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Authors	Kelly, Helen;Kennedy, Fiona;Britton, Hannah;McGuire, Graham;Law, James
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Narrowing the “digital divide”—facilitating access to computer technology to enhance the lives of those with aphasia: a feasibility study

Helen Kelly	Speech & Hearing Sciences, School of Clinical Therapies, University College Cork, Cork, Republic of Ireland; Speech & Hearing Sciences, Queen Margaret University, Edinburgh, Scotland;
Fiona Kennedy	Speech & Hearing Sciences, School of Clinical Therapies, University College Cork, Cork, Republic of Ireland
Hannah Britton	Speech & Hearing Sciences, Queen Margaret University, Edinburgh, Scotland;
Graham McGuire	Speakability, Edinburgh, Scotland
James Law	School of Education, Communication and Language Sciences, Newcastle University, Newcastle upon Tyne, United Kingdom

Corresponding Author:
Dr Helen Kelly, Speech & Hearing Sciences, School of Clinical Therapies, University College Cork, Cork, Republic of Ireland helen.kelly@ucc.ie

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Background: Despite advances in technology and the universal accessibility of the Internet, the aptly named “digital divide” still prevents equal access to, and use of, computer technology by people with aphasia. The use of technology has clear potential for improved quality of life in terms of increased methods for communicating as well as the facilitation of self-management; however, substantial barriers still pervade. Aims: The aims of this study were to evaluate a bespoke computer training course appropriate for people with aphasia and examine the personal experiences of a small sample of individuals with aphasia following their participation on the course.

Methods & Procedures: This feasibility study with mixed-methods evaluation recruited participants with a range of aphasia severity and different experiences in using computers. Participants (n = 17) discussed their personal experiences of attending the computer course, gathered through topic-guided small focus groups, immediately postcourse and follow-up Refresher class. A Framework Method approach was considered an appropriate methodological design and data were analysed using thematic analysis. Participants also self-rated their skills in using computers before and following this bespoke computer course (n = 16) and at follow-up (n = 10), which was statistically analysed.

Outcomes & Results: Statistically significant differences were found in the improved self-rated ability of a range of computer skills following course attendance. However, participants who attended a Refresher class (5, 9, or 12 months following course completion) reported that without support a number of these skills had notably declined. Three main themes emerged from the focus group data: (i) Facilitation of Social Engagement—technology offered new opportunities to communicate and more independently self-manage day-to-day tasks; (ii) Course Framework—participants reflected on their preferred model of delivery of the course; and finally (iii) Overcoming Barriers to Technology—the advantages of bespoke computer training, and requirements for ongoing support were highlighted as essential components of a training course appropriate for people with aphasia.

Conclusions: The personal experiences of this group of people with aphasia highlight the advantages of accessing technology as a way of facilitating increased communication and an enhanced ability to manage their day-to-day lives. Yet, despite these benefits and the necessity for many people with aphasia to learn or relearn computer skills, finding courses that can accommodate individual needs is problematic. This research highlights the need for bespoke computer training and follow-on support, and highlights the necessary components of such training as identified by this group of people with aphasia.

Rapidly evolving developments in information and communication technologies (ICT) have resulted in access to the Internet becoming a significant essential in the daily lives of individuals of all ages. With UK Internet users reportedly spending an average of 31 hours per month browsing the Internet on a laptop or desktop device (Ofcom, 2014), the Internet currently permeates almost every aspect of daily life, including employment, entertainment, and social activities. Furthermore, half of the UK Government services are now online (Koss, Azad, Gurm, & Rosenthal, 2013) and even the provision of healthcare information and management/rehabilitation is increasingly utilising technology and software applications for the remote management of chronic health conditions (Brandenburg, Worrall, Rodriguez, & Copland, 2013; Sarasohn-Kahn, 2010). Major advances in ICT offer a range of affordable devices to access the Internet with the most important in the UK reported to be laptop/notebook (47%) and desktop computer (31%), followed by more mobile technology such as smartphone, tablet, and other devices (Ofcom, 2014). While almost half of the UK online population claim to have advanced technology (i.e., tablet), laptops remain the most popular device in homes, with laptop and desktop online active audience growing to 39.7 million in 2014 (Ofcom, 2014).

The Internet also facilitates new ways of communication, such as email, Skype, and social networking, helping people stay connected with family, friends, and the world around them. One of the most salient aspects of online communication for individuals with disabilities is the potential to "mask," for example, physical or cognitive impairment, from the forefront of interactions, thereby facilitating social interactions that may not otherwise be possible offline (Bowker & Tuffin, 2002; Guo, Bricout, & Huang, 2005; Seymour & Lupton, 2004). More specifically, individuals with communication disorders can use nonverbal (e.g., gesture with Skype) and written strategies (e.g., email) to overcome communication breakdowns in spoken communication when using computers as a medium of communication, where the offline element of technology allows time to process incoming information and formulate responses. Computer and Internet usage has been found to enhance both the level and the quality of interactions between individuals with disabilities

and others, thus broadening their communicative network (Bradley & Poppen, 2003). Furthermore, enlargement of social networks and increased levels of independence and self-determination have also been reported among individuals with disabilities using computer technology (Cook et al., 2005; Grimaldi & Goette, 1999). The psychosocial benefits of providing Internet access to healthy older adults have been widely reported (Koss et al., 2013) and illustrated in a retirement community that highlighted the importance of facilitating access to technology by older adults (White et al., 2002). This randomised controlled trial indicated that following completion of a training programme, participants reported decreased loneliness, substantial increase in social interactions, and significant improvement in quality of life.

