Univ Access Inf Soc
DOI 10.1007/s10209-010-0208-6

SHORT PAPER

The barriers that older novices encounter to computer use

Anna Dickinson · Roos Eisma · Peter Gregor

Abstract A course on computers was run for computer beginners aged over 55. An iterative and flexible approach aimed to ensure that students' anxieties and difficulties were addressed as the course proceeded. Several layers of difficulty were encountered, ranging from initial difficulties understanding Windows systems and the working of the mouse to more fundamental and long-term problems such as repeatedly forgetting to move the focus before typing or failing to recognize onscreen objects and understand their behaviours. Inclusive design approaches should benefit from detailed recording of barriers to use, but the diversity of the user population will also necessitate flexibility to ensure inclusivity.

Keywords Older adults · Barriers · Inclusion

1 Introduction

User sensitive design is an approach which involves recognizing the diversity of 'extraordinary' computer users and the difficulty of 'designing for all' in the face of this diversity. This paper presents a record of the problems encountered by older adults during an 11-week computer course. Gathering knowledge about the difficulties and barriers that users face to technology use, not only when they first encounter a system but during the process of learning to use it, should help trainers and designers to avoid some of the difficulties commonly faced by such users, and thus allow the development of more appropriate teaching materials and interface designs. The course allowed the trainers to gain insight into the early problems that older novice users encountered when first using computers, but also into the progression of barriers as the initial layers were overcome and subsequent difficulties uncovered. The adopted approach was iterative and responsive; by adjusting flexibly to the requirements of students, it became possible to run a genuinely inclusive class.

While there is a certain amount of research published on computer courses for older adults, in general, this focuses on participants' attitudes and computer anxiety [1, 2], or the effects on users' well-being [3, 4]. Older people can find computer use frustrating and off-putting, but details of the problems that they encounter to frustrate them are less common. The published research shows a high drop-out rate among members of computer-training intervention groups (e.g., [3]), but little explanation of why people do drop out. By recording the difficulties that people faced learning to use computer systems, it is hoped to support research in this area.

2 Context: the course

A course in computers, lasting for eleven two hour weekly sessions, was designed and run by research staff at the University of Dundee. Attendees were members of the local Discovery group, a group for the over 50 s, who were learning to use computers. Sessions took place in the Computing laboratories. The class size varied from 10 to 15 people from week to week. Although the course was intended for beginners, in fact knowledge of computers varied widely from no prior knowledge to some word processing use. None of the students had used the Internet when they began the course.

A. Dickinson (✉) · R. Eisma · P. Gregor
School of Computing, University of Dundee,
Dundee DD1 4HN, Scotland, UK
e-mail: adickinson@computing.dundee.ac.uk
URL: http://www.computing.dundee.ac.uk

Published online: 05 September 2010

The aims of the course were to teach essential computer skills and the basics of interacting with a computer. The course covered word processing, email and an introduction to the web. In addition, the basics of computer use were covered, including turning the computer on and off and the use of the desktop.

2.1 Students

The students who attended the course were all people over 55. The initial twelve students who signed up for the course answered short questionnaires aimed at collecting demographic information and an indication of computer experience (Table 1).

One student had some hearing impairment, another had suffered a stroke which had some effect on fine motor control, one had been diagnosed as dyslexic and all but two wore spectacles. In general, members of the group were very highly educated; several had recently retired from teaching at the university or the hospital, others were former school teachers, librarians and managers. Their experience was very valuable as highly intelligent, well-educated and generally confident older learners, who may not have known the specific technical terms to describe the difficulties and irritations they encountered, but who were often prepared to articulate them anyway. Others joined the class later and have not been included in the demographic information.

