet independently. Increase in age causes reduced physical and psychological abilities. Almost 75% of the home user volunteers had a mobility problem. In most cases this did not affect their use of the computer but in a few cases it did. The COL project successfully demonstrated that assistive technologies and specialised training and support could overcome barriers presented by the volunteers' health condition(s). Having lower computing capabilities did not necessarily mean that the volunteers could not become competent computer users. In fact, the majority of the volunteers did begin with low capabilities but then developed their skills to become competent computer users. A few volunteers lacked basic literacy and numeracy skills which affected their progress compared to the other volunteers. These individuals required much more training and support and did not necessarily reach a similar level of competence.

Having some prior experience in using computers and/or the Internet and email made it easier for volunteers to understand other features and uses of the PC. For over half of the volunteers, COL was their first experience with the PC and for the majority of volunteers it was their first experience with the Internet. Low previous experience did not hinder the progress of the volunteers, as it was overcome by the training and support provided by the COL project. In addition, it was demonstrated that prior usage of computers and computer ownership was not a good predictor of the level of support a given user would need, as some of the more experienced users and computer owners still needed high levels of support.

5.2 Training

Providing volunteers with training was found to be a critical factor to the successful adoption and use of computers and the Internet. This is because the volunteers were given the appropriate skills to use the computer and Internet effectively and they had support at hand if they experienced any difficulties.

The project has demonstrated that it is possible to support users with different degrees of dependency in their own homes by one-to-one training. At the start of the COL project, the degree of support that would be required to support service users in their own homes was not known and one trainer was budgeted within the project. Training at shared usage schemes was group based rather than based on one-to-one sessions. Training materials were also developed in the trial phase of the project and refined as a result of user feedback.

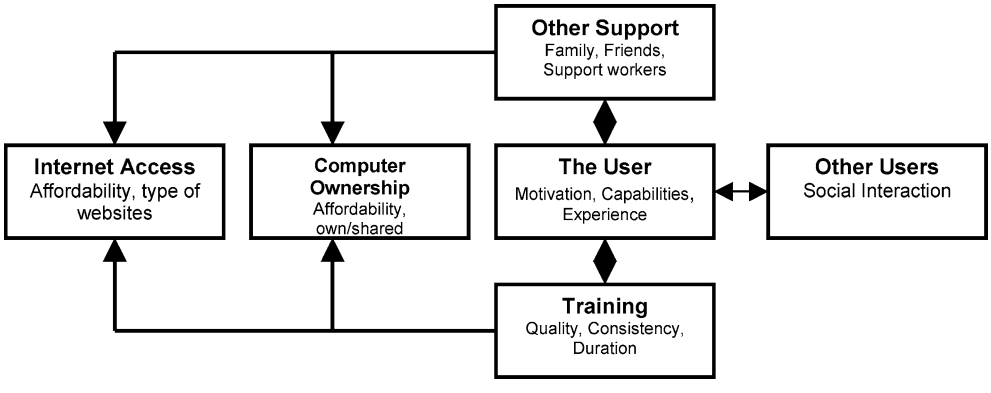

Fig. 2 Factors contributing to older people's computer and internet experience

Support for home user volunteers was provided by a single trainer which assured consistency. A personal and somewhat informal approach to training has taken place at volunteers' homes and the personality of the trainer is likely to have been a significant factor in the success of this approach. Selection of trainers for their enthusiasm and caring attitude is therefore likely to be as significant as their technical skills in providing support to their users. It is estimated that a full-time trainer could only support approximately 30 volunteers at any one time, based on the expectation that approximately four volunteers could be assisted every working day and that some time would be needed for administrative activities. The geographical dispersal of volunteers within the county was also a factor, as this determined the time required to travel from one volunteer to another as well as the time needed for training sessions. Analysis of training data revealed that older volunteers required significantly more training sessions than their younger counterparts. A small number of volunteers also required a disproportionate quantity of training resources available to the project in terms of continued need for training, special adaptations and support. It can therefore be concluded that it is important for such schemes to have minimal selection criteria to assess whether a person is likely to benefit from such a scheme and determining some limit on the support resources to be allocated to each individual.