The original intent of the Internet was that it would be universally accessible (Berners-Lee, 1999); however, despite computers being more readily available, the aptly named "digital divide" still prevents equal access to, and use of, ICT by different sectors of the community (Cooper, 2006). "Participation," according to the World Health Organisation's (WHO) International Classification of Functioning, Disability and Health (ICF), is defined as "involvement in life roles" (WHO, 2001, p. 12). However, fully embracing a move to the provision of leisure pursuits, social networking, government services, and healthcare through technology consequently results in excluding those people who have difficulties using such technology. Therefore, facilitation of this "digital participation" (Brandenburg et al., 2013) is essential. As highlighted by Elman (2001) participation in the digital world is now as important as participation in the physical world. Notwithstanding the clear evidence of the potential for increased quality of life through the use of ICT, substantial barriers still prevent people with disabilities from accessing computers and the Internet, thereby resulting in them being significantly less likely to use the Internet than their nondisabled peers (Zickuhr & Smith, 2012). Although the term digital divide originally referred primarily to physical difficulties impacting accessibility to technology (Warschauer, 2004), barriers clearly reach beyond physical limitations significantly impacting those with cognitive or communication impairments—one population being

people with aphasia (Elman, 2001; Seymour & Lupton, 2004; Simpson, 2009). Owing to the multimodal nature of aphasia deficits, that is, reduction in the ability to communicate through speaking, understanding, reading, and/or writing, using technology remains a significant challenge (Elman, 2001).

The continual advancement of technology results in the consequential need for training courses to equip people in keeping their ICT skills updated. Additionally, despite the perception that Internet use requires only basic digital literacy, 63% of working-age and 78% of retired non-Internet users report that they do not possess the necessary skills to use the Internet (Koss et al., 2013). Despite an increase in the use of Internet by the ageing population, with the largest proportion of UK users being over 55 years of age (Ofcom, 2014), computer training generally caters for the needs of the younger generation (mainly text instructions) (Egan, Worrall, & Oxenham, 2004), whereas older generations (>50 years) benefit from the provision of multimedia tutorials employing short, simple instructions to reduce working memory demands, incorporation of illustrations to illuminate text instructions, and an increased font size (Akiyama, 2009).

One of the main barriers to rehabilitation through technology for individuals with aphasia is a lack of accessible training and support for both people with aphasia (Finch & Hill, 2014; McCall, 2012; Parr, 2007) and speech and language therapy (SLT) clinicians (Davis & Copeland, 2006). Individuals with aphasia often face significant barriers to computer training due, for example, to impaired comprehension of spoken/written verbal commands, difficulty asking questions, and writing deficits (Elman, 2001; Lazar & Antoniello, 2008). Participation in ICT training may also be compromised by often co-occurring cognitive, sensory-motor, and psychosocial impairments. Cognitive deficits including impaired short-term memory and recall of verbal information, reduced attention, distractibility, difficulty sequencing steps to complete tasks, and decreased problem-solving abilities (Makin, Turpin, Dennis, & Wardlaw, 2013; Mok et al., 2004) may present difficulties for individuals with aphasia completing computer-based training. Physical impairments such

as hemiplegia, hemiparesis, or limb apraxia may cause additional difficulties when using a standardised keyboard and mouse (Egan et al., 2004). Furthermore, the psychosocial effects of aphasia may result in social access barriers for individuals with aphasia who are considering enrolment on a computer training course given their reduced social network compared to the general population (Cruice, Worrall, & Hickson, 2006; Davidson, Howe, Worrall, Hickson, & Togher, 2008; Hilari, 2011; Hilari & Northcott, 2006) and limited participation in leisure activities compared to their healthy peers (Cruice et al., 2006) or people without aphasia post-stroke (Hilari, 2011).

Computer training courses and self-directed learning textbooks remain largely inaccessible for individuals with aphasia (Egan et al., 2004). In addition, the environment in which computer classes are typically held, such as large public locations comprising people of varying ages and abilities, can discourage people with disabilities from attending, where the pressure to participate in a nondisabled environment may result in feelings of failure, intimidation, and frustration (Obrenovic, Abascal, & Starcevic, 2007). Furthermore, such classes are typically unable to facilitate the complex needs of individuals with aphasia, for example, auditory comprehension impairments, difficulties asking questions, and a lack of one-to-one tutoring. Despite the potential benefits of bespoke training programmes (White et al., 2002), it appears that very little study has been undertaken to develop and evaluate courses that are accessible for this population. Egan et al. (2004) developed an Internet training package accessible for people with aphasia, with outcomes evaluated through Internet skills assessment and questionnaire. Significant differences between precourse and postcourse abilities were found following training completion. Results indicated that people with aphasia were successfully able to learn how to use the Internet with the assistance of one-to-one teaching and materials specifically designed for their needs.

The psychosocial benefits of engaging with ICT (Bradley & Poppen, 2003; White et al., 2002) suggest the potential to reduce negative psychosocial and interpersonal changes often experienced by people with aphasia, for example, feelings of social isolation, frustration,

anxiety, stigma, vulnerability, and helplessness (Brumfitt, 2006; Nyström, 2006; Parr, 2001). However, given the plethora of challenges that can create barriers for people with aphasia taking opportunities to enhance their lives through the use of technology, it is important to ascertain their perspective and examine their personal experiences in engaging in a bespoke training course developed to reduce such access barriers. The aims of this current investigation were (i) to evaluate a bespoke computer training programme for people with aphasia and (ii) to examine the perceived functional impact of learning computer skills on their daily lives.

Methods

This feasibility study with mixed-methods evaluation was developed collaboratively between Queen Margaret University (QMU), Edinburgh, and Speakability (a user-led charity for people with aphasia), and was approved by the QMU ethics committee. Participants were recruited through flyers and face-to-face discussions with members of stroke charities. In order to examine the experiences of participants with a wide range of communication impairments and computer experience, a purposive sampling strategy was employed; participation criteria included (i) presentation with poststroke aphasia and (ii) own (or have access to) a laptop or desktop computer.

Participants

Twenty-one participants were recruited to the courses and were permitted to attend even if they did not wish to provide research data. Seventeen of these participants (3 female, 14 male—age range 40:2–80:11) provided quantitative and qualitative data for this study. All participants presented with poststroke communication difficulties, primarily aphasia, apart from one participant who presented with aphasia but whose medical diagnosis was unknown prior to commencement of the course. Time post onset ranged from 6 months to 12 years. Table 1 highlights the range and variation in the presentation of participants' aphasia and cognition according to performance on the Comprehensive Aphasia Test (CAT) (Swinburn, Porter, & Howard, 2004). As Table 2 indicates participants had a range

of prestroke computer experience; three participants had never previously used computers. Of those computer-experienced participants, computer usage ranged from on average <1 weekly to many times daily; for most people this reduced considerably following their stroke, with six of these participants unable to use their computer post stroke.