2.2 Set-up

The course was prepared drawing on the research of both Czaja and Lee [5] and Morris [2], as well as on extensive feedback received from older people on their experiences learning to use computers and at computer courses. The intention was to avoid, as far as possible, problems that were already known of. This, it was hoped, would allow other difficulties and barriers to be discovered. In order to avoid some known problems, the following approach was adopted:

- Simplification: interfaces, instructions and tasks were as basic as possible at the initial stages, while people got used to them. The easier that it is to start to use a system, the more successes that people have, the more likely they are to continue to learn. Functionality was dramatically simplified, reduced in the first instance to five buttons on a single Word toolbar, in order to support learning by reducing the possibility of errors, as suggested by Carroll and Carrithers [7], and reducing complexity, which has been shown to be a barrier to older adults [8].
- Enlarged targets: desktop and application interfaces were adapted to be more appropriate for older beginners, with larger button sizes. Data exist on the difficulties older novice computer users face using the mouse [6], and the increased size of targets was intended to address this, as well as to reduce any visual difficulties that people faced.
- Support: it is important not to assume that the user has knowledge about the way that the interface works. This includes not assuming that they will remember information after being told once or twice. A high level of support (one trainer to every two or three students) was intended to ensure that help was quickly available when needed.
- Self-paced learning: worksheets were prepared before each session providing learners with background information and step by step instructions. This removed the necessity of depending solely on memory to carry out, and repeat, tasks. Handouts were always available for reference and enabled people to work at their own pace, with no pressure to keep up with the rest of the class.

Table 1 Discovery course students, age and sex

	55–64	65–74	75–84	85+
Men	3	2	1	1
Women	2	3	0	0
Total	5	5	1	1

2.3 Data recording

The Discovery computer classes were informal and flexibly structured. No formal evaluation of students' performance took place, since the purpose of the classes was to teach computer skills. When a student needed support, the volunteer who helped them would record the issue that had led to the need for support. The subsequent analysis was based on this list of issues.

3 Experiences and discussion

This section describes the results of 11 weeks of teaching computing to the Discovery group and the conclusions drawn from this process. The issues arising concerning web use are discussed in [9].

The first conclusion arising from the process was that the immediately obvious barriers to computer use for most of this group were conceptual/cognitive rather than related to visual or motor-control impairments. Others, using a similar approach, have stated that "eyesight and motor control did not cause many difficulties" [10] and concluded

that conceptual obstacles are the most serious barriers. Having altered the interface to reduce difficulties with text and target size, it may be that this was sufficient for most of the Discovery group users to overcome any serious difficulty; however, it may simply indicate that conceptual difficulties are more likely to be commented on by learners.

3.1 Using the mouse

Although using the mouse was an initial barrier, it was relatively quickly overcome. Most students learned to use the mouse to a sufficient standard to cope with computing tasks. There were three exceptions, all of them men and all of them older than the average class member, who had significant and ongoing difficulty with the mouse. One of these students had had a stroke within the last year and had serious difficulty manipulating the mouse to carry out basic tasks (point and click). His determination to use the mouse and his difficulties doing so caused him significant frustration. Another user was in his late 80 s and experiencing manual dexterity difficulties which made it extremely difficult for him to use a pen, for example. Although he could use the mouse, it took some effort and several attempts for tasks more challenging than point and click (this did not act as a barrier to his computer use; however, he was an enthusiastic computer user, with experience in word processing). Finally, a third older man also had significant difficulty with the mouse, with no immediately identifiable reason.

Most class members had problems with more complicated mouse tasks, particularly with double-clicking and with dragging to select text. These were surmountable with multiple attempts, but constituted an irritation for even the most able class members and a significant barrier for those who found mouse use difficult.

3.2 Vision

There was little evidence in the comments of the students to indicate that they had difficulty seeing the information on the screen. It should be remembered that part of the set-up for the course was an increase in the size of icons, scrollbars, etc.

Nonetheless, some minor difficulties were observed, with one user especially leaning towards the screen to see more clearly. Some users also found they had difficulty with their spectacles: wearers of bifocals especially had difficulty reading information at the top of the screen. Users appeared to have some difficulty noticing the caret, but this was never commented on.

3.3 Conceptual barriers

Standard computer systems are not well designed for learners; no explicit help is given at the first level of the interface, and even help which exists is frequently inappropriate and unhelpful [11]. Given the context of the classes, it is difficult to distinguish conceptual barriers from age-related cognitive difficulties.