Training at the shared schemes did raise some cause for concern with regards to the limited effectiveness and progress that some users made. It was reported that training at some of the shared schemes could have been made more interesting and motivating for users. Motivation to learn could be facilitated by exploring with the user what they would like to do with the computer and adjust the training accordingly. There is a need to ensure that volunteers are trained as individuals rather than as a group and, if group training does take place, then it would be imperative for each user to have access to their own PC. At the start of the COL project, it had been assumed that some users trained to use COL at shared schemes would be able to support others in learning to use the system. This proved to be a somewhat naïve assumption within the constraints of a short-term project, though at the end of the project, this had indeed started to take place at one location. This indicates that facilitating computer usage by this means is likely to be a slow and long-term process, unless some of the involved volunteers already have some prior computing skills.

5.3 Other forms of support

Having support from family and friends also increased the volunteers' motivation to using the computers and the Internet and provided them with additional help in the absence of the trainer. This type of support is not essential if there is adequate training provided, but it enhances the user experience as it injects confidence. However, lack of support and negative feedback will discourage the volunteer and hinder their progress.

5.4 Computer access

A very important finding from the project was the failed attempt to use set-top boxes to access the Internet. In addition to the technological difficulties, the dynamics associated with accessing the Internet through the television were interesting. Televisions are not easy to move and the volunteers were restricted to viewing the Internet from their seats, which also were not easy to move. This combined with poor picture quality led to an awkward experience of using the Internet. Surprisingly, the experience of failed technology did not adversely affect them when the volunteers converted to home PC trials.

It was found that many of the volunteers would not have used a computer if it were not for the COL project. The COL project provided the volunteers with the relevant equipment and any adaptations that they required. Many people, particularly older people, are deterred by this initial cost factor which the COL project overcame.

The findings from the shared schemes demonstrated the difficulties of group computer usage. Sharing a computer restricts the time when and where location the volunteers could use the computers, and limited their privacy and usage.

The volunteers were allowed to retain computer equipment given to them by the COL project. This was important as the end of the project did not mean that they were left without a computer and return to the situation they faced before the COL project.

5.5 Internet access

The COL project not only provided the volunteers with computer equipment, but also paid for Internet access for the duration of the project. This removed the cost implications from the volunteers and gave them an opportunity to experience the benefits that the Internet could bring to them. Over two-thirds of the volunteers interviewed reported that they had had no intention to connect to the Internet prior to the COL project. The volunteers were responsible for paying for Internet connection once the COL project had finished, and the majority of the volunteers were willing to do so. This illustrates the positive attitude that the volunteers had formed towards using computers and the Internet.

In addition to a safe and supporting learning environment, the COL project provided the volunteers with a tailored web portal. This gave them information and links to services that they would find useful, as well as acting as a safe base for further surfing activities. Volunteers were able to explore an easily accessible website that they could use as a base to develop their skills in using the wider World Wide Web, and were able to easily return to the COL portal.

5.6 Social Interaction

The COL project facilitated social interaction amongst the volunteers. The volunteers were introduced to people within a local area in similar situations. The COL portal also provided email links between the different volunteers within the scheme, which provided to them the opportunity to make new friends and share experiences. Many of the volunteers made friends with others on the scheme and kept in regular contact through email and the COL message board. Access to computers through the COL project also proved to be an invaluable opportunity for many of its users to keep in touch with family and friends and keep up-to-date with current events.

6 Conclusions

The COL project has had a positive effect on the lives of the elderly and vulnerable volunteers in both the home and shared usage environments. The project has clearly shown that with appropriate levels of training and support, computer and Internet usage amongst older and disabled people can be facilitated. The COL project has found the PC to be the most effective technology for providing these services given the current limitations in Internet TV technologies. The COL project has demonstrated that older people can become active users of, and benefit from, the use of computers and the Internet. Factors such as user characteristics, training, support, type of access and social interaction need to be considered and addressed for the users to accept and adopt the use of computers and the Internet. The COL project has provided services to the volunteers at the point of need, i.e., in their own home, rather than the volunteers having to go to the service, and this has proved to be of great value for the volunteers. The older age group has a more critical need to be able to make new friends and meet new people whilst in the comfort of their homes, as these are the people who are more likely to be facing social isolation due to health problems and death of loved ones. COL has clearly demonstrated the positive impact that computers and the Internet can have on the lives of older and vulnerable people, and the COL scheme is an example that should be followed by others in order to make it easier for these people to take the step of integrating computers and the Internet into their lives.