Table 1 and Table 2 around here

Attendance at all classes was very high with 100% attendance for 16 of the 17 participants; one person missed one class due to illness. One participant (UT) had originally attended three classes of the weekly course but withdrew due to ill health; however, he later attended 100% of the intensive course when his health improved (see Figure 1 for participation process). Twelve participants attended one Refresher class, 5, 9, or 12 months following course completion, with participants providing quantitative (n = 10) and/or qualitative (n = 11) research data.

Figure 1 around here

Intervention

The course comprised a number of different components to reduce potential participation barriers and ensure participants would be supported in the development of their computer skills, namely an Orientation seminar, Computer class, and Refresher class.

Orientation seminar

Being the first time that many participants had considered engaging in formal learning following their stroke, an essential component of the recruitment process was attendance at an Orientation seminar at QMU (where the courses took place). This served to reduce anxiety and concerns about the course itself and to become familiar and comfortable within the University environment. It also provided participants and family the opportunity to meet course facilitators and learn about the course, giving them context for discussions at

home. In addition, potential to overcome barriers caused by physical and communication difficulties was illustrated through demonstrating a range of adaptive equipment (e.g., trackerball mouse and screen reader software).

Participants who decided to attend the course completed an information sheet providing details of their computer experience and abilities, and allowed them to indicate topics they wished to learn—this information fed directly into the development of the course content. In order to determine individual support requirements, communication profiles were evaluated using the CAT (Swinburn et al., 2004), and to meet any physical needs, potential benefits of using adaptive equipment were considered through discussion and trialling of equipment. This was further examined during the first class "Safe sitting at your computer," where participants were facilitated in finding the most comfortable seating positions by staff trained in computer ergonomics.

Computer classes

The three-hour classes (with refreshment breaks) aimed to develop proficiency in computer use by providing a flexible framework that gave people the opportunity to learn or relearn basic ICT skills at their own pace (Table 3), as well as focusing on individual interests. The majority of participants owned or had access to desktop computers; therefore the course focussed on this technology device rather than on more advanced technology such as iPads. In saying that, two participants with laptops, and one who newly acquired an iPad during the course, were encouraged to use them during the classes and materials were individually tailored as required.

Table 3 around here

Two course models were offered, which were aligned with timings for SLT student clinical placements—eight weekly classes for eight weeks, or more intensive, eight classes over three weeks—each class comprising a maximum of eight people with aphasia. This allowed

exploration of the feasibility of providing different levels of training intensity from the perspective of the participants.

The classes and all materials were developed and delivered by a qualified speech and language therapist (HK). The content was determined through examination of community/ public computer classes and importantly topics highlighted by participants during the Orientation seminar. Most popular topics were provided for the group as a whole, for example, getting information from the Internet, replying to emails (see Table 3). Where participants identified individual topic areas (e.g., inserting document hyperlinks or using Skype and facebook), these were taught on an individual basis. The presentation of receptive and expressive aphasia experienced by the participants (see Table 1) was taken into consideration, in particular, when teaching new terminology and skills. Teaching methods included an introduction to and demonstration of skills using PowerPoint presentations and aphasia-accessible materials. Participants were provided with a booklet for each topic and home practice tasks, for example, replying to an email from the tutor before the next class. The booklets, based on recommendations by Egan et al. (2004), employed screenshots and simplified phrases to guide participants through targeted tasks.

Each participant received 1:1/2:1 support, ensuring accessibility of the course through explaining, instructing, facilitating, and further adapting course materials to meet individual participant needs, for example, larger text. This element of support was provided by SLT students forming part of their clinical placement. These students had theoretical knowledge about aphasia and were closely overseen by the tutor and supported by indepth discussions about their particular participants at the end of each class. Such level of support ensured the prompt identification and resolution of difficulties encountered by participants. In addition, training focussed on each participant's personal goals, thereby aiming to have a positive impact on their daily lives. Personal goals identified by participants included learning how to: use facebook; Skype relatives living abroad; insert "hyperlinks" within documents; order grocery shopping online; review online sports results; and use

audiobooks. Participants were interviewed individually midway through the course to ascertain their progress and enjoyment of the classes, for example, topics found useful, challenges encountered, identification of further adaptations to facilitate better engagement and learning, and discussion around personal goals for the remainder of the course.

Refresher classes

Following completion of the courses, residual funding permitted the provision of a Refresher class for those participants who attended one of the computer courses. Therefore, all participants were invited to attend one Refresher class held at 5, 9, or 12 months following the course. Refresher classes allowed participants to further practice computer skills and resolve any difficulties experienced since course completion. Participants also provided follow-up data in small focus groups, reflecting on the long-term usefulness of the course and any impact it might have had on their lives.

Data collection and analysis

A mixed-methods approach, employing self-rating scales and focus group discussions, facilitated exploration of perceived skill change, level of computer use, personal experience of the course, and if learning how to use technology had had an impact on participant quality of life.

Self-rated computer usage and computer skills

Self-rated reporting of computer usage and skills was gathered before and immediately following the course, and during the Refresher classes using an aphasia-accessible rating scale. Participants indicated their average weekly computer usage (Table 2) and how easy or difficult (“impossible” to “no problem”) they found a range of tasks, for example, “go to a website,” “get information from the Internet,” or “reply to an email.” Data were analysed using the Wilcoxon signed-ranks test.

Personal experiences of the course

To gain insight into their experience of the course, all participants were invited to attend focus group discussions, immediately following each course and Refresher class (see Figure 1). Given the limited time, the use of focus groups facilitated the capture of a wide range of participant opinions (Kirk & Miller, 1986). Topic guides (see Appendix) enabled the examination of predetermined themes related to the structure and impact of the course, as well as providing the opportunity to discuss other areas of interest to the group. Focus groups were facilitated by individuals not involved in the development or delivery of the course, apart from one facilitator (MG) who facilitated a group of people she had not been involved with. Three of the facilitators were SLTs and the fourth, an audiologist; all were experienced in working with adults with acquired communication impairments. To ensure comprehension and facilitate discussion, facilitators used supportive conversation techniques, such as rephrasing questions or clarifying with open or closed questions, provided pen and paper, and ensured that each person in the group could contribute to the discussions. This format also enabled participants with limited expressive language to offer opinions by indicating agreement or disagreement with other individual's perspectives, which would not have been possible without the interaction of the group. Multiple focus groups provided a more representative sample to examine patterns and disparities in participant opinions (Krueger & Casey, 2000).