3.3.1 Primary barriers

There was a series of misunderstandings and errors that students encountered as quite distressing during their initial use of computers. These demanded a lot of support, but were relatively quickly overcome. One minor example was uncertainty about which mouse button to click or when to double click, but others were more serious. Central among these was fear of losing one's work. During the early sessions, trainers were repeatedly called over to find lost work, and it is probable that there were also occasions when the student did not seek help for lost work. Students found losing work both disconcerting and frustrating, and this reaction was only slightly modified by the recovery of the work. Work was often "lost" in the following ways:

- Opening a new document (which obscured the document being worked on).
- Opening a new program or window which overlaid the document.
- Clicking "minimise".
- Inadvertently repeatedly pressing "return" (and occasionally the spacebar or another key) which pushed work off the visible area of the screen.

A similar problem was when the system behaved in ways that the student did not expect. A good example of this is the appearance of a menu when the right-hand mouse button is clicked. Users expected a click to select something and were surprised by the apparently random appearance of a menu in the middle of the screen.

The most useful strategy for dealing with unexpected system behaviour or lost work was a "panic sheet", which allowed students to problem-solve for themselves when unexpected events occurred or when they apparently lost the document they were working on. The most common problems were listed (e.g., "I've lost all my work!") with suggestions for their solution. Often this allowed students to solve their own problems without needing help from the trainers and reduced the tension associated with making such an error.

Another barrier that was encountered initially, but relatively quickly overcome, was understanding the relationship between the Menu labels (File, Edit, etc.) and the icons on the toolbar. Users were uncertain about whether the labels referred to the toolbars i.e., whether the word "File" was a label for the button underneath it (which was in fact the new document icon). In fact, of course, the two are not directly related, since the toolbar simply provides a

range of shortcuts to options also accessible from the menu bar, but nowhere on the interface is this made clear. In addition, there was confusion about what the icons on the toolbar were intended to represent. The "save" icon provided an interesting example; although trainers had introduced students to floppy disks and related the icon directly to these, students found it hard to remember what it was intended to represent. It was not until one student described it as "the picture of the small television", a description that rapidly spread through the class, that this difficulty was overcome.

Although these problems were overcome within a few sessions, they presented a significant initial barrier to older users' interaction with the system. It is important to note that support was often necessary to teach people how to find "lost" work and overcome other difficulties. It was noticeable that the stress associated with the perception of having committed a serious error appeared to retard the process of learning to overcome it. For people learning on their own or for those with cognitive and memory difficulties, these barriers are likely to be considerably more important and to constitute a distressing and irritating obstacle to confident computer use.

3.3.2 Medium term barriers

There were a number of further barriers, attributable to the unfamiliarity of computers, which were not overcome immediately, but gradually became less important during the course. The behaviour of scrollbars was a primary example of this: scrollbars were initially rarely noticed by users, who also found them difficult to manipulate with the mouse. The first and primary barrier, however, was understanding that scrollbars were controls, the way in which they operated and the role they played. Because the scrollbar was peripheral to the screen, and therefore rarely noticed, it needed to be pointed out to beginners. Once it had been, the users were uncertain about the way to manipulate it, that is whether clicking "up" would move the content up or down (in fact, it moves the content down). This barrier is not unusual for older users [12].

Another difficulty was students' ability to distinguish between applications and documents; this was especially difficult when students tried to close documents using the "close" button at the top right of the screen. Frequently, instead of clicking on the document close, which was small and not especially salient, students clicked on the large, red close button to close the application. This error was both worrying and irritating for learners. It was also likely to lead to the loss of work, since small dialog boxes were rarely read but perceived as a barrier that could be overcome by clicking, often users anxious to carry out a task (close a document, for example) chose an inappropriate option simply because it made the dialog box disappear.

A similar problem was judging the applicability of options: the "undo" button on Word, for example, was rapidly adopted by most learners. However, the option only undoes actions referring to the document; it does not work for interface-level actions, such as resizing the window or removing the menu bar.

Another difficulty involved the difference in application interfaces. Moving from standard application interfaces like Word, students were confused by the Internet Explorer interface and on several occasions sought to increase text size on a web page as they would in Word, by seeking the font size menu.

Email addresses were another barrier that people overcame during the course, in part because of Outlook Express' facility for auto completion. Initially, when users were asked to bring the email address of a friend or relative, there was confusion about which parts of the address were necessary and how it should be written. Indeed one participant who had written down an email address after a phone call had written something similar to "sally at hotmail dot com".