The success of the COL project has encouraged Leicestershire County Council to continue working in this area and to explore cost effective ways of providing such services to its clients. Leicestershire County Council is part of the Leicestershire partnership of Internet offerings which includes County, District and City councils. The COL scheme is being rolled out across the county as part of mainstream Social Services provision. This includes the provision of 150 computers (20 touch screens) by April 2005 enabling free Internet access for over 1,000 to 1,500 residents (including approximately 22 sheltered housing schemes), as well as members of the public at seven council locations and ten voluntary organisations.

Acknowledgements The authors are grateful to the 'Invest to Save' initiative for funding the project and the 'Care OnLine' Consortium and project team, including Peter Chester, and in particular Ian Retson for his contributions. The authors would also like to thank all the volunteers who participated in the 'Care OnLine' project.

References

1. Banes D, Walter R (2000) Internet for all. David Fulton Publishers, London
2. Care OnLine (COL) Web site (2003) Available at: http://www.leicscareOnLine.org.uk/careOnLine_2/default.asp
3. Coleman R (2001) Designing for our future selves. In: Preiser WFE (ed) Universal design handbook. McGraw Hill, USA
4. Czaja S J (1996) Interface design for older adults. Advances in Applied Ergonomics, USA Publishing, pp 262–266
5. Freudenthal D (1998) The learning process of elderly in association with technology. Tijdchrift Voor Ergonomie 23(4):94–97
6. Irizarry C, Downing A, West D (2002) Promoting modern technology and Internet access for under-represented older population *s*. J Technol Hum Ser 19(4):13–30
7. Keates and Clarkson In: Keates S, Clarkson P J, Langdon P, Robinson P (eds) (2004) Designing a More Inclusive World. Springer, Berlin Heidelberg Newyork, pp 183–192
8. Lee B, Godbey G, Sawyer S (2003) Research update: seniornet. v. 2.0: the changing roles of computers and the internet in the leisure lives of older adults. Parks & Recreation 38(10):22–29
9. National Statistics website UK (2004); Older people available at: http://www.statistics.gov.uk/cci.gov.uk/nugget.asp?id = 874 and internet access available at: http://www.statistics.gov.uk/cci.gov.uk/nugget.asp?id = 914
10. Nicolle C, Abascal J (eds) (2001) Inclusive design guidelines for HCI. Taylor & Francis, London, pp 131–142
11. Osman Z, Tarkiainen M (2003) Older users' requirements for location based services and mobile phones. In: Proceedings of 5th international symposium on mobile HCI, Human-computer interaction with mobile devices and services, Udine, Italy, September 2003, Springer, London, pp 352–357
12. Philbeck J (1997) Seniors and the internet. Available at: http://members.aol.com.cybersoc/is2joyce.html
13. Poulson D, Osman Z (2003) Post implementation review—care online. In: ICAT conference 2003 'digital divide amongst people with disabilities'. Available at http://www.bcs.org.uk/disability/icat/papers/paper7.htm
14. Sheard M, Noyes J, Perfect T (2001) Older adults and internet technology. In: Contemporary ergonomics. Taylor & Francis, London, pp 237–242
15. Umemuro H, Shirokane Y (2003) Elderly Japanese computer users; assessing changes in usage, attitude, and skill transfer over a one-year period. Univ Access Inf Soc 2:305–314
16. World Wide Web Consortium—Web Accessibility Initiative (W3C-WAI) web site (2003). Available at: http://www.w3.org
17. Zajicek M (2001) Supporting older adults at the Interface. In: Proceedings of interact 2001, conference on human-computer interaction 2003, 9–13 July, Tokyo, Japan, IOS Press, pp 447–454