A Framework Method was considered an appropriate methodological approach for this study combining both deductive (i.e., pre-established themes, devised to address research aims) and inductive (themes generated from data) data (Gale, Heath, Cameron, Rashid, & Redwood, 2013; Pope, Ziebland, & Mays, 2000; Smith & Firth, 2011). Pope et al. (2000) identified the following five main stages of data analysis in the framework approach: Familiarisation with the raw data to identify key ideas and recurrent themes, and to identify a thematic framework for detailed examination; application of the thematic framework through allocating codes to transcripts supported by text descriptors (Indexing); Charting by rearranging the data according to related thematic framework, forming a chart per key

theme; and Mapping and Interpretation through using the charts to identify associations between deductive and inductive themes to provide explanations for the findings. The Framework Method has been used successfully with a number of studies that analysed aphasia-related qualitative data (Law et al., 2010; Parr, 2007, 2001; Wade, Mortley, & Enderby, 2003).

Processes were established to ensure rigour was upheld throughout the data collection and analysis process. Focus groups were audio recorded and verbatim orthographic transcription was carried out in full by HB and independently checked for accuracy by FK and HK who relistened to the audio files and read the transcribed data. As author HK developed and facilitated the computer course, and in order to maintain transparent integrity HB (student tutor for one course) and FK (not involved in any aspect of the research) also independently analysed the data. The transcripts were coded independently using an agreed coding system by HB (NVIVO software) and FK (paper-based). FK and HK independently categorised the coded data within an agreed framework and held discussions around what constituted codes, subcategories, and categories. Any discrepancies were discussed to consensus.

Results

Self-rated computer usage

Data for precourse and postcourse level of computer usage was available for 17 participants (Table 2). Before the course commenced, nine participants reported having "never" used computers post stroke. Following the course, seven of these participants reported using ICT on a weekly basis while two people used it daily. Three people reported using ICT less than once a week on average, increasing post course to between one to two times per week for one person and three to five for the others. Prior to the course five participants reported using computers either daily or many times daily; this level of usage was maintained following the course. Long-term maintenance of computer usage (n = 10) was examined following the Refresher classes. Three participants maintained daily computer usage, with

three others increasing their usage to daily. One participant reduced usage from daily to three to five times per week and the other two participants maintained one to five times weekly. Unfortunately, one participant's computer was damaged and so was unable to practice his skills following the course.

Self-rated computer skills

Self-rated skills on a range of computer tasks were reported by 16 participants before and following the course and analysed using the Wilcoxon signed-ranks test. Table 4 presents the percentage in self-rating scores for each area of ability. Statistically significant improvement in self-reported skills from baseline to post course was found for turning on/off computer ($z = -2.539$, $p < 0.05$); connecting to the Internet ($z = -2.699$, $p < 0.01$); going to a website ($z = -2.762$, $p < 0.01$); getting information from the Internet ($z = -3.344$, $p < 0.01$); using favourites ($z = -2.454$, $p < 0.05$); connecting to email ($z = -2.689$, $p < 0.01$); reading email ($z = -2.223$, $p < 0.05$); and replying to emails ($z = -2.594$, $p < 0.01$). No statistical difference was found in printing a page ($p > 0.05$), which would be expected as it was not included in the course due to technical practicalities. No significant difference was found in using online social media ($p > 0.05$); however, this was only of interest to four people across the courses, three of whom continue to actively use facebook. Self-rated long-term maintenance of computer skills reported at the Refresher classes ($n = 10$) revealed maintained ability to carry out a range of computer tasks since the end of the computer classes (Table 5). However, a number of skills were deemed more difficult to carry out, in particular, reading email ($z = -1.913$, $p = 0.056$) and reaching significance replying to emails ($z = -2.041$, $p < 0.05$), getting information from the Internet ($z = -2.043$, $p < 0.05$) with 4/10 people finding the task now very difficult/impossible or no longer use, and using favourites ($z = -2.328$, $p < 0.05$) (no longer used by 50% participants). No statistical differences were found related to the other topic areas ($p > 0.05$).

Table 4 and Table 5 around here

Participants' personal experiences of the course

In total 17 participants spoke about their personal experiences of participating in the computer training in the focus groups. While topic-guided questions prompted information from pre-established themes, i.e., (i) Facilitation of social engagement and (ii) Course framework, the initial open coding approach (to ensure important aspects of the data were not missed) resulted in a third overarching theme—(iii) Overcoming barriers to technology (computer usage/training).

The desire to learn how to engage with technology in a meaningful way was expressed by all participants who completed the course, irrespective of age, severity of aphasia, or previous computer experience. They discussed at length the advantages of using ICT, describing it as a source of information, providing enhanced opportunities to communicate, and engage in activities more independently. In addition, participants described tools that helped them overcome barriers to accessing technology-based resources and computer training specifically. Participants articulated in detail the skills they had acquired and/or relearnt and the consequential new opportunities in terms of communication, self-management, and overall enhanced quality of life following the computer training. The Refresher classes were referred to by participants as a "reminder" day where they reported practicing some skills and relearning those that were forgotten, for example, online grocery shopping. These reflections by participants are discussed in relation to the themes and categories that emerged from the data. In addition, Figures 2–4 provide a visual representation of the Framework Matrices related to each theme with examples of categories and codes supported by a range of verbatim quotations from participants. Verbatim quotations identify focus group origin (FG) and timeline, that is, immediately following the course (PC) or Refresher class (PR); for example, FG4PC relates to a comment made by a participant in focus group 4, following the course, whereas FG1PR relates to focus group 1, following the Refresher class.

Figures 2-4 around here

Theme 1: facilitation of social engagement

Participants deliberated about how attending the computer course had opened up new opportunities to access the same communication, information, and leisure opportunities enjoyed by the general population. Specifically, new opportunities to communicate (Category 1) and self-manage (Category 2) were the main topics discussed (see Figure 2).

New opportunities to communicate

Attendance at this training course increased the range of technology participants could use when communicating. In particular, many people reported how technology helped them overcome some of the barriers they faced when communicating verbally, for example, TN described the benefits of using the computer compared to telephone correspondence "cos' I can't speak to people on the phone.. cos' they don't understand me … you know.. but when I'm doing it.. on text.. it's easier" (FG4PC). Using written rather than spoken communication reportedly helped maximise many participants' capacity for effective communication and enhanced the quality of interactions, making communication easier as discussed by the majority of participants.

The range of communication platforms participants learnt (or relearnt) on the course was discussed and preferred interfaces to connect with family and friends, such as Skype and facebook, were deliberated. Participants highlighted that having the necessary skills to use technology increased the amount of contact they had with people. A number of participants learnt how to use Skype to keep in contact with family and friends. BH, for example, found it particularly difficult to speak to family living abroad by telephone, so his personal goal was to learn how to use Skype to converse with his son, noting that it was now a lot easier to keep in contact with family as both communicators could use nonverbal and written strategies to overcome communication breakdowns, thereby maximising communicative effectiveness. Four participants on the course learnt how to use facebook, three of whom still actively use it. One of the main attractions for participants was that it didn't require much text, photographs could be uploaded to share life events, and arrangements for social

occasions could be made. To some degree this helped participants mask their disability. TP, for example, has severe expressive aphasia with apraxia of speech, but used facebook to link with people arranging a school reunion, which he then attended. Email in particular proved a popular method of communication for all participants, in their communication with family and friends living both at home and abroad, and made staying in contact with people more manageable as reported by DR, “it’s much easier … and I’ve.. established an e-mail relationship with.. quite a number of the people.. from school.. we get in touch regularly now by e-mail … and it’s a great help” (FG2PC). It also made disseminating information easier such as organising committee activities and meetings or in organising holiday arrangements.

Facilitation of self-management

Another area of importance highlighted by all participants was how technology now facilitated their ability to self-manage their day-to-day lives (Figure 2). Participants reflected on positive changes in their independence and how focussing on personal goals during the classes empowered them to conduct activities of daily living more independently. This included aspects related to the ergonomic use of computers, “so uh.. you know even setting.. setting the desk.. and how to.. how to..s- you know what height y- you should be and so on” (BH-FG3PC). Participants’ personal goals illustrated the diverse desires of individuals with aphasia and how the use of technology contributes to meeting these needs, fostering more independent and meaningful living. DR reported that she required her computer to help with correspondence, “because I couldn’t write letters without my computers … and I couldn’t.. find out the things I want to find about.. and I.. it’s.. such a great help”(FG3PR). Whereas TN had forgotten how to download music following his stroke but found the course “very helpful cos’.. what I wanted to do was download my CDs and everything … and they’ve shown me how to do it…. I used to do all the before.. but I just forgot how to do it” (FG4PC). A number of participants who retained basic computer skills following their stroke learnt more advanced tasks pertinent to their social participation. For example, EI learned how to insert hyperlinks into

documents during the course, which gave him more independence in organising paperwork related to Cubs—"if I press a button.. I would find.. out.. mine was it's the Cub.. I press that Cub.. I find out where he stays … and more information about him" (FG4PR). Another participant, QN, learnt how to organise electronic documents into folders and reported "I am now more organised than I have been for the last 15 years" (FG1PC).

A number of people reflected on how learning to use software enabled them to overcome some of the barriers associated with their communication deficits. Screen reader software was particularly useful to a number of participants who would otherwise not be able to access information on the computer. One participant explained that "it takes me an h-.. a hour and a half to read.. one.. page hhh um.. but this in uh i- i- if it will speak.. it will read it for me" (QN-FG2PR). An excerpt from EI's discussion also illustrates how such software reduces reliance on others, promoting independence and self-management:

> well it.. it helps me.. fo- this thing here.. I couldn't.. sit and read that … um but what.. you … on the course … just type it in and listen to it uh … before.. I was doing.. using the computer.. I was.. um jumping in the car and going to my Mum and Dad's … it doesnae make sense to me … and they read it and te.. tell me what it actually means … but now.. with the computer and that .. typing it in and listen to it.. it just about get making sense. (FG4PR)

The ability to access the Internet in particular was reported by all participants as having a significant positive impact on their overall quality of life. It allowed them to access the same information as the general population as explained by CN

> one of th-.. one of the lovely things I suppose of the computer business is that … like normally uh at home you'd have a question..you've gotta wait another day.. you know or two days.. or weeks.. until I see someone about it … but the lovely thing is I've got loads of questions that means I can get the old computer.. and then I get the answer back … that's beautiful that. (FG4PC)

Participants commented on the fact that they now use the Internet to independently carry out activities of daily living, with online shopping and banking being popular resources for some participants. Others valued the fact that the Internet gave them instant access to resources such as audiobooks, allowing people with aphasia to access the same reading material as the general population.

> I've got that Talkability thing.… I-.. you go to a book and it will speak.. and tell you every word that's in it … cos' it- it's handy because.. my stroke.. I- I couldnae write.. or I couldn't do reading … and this is very handy it's.. you know. (TN-FG4PC)

The introduction to online media, such as online radio and television, during the training was of great interest to many participants. CX and UT reflected on the benefits of being able to listen to and replay programmes, which helped them overcome difficulties with live media.

> CX: yes.. just it's easy.. easy way to get the news and.. the weather.. and ((laughs)) and then check the e-mails
> UT: the cr- the cricket ((laughs))
> CX: oh cricket ((laughs)) the cricket result.. yeh.. oh yes.. yes and then I find.. um … on the radio.. I can find.. what I want to.. um .. if.. if I.. miss.… I can then go down the thing and get that one on again …. (FG1PR)

Theme 2: course framework

The framework of this training programme allowed individuals to learn or relearn basic and/or more advanced computer skills, depending upon computer experience. This approach ensured that individual interests of participants were targeted where possible. This flexible framework also allowed participants to choose which model of course delivery they wished to attend, that is, weekly or more intensive classes. This theme facilitated reflection on the "best" model of providing computer training to people with

aphasia. The data provided insight into two areas, specifically "computer experience" (Category 1) and "course model of delivery" (Category 2) (Figure 3).

Computer experience

To maximise accessibility for all participants, classes covered a range of skills from the basic use of computers to more advanced activities, thus ensuring the training needs of participants who had never used computers before or those who had forgotten how to use computers post stroke were targeted. It was evident that most previously experienced participants had forgotten a range of computer skills, with some finding even the most basic tasks difficult post stroke, even if they had worked extensively with computers as part of their prestroke employment. Three participants had never used a computer before, and in fact one person (HJ) stated that he had never even "seen" a computer before—this assertion was supported through observation of HJ, for example, lifting the mouse and trying to operate it by trailing it across the monitor on the first day of the course. The other participants had a range of previous computer experience, from basic skills, for example, as CX termed "secretarial" skills to others having used ICT skills as part of their employment, or in the case of TM and HE working in the computer industry itself. As expressed by CN, computer knowledge and skills of participants with previous computer experience were mostly forgotten post stroke:

> I used.. when I was a Manager I mean I used the.. the computer.. and I did.. most of the work I did used that … and then with the stroke.. I couldn't work it.. and then.. I tried.. again and I just gave up…. I was too confused.. I couldn't work it anymore. (FG4PC)

There were initial concerns about mixing people with such a wide range of computer experience and while a few participants indicated that it might be useful to have a separate beginners and more advanced group, the majority of participants reported benefiting from reviewing the basic skills and those participants who were more advanced worked on more advanced tasks individually with their allocated student for support.

Course model of delivery

Participants were asked to reflect on the frequency and duration of the course and the usefulness of the follow-up Refresher class. Interestingly, all participants who attended the more intensive programme unanimously preferred this model of delivery. Participants explained that this format was advantageous as it was easier to remember their learnt skills from one class to the next. CN further highlighted that if the course "… had been like you know ((bangs table)) Monday Tuesday Wednesday .. I think it would have been too much." He explained that it was beneficial that the three days were spread out over the week (Monday/Wednesday/Friday), "… but.. i- it helped for me that o-on the Monday.. I'm s-still thinking..um…. I'm thinking about things.. so by the Wednesday I'm ready t-to learn more … so it's good.. it gives me twenty-four hours t-to think" (FG4PC). When the group was asked if they would have preferred to attend the course delivered one day per week, all participants in that group responded no. In contrast, participants who attended the weekly programme did not discuss this aspect of the course during their focus groups.

The majority of participants felt that the eight weeks of training was insufficient time for them to learn/relearn their targeted skills—"I- I don't think we.. I think you didnae get long enough" (HJ-FG4PC); "too short I think" (TN-FG4PC), whereas a small number were happy with the course length. When asked if they would like the course to be longer, participants responded aye and some participants asked if other such courses would be running in the future. The Refresher classes were considered to be useful by many participants in helping them practice skills that they had learnt during the computer classes, which they had by then forgotten, with some participants calling them "reminder" classes, highlighting the fact that some participants had forgotten how to carry out some tasks, such as online grocery shopping, adding email attachments, and creating/accessing website favourites. A number of participants commented that attending these "reminder" classes also motivated them to continue using their computers and refer to their course booklets.

Theme 3: overcoming barriers to technology (computer usage/training)

All participants identified several factors, which they highlighted as crucial elements to their successful engagement in the training programme. Most participants reported that it would not have been possible to reach their levels of independence using computers without such assistance, namely "bespoke training" (Category 1) and "ongoing support" (Category 2) (Figure 4).

Bespoke training

The importance of the "bespoke" aspect of the training was considered by all participants to have made the course accessible to them. While participants agreed that small class size was an important feature of the course, all participants highlighted two major components they considered to be essential elements required to facilitate their learning, namely the specially designed materials (adapted for individual needs) and the participant–tutor ratio, that is, 1:1/2:1 support. The importance of individually tailored booklets was emphasised throughout discussions and considered by all as "hand-outs … absolutely essential" (QNFG1PC) during the classes themselves as well as practising at home between classes —"the the hand-outs.. v- very useful … uh.. you could always look back" (BH-FG3PC). Although CX commented that his home computer used older software than the course computers and different screenshots affected how easily he could identify the correct icons in carrying out tasks, with 1:1 tutoring this problem was identified early and booklets were adapted accordingly.

While aphasia-accessible booklets were considered essential, participants unanimously indicated that an equally fundamental aspect of the course was the small participant–tutor ratio. In fact, a number of participants indicated that without this they would not have continued with the course as discussed by CN and TN:

> CN: I think if.. if it.. if I didn't have someone..w- with me … who's there listening and..showing me how to do this.. I think I wouldn't have.. th- that.. after that first day I would have shoot and gone
>
> TN: I would have been the same. (FG4PC)

Participants reflected on how they could ask tutors anything “aye because you’ve got a one-to-one.. you can ask them anything” (TN-FG1PR) and having such support gave them confidence in asking for clarification as required to aid understanding “you can ask two or three times.. because I do- don’t understand certain things.. but it’s all there to say it again” (CX-FG1PR).

Ongoing support

This short training course provided many participants with basic computer skills necessary for future learning—“only just a stepping stone” (TN-FG1PR). EI reflected “it’s good.. it gets you up and started anyway gets you started and gets you keen. This course here was good … basic…. I would like to go a bit further” (FG4PR). QN highlighted difficulties for people with aphasia independently learning how to use technology stating “… teaching yourself.. particularly in our situation is one of the real difficulties because.. at least from my point of view.. because my brain doesn’t doesn’t work properly … so if I’m trying to work out uh..to do something new.. it’s really extremely difficult” (FG1PC).

During the follow-up focus groups, many participants indicated that while they continued to use their computers, they highlighted a requirement for ongoing postcourse follow-up support, with most identifying family or friends for such assistance. Where this support was lacking, newly acquired skills could not be practiced and therefore forgotten. A few participants tried to access support out with their family/friends network; however, it was clear that essential elements required by people with aphasia are not readily available elsewhere. TN explained that his publicly available computer course had just one tutor responsible for the learning needs of the full class, which negatively impacted his learning: that’s what I’m finding now.. if I’m not sure of something.. and I’ve got to ask the boy..by the time he comes to me.. the class has finished … if you’ve got a problem with something on the computer … the boy I’ve got.. he doesn’t show you.. he does it himself … you know.. he doesn’t take time to show you.. it’s too quick … far too quick..you know.. you learn nothing.. you know.. you come out the class and you’re thinking what have I done

today.. you've done nothing.. you know.. and you've got to try and keep up with it.. that's hard. (FG1PR)

Others such as QN had paid for one-to-one tutorials with success dependent upon whether tutors understood the communication and cognitive difficulties that impact the learning of this population. QN stated the "right sort of person … you know that what yo- your problems are.. er.. which is not.. not easy.. they might tell you quite a lot of.. things.. which you then forget.. because of th- th- of the um.. stroke" as they did not understand his communication/cognitive difficulties. However, he noted "but the really good people.. that do exactly the same sort of thing as you people did.. um with th- things that you can.. look at easily.. and keep it.. um.. and that's been very helpful" (FG2PC).

Discussion

The aims of this mixed-methods feasibility study were to evaluate a bespoke computer training course that could be easily accessed by people irrespective of the severity of aphasia or computer experience, and to explore the personal experiences of participants in order to examine any perceived functional impact of learning computer skills on their daily lives. Overall, participants rated their newly learnt or relearnt computer skills more favourably following the course, reaching statistical significance for most tasks, similar to participants in the Egan et al. (2004) study. However, some areas were noted to decline at follow-up. Importantly, small focus groups gave participants the opportunity to describe their personal experiences of the course. Three overarching themes emerged from the data: facilitation of social engagement, course framework, and overcoming barriers to technology.

Participants described how learning/relearning ICT skills and expanding their knowledge of technological resources, for example, Skype, email, and social media, offered them more opportunities to communicate with family and friends. Many participants advocated offline technology such as email and facebook, which allowed them to overcome communication

difficulties, as reported in the literature (Guo et al., 2005: Seymour & Lupton, 2004), with increased communication opportunities potentially reducing social isolation (Van De Sandt-Koenderman, 2011). In addition, participants reflected on various ways technology enhanced their autonomy in functional tasks, for instance, learning how to use the Internet facilitated independence in online shopping and banking, and facilitated access to the same information enjoyed by the general public. Participants highlighted how being able to employ resources from the Internet allowed them overcome poststroke reading difficulties, for example, independently "read" books using screen reader applications or listening to audiobooks. Therefore a key finding from this study highlights the importance of technology in facilitating engagement in "meaningful activities," which is identified in the literature as an important aspect of living successfully with aphasia (Brown, Worrall, Davidson, & Howe, 2012; Grohn, Worrall, Simmons-Mackie, & Hudson, 2014). The literature highlights that while many expressing a desire for increased social activities in their lives, the communication difficulties that people with aphasia experience results in them performing less social activities than healthy older adults (Cruice et al., 2006) and poststroke individuals without aphasia (Hilari, 2011). The impact of this results in people with aphasia becoming less socially engaged and often experiencing social isolation and exclusion (Parr, 2007; Sarno, 1993). Consistent with the literature (Grohn et al., 2014; Hilari, 2011), findings from this study highlight the significance of engagement in social and leisure activities as an important means of feeling connected with family and friends, living more independently, empowering increased participation in society, and improvement in overall quality of life.

In order to inform future training, participants were requested to reflect on the course framework in terms of the mix of computer experience, the frequency and duration of classes, and the usefulness of the follow-up Refresher class. A small number of participants suggested that it might be useful to separate beginners from more advanced learners; however, all other participants indicated that having one-to-one support ensured that their level of ability was targeted during the course. Some participants indicated that they were

initially reluctant to attend the course but through encouragement by their families, and in one case their speech and language therapist, they decided to attend. Although the Orientation seminar was not explicitly discussed by participants, there was a sense that this was essential in putting people at ease in the University environment and obtaining a commitment of attendance from potential participants. Both weekly and more intensive training programmes were considered appropriate course models; however, the majority of participants would have preferred the course to be over a longer period of time and many asserted that it should be available for all people with aphasia. Participants valued further opportunities to receive one-to-one support in practising or resolving difficulties around tasks during the Refresher class. Follow-up data indicated a significant fall in computer skills at these classes, notably some considered important in facilitating social engagement, such as reading and replying to emails, and obtaining information from the Internet, therefore raising issues around sustainability of skills without appropriate ongoing support. The inaccessibility of technology and appropriate training continues to be an important issue for people with aphasia limiting their ability to participate equally in society alongside the general population (Egan et al., 2004; Elman & Larsen, 2010; Parr, 2007; Van De Sandt-Koenderman, 2011). The third overarching theme from participant discussions described what they considered to be the essential components required by people with aphasia in order to overcome barriers to using technology. Importantly, they highlighted the need for bespoke training over and above that provided by publicly available training courses, which included aphasia-accessible materials and fundamentally regular access to one-to-one support. In addition, ongoing support by follow-up courses, paid tutors, or "tech-savvy" family/friends was identified as a requirement for resolving posttraining computer-related issues.

An essential component of research is the measurement of change from baseline following intervention. The measurement of baseline and progression of computer skills with this participant group in particular, where communication and cognitive impairment may hamper accurate reflection and self-evaluation, is challenging. The investigators in Egan et

al.'s (2004) study used a before and after skills assessment. Participants in this current study self-rated their computer skills prior to and following the training, and at follow-up by those who attended a Refresher class. In addition, SLT students measured the progress of participants' skill and independence during each session; unfortunately the class structure did not accommodate rigorous monitoring of these measures and therefore was not included in this paper. Given the advances in technology, future studies might consider collaborating with Human Computer Interaction specialists in employing technology to record more rigorously objective participant engagement and independence in computer skills as well as highlight specific areas of difficulty.

The findings of this study illustrate how engagement in computer training, given appropriate support, can provide people with aphasia with a sense of achievement, confidence, and independence that can potentially extend beyond the life of the course itself. This sense of excitement around the potential use of technology comparable to the general population is beautifully expressed by CN:

> … it's just been … terrific … ch- changed.. my life … l;-learning more about … the Internet…. I really want to get the computer up and I want to use it.. I want to be able to use it for me.. just as a- any bloke somewhere you know.. and I never thought I'd be able to do it again. (FG4PC)

Clinical implications

Van De Sandt-Koenderman (2011) highlights that the majority of SLT intervention delivers therapy focused on the impairment level of ICF, with much less targeting functional and participation levels. Gaining a sense of independence and fostering pleasure or well-being have been highlighted as two of the most frequently mentioned reasons for valuing participation, indicating that clinicians should therefore address participation in the early creation of therapy goals by identifying activities with the client that will have the greatest impact on their independence (Brandenburg et al., 2013). Research indicates that more communication networks, government and healthcare information and services are being

provided online; therefore, people need to be technologically and Internet-savvy if they wish to be able to access these facilities.

Findings from this study certainly indicate that people with aphasia are one group who find it difficult to engage with this technology, highlighting that access to technology for people with aphasia requires time, expertise, and training. Indeed, the essential components of computer training appropriate to the needs of people with aphasia, identified by participants in this study, could argue for the involvement of speech and language therapists in its development, for example, consultation in the design of appropriate booklets, provision of training for potential tutors, or actually facilitating the training themselves. Although resource implications may present in the development stages, there is clearly a role for supervised SLT students who according to the participants in this study would make excellent tutors, providing assistance in the adaptation of materials for individual participants, provide 1:1/2:1 support, and in turn offer students the opportunity to engage in functional therapy resulting in potentially tangible quality-of-life changes. While traditionally the training and support of technology are not considered part of the clinician's therapeutic role (Brandenburg et al., 2013), McCall (2012, p. 235) asserts that "it seems clear that successfully using software to empower a person with aphasia to do something that cannot be done without the technology is actually the treatment." Indeed, apart from the potential benefits in terms of improved social interaction and general quality of life, computer-based software programmes are continually being developed specifically targeting the rehabilitation of aphasia (Mortley, Wade, Davies, & Enderby, 2003; Ramsberger & Marie, 2007).

Given the present economic climate that has resulted in significant funding and resource cutbacks and therefore reduced availability of face-to-face aphasia rehabilitation (Archibald, Orange, & Jamieson, 2009), speech and language therapists need to consider alternative and flexible means of service delivery, for example, employing the use of technology. However, basic computer skills are an essential precursor to accessing

potentially intensive, effective therapy; therefore any ICT illiteracy of this client group and requirements for follow-up support must be targeted if they are to be able to access such rehabilitation. The clinician must therefore consider expanding the range of technology uses in aphasia rehabilitation to span the disorder-orientated, functional treatment and social participation aspects of care (Van De Sandt-Koenderman, 2011), although it is acknowledged that clinicians may themselves need training and support in their use of technology in aphasia rehabilitation (Davis & Copeland, 2006).

Limitations and future directions

This research developed a bespoke computer course that aimed to narrow the digital divide and target reducing a range of physical, cognitive, and communication barriers for a group of people with aphasia. Participants (n = 17) were predominantly male, ranged in age (40:2–80:11), time post onset (5 months to 12 years), severity and presentation of aphasia (Table 1), experience in using ICT (never use to daily use) (Table 2), and were mainly members of self-help groups in the Edinburgh area. It is acknowledged that the small sample pertains to a select group of self-volunteering people who may therefore be motivated to be involved in research and may not represent the aphasia population as a whole. In saying that, the data obtained is invaluable in the information it provides relating to the facilitation of more independent participation in society through ICT and therefore warrants further investigation.

Essentially, this research endeavoured to facilitate the learning of ICT skills with people with a range of aphasia severity and no one was excluded from the course or opportunity to participate in focus group feedback. Challenges in measuring baseline and progression in ICT skills with this population due to communication and cognitive deficits have been discussed and indicate a need for collaboration with HCI specialists in future research. While experienced facilitators used a range of total communication techniques to ascertain opinions from participants with severe expressive aphasia (some limited to single word and yes/no responses), their aphasia was likely to have limited their participation, for example,

introducing new ideas for discussion. Therefore, future studies could employ participatory methods considered to be useful in including participant groups who are frequently excluded from the research process (MacFarlane, O'Reilly-de Brún & de Brún, 2008), such as the aphasia population. These techniques have been successfully used with people with aphasia and, according to McMenamin, Tierney, and MacFarlane (2015a, p. 5), are considered to "promote genuine involvement and participation of participants" (see McMenamin et al., 2015a, 2015b). Using this methodological approach, participants would be considered coresearchers in the generation, organisation, and analysis of data, thus allowing participants with severe aphasia to more fully contribute to the development and evaluation of future ICT projects.

Surplus resources permitted the facilitation of additional focus groups ranging from 5 to 12 months post course. These groups provided follow-up information invaluable for designing and sustaining ICT courses. Future research should therefore plan to include follow-up focus groups and ICT skill assessment (e.g., 3, 6, and 12 months post course), which could more robustly examine the sustainability of newly learnt/ relearnt skills. As sustainability was an issue for participants in this study who had varying access to postcourse ICT support, future research could consider training family members/friends equipping them in supporting long-term use by participants and reducing the need to seek potentially expensive and inaccessible classes/tutors. As technology is now part of everyday life from an early age, basic difficulties such as those experienced by participants in this current study (e.g., turning on/off computer) are likely to lessen. However, given the rapid developments of ICT, without ongoing support, access to new or updated ICT could result in a continued widening of the digital divide for people with aphasia (Elman & Larsen, 2010).

This study was carried out in a university setting, which provided a computer suite that was suitable for the needs of participants in terms of accessibility, canteen facilities, and adequate computer technological support. Other venues had been considered for this course

but did not provide all the required services. However, the university environment may be off-putting for potential participants and in order to make such vital training available to more participants, future trials could evaluate the provision of ICT skill training in the community setting, for example, libraries or day centres. It would also be important to engage in discussions with SLTs to obtain their views in terms of their potential role in providing this foundational computer training.

Conclusion

This study provides understanding about the usefulness of technology for people with aphasia through exploring the personal experiences of participants who attended a bespoke computer course. Irrespective of age, severity of aphasia, or prior computer experience, all participants highlighted the advantages of using technology in order to facilitate increased communication and an enhanced ability to independently manage their daily lives. Participants considered a number of components to be essential in facilitating their engagement in such courses, in particular, bespoke booklets and fundamentally, oneto-one support from someone who