3.3.3 Longer term barriers

Some problems that were encountered were not overcome within the time period of the course. These reflected more fundamental conceptual difficulties and were often commented on by the students themselves. One of these general difficulties was the multiple ways in which it is possible to carry out a task. Although there are good usability arguments for including such multiple pathways in mainstream systems, it is not helpful to introduce them to older learners. Learners found that they became stuck when they confused two different ways of achieving the same end. Students were vocal about their dislike for these multiple options.

A central problem that was not overcome within the 11 weeks, despite a number of attempts, was the issue of saving files to the computer and finding them again. One user, who had used computers for 8 years, reported that because he could never find his files again he only saved work to floppy disks. Floppy disks, which were physical objects, were easy to manage and to file, whereas the concept of files on the computer was a barrier.

Perhaps for similar reasons, sequences of actions presented difficulties because one missed step invalidated the whole sequence. Especially noticeable was users forgetting to select text before they carried out an operation on it.

Another ongoing problem was remembering to move the "focus" between text boxes. Although this was normally overcome, it was consistently observed. At the initial

stages, this was also complicated by the physical difficulty of manipulating the mouse.

Within the 11-week course users never sorted out the differences between buttons, drop-down lists and tick boxes. The cues about the way in which these onscreen objects behaved were too subtle and unfamiliar to be helpful at this stage.

3.3.4 Issues arising

In addition, wider general issues were noted over the time of the course. The first of these was the centrality of familiar interfaces. Users found alterations to the interface extremely disconcerting and would report to the trainers in dismay if something had changed. Although, perhaps through experience, this became less of a problem as the course went on, it does raise questions about appropriate ways of introducing interface "layering".

In worksheets provided for their use, students did not tend to read sections of text, but instead focused on the diagrams. Shorter pieces of text were read, however.

The speed of progress at which complete beginners were comfortable was distinctly slower than the trainers had anticipated. This is a common finding [5], but emphasizes again the difficulty of judging when a student is "ready" to progress to the next stage of computer use, particularly when it is of central importance not to rush older students and to allow them to learn at their own pace [13].

The discovery course had a high trainer–student ratio (one trainer to every two or three students), and the environment was deliberately very relaxed and informal.

Feedback from the students reflected their recognition and appreciation of this environment, e.g., "I was very aware of not feeling silly when asking what must have seemed very basic questions". Nonetheless, issues did arise about whom to ask for help. Several students, particularly men, were noticeably reluctant to ask for help with difficulties. These students tended to prefer to ask their neighbours for support. By contrast, some of the students had spouses (often wives) who were experienced computer users. These students were deeply reluctant to learn about computing at home, sometimes arguing that their spouses were too busy to have time to help them.

The fundamental barriers encountered at the beginning of the course were lack of confidence and nervousness about the technology. Building confidence was a slow process which could be upset by a single mistake.

4 Conclusions and discussion

A difficulty that faces the computing community is that older adults who find themselves struggling with computer use may simply abandon the attempt [3]. If design is to be truly inclusive, it is important to retain these users as far as possible. This paper has reported on a class in which all participants completed the course, despite the difficulties they encountered. It is suggested that this occurred because of the flexible and iterative approach to teaching that was adopted. Even with a considerable knowledge of the literature on older users and a knowledge of the cognitive, sensory and physical changes commonly associated with age, the diversity of the group makes it difficult to predict the behaviour and concerns of an individual group; this is one of the fundamental challenges of 'universal design'. By adapting the course in order to support the specific problems being encountered by the participants, for example, providing a "panic sheet" that allowed them to escape from apparently serious errors, it was possible to genuinely support the users and maintain their presence throughout the course.

Further, the identification of a series of problems, including those that could not be solved within 11 weeks, indicates that inclusive teaching methods have to be flexible and adaptable in order to support learners at all stages of their development.

Within the time range of an 11-week course, three layers of problems and barriers emerged. The solution of one layer simply led to the next layer being encountered. Although with support, most students were able to overcome the barriers and progress, this took significantly longer than anticipated. All but three of the group are now experienced and enthusiastic computer users (one participant has sadly since died, another two were unable to master mouse use which made standard computer technology effectively unusable).

It is important to remember that this group was relatively young and well educated. Work by Czaja et al. [14] shows that high education levels and intelligence levels are predictors of computer use. Difficulties that most of them were able to overcome through support and their own positive attitudes are likely to be far more significant barriers to those who are older, less well educated and with lower levels of intelligence. For these potential users, it is vitally important to remove as many barriers as possible to ease of use, because such barriers may prove insurmountable, preventing or complicating access to computer technology until it becomes unusable.

It is worth emphasizing that the barriers described above are those that were observed during the course or those that were commented on by the students.

They were therefore addressed by the trainers, who concentrated time and effort towards helping students to overcome them. Encountering barriers in a supportive context with high levels of support from both experts and peers is a very different experience from encountering the

same barriers in an unsupported environment where their cause, solution and possibility of recurrence may be unknown or unrecognized. Issues that were irritants for the Discovery group could easily, in another context, have been significant barriers, making computer use sufficiently difficult to be, in effect, non-viable.

Acknowledgments We would like to acknowledge the central contributions made by Scott Milne and Audrey Syme to the Discovery class. Funding was provided by SHEFC, the Scottish Higher Education Funding Council.

References

1. Turner, P., Turner, S., Van De Walle, G.: How older people account for their experiences with interactive technology. Behav. Inf. Technol. **26**(4), 287–296 (2007)
2. Morris, J.M.: Computer training needs of older adults. Educ. Gerontol. **20**(6), 541–555 (1994)
3. Shapira, N., Barak, A., Gal, I.: Promoting older adults' well-being through internet training and use. Aging Ment. Health **11**, 477–484 (2007)
4. White, H., McConnell, E., Clipp, E., Branch, L.G., Sloane, R., Pieper, C., Box, T.L.: A randomized controlled study of the psychosocial impact of providing internet training and access to older adults. Aging Ment. Health **6**, 213–221 (2002)
5. Czaja, S.J., Lee, C.C.: Designing computer systems for older adults. In: Jacko, J.A., Sears, A. (eds.) The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications, pp. 413–427. Lawrence Erlbaum Associates (2003)
6. Worden, A., Walker, N., Bharat, K., Hudson, S.: Making computers easier for older adults to use: area cursors and sticky icons. In: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp. 266–271. ACM, Atlanta (1997)
7. Carroll, J.M., Carithers, C.: Training wheels in a user interface. Commun. ACM **27**(8), 800–806 (1984)
8. Newell, A.F., Carmichael, A.R., Gregor, P., Alm, N.: Information technology for cognitive support. In Jacko, J., Sears, A. (eds) The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications, pp. 464–481. (2002)
9. Dickinson, A., Eisma, R., Gregor, P., Syme, A., Milne, S.: Strategies for teaching older people to use the World Wide Web. Univ. Access Inf. Soc. **4**(1), 3–15 (2005). (Springer)
10. Bailey, S., Barrett, S., Guilford, S.: Older users' interaction with websites. In: Goodman, J., Dickinson, A. (eds.) Proceedings of the Workshop on HCI and the Older Population at British HCI, Napier, Edinburgh (2005)
11. Syme, A., Dickinson, A., Eisma, R., Gregor, P.: Looking for help? Supporting older adults' use of computer systems. In: Rauterberg, M., Menozzi, M., Wesson, J. (eds.) Human-Computer Interaction INTERACT, pp. 924–931. Zurich (2003)
12. Ellis, R., Kurniawan, S.: Increasing the usability of online information for older users: a case study in participatory design. Int. J. Hum. Comput. Interact. **12**(2), 263–276 (2000)
13. Fisk, A.D., Rogers, W., Charness, N., Czaja, S., Shait, J.: Designing for older adults: principles and creative human factors approach. CRC Press, Boca Raton (2004)
14. Czaja, S.J., Charness, N., Fisk, A.D., Hertzog, C., Nair, S.N., Rogers, W.A., Sharit, J.: Factors predicting the use of technology: findings from the center for research and education on aging and technology enhancement (CREATE). Psychol. Aging **21**(2), 333–352 (2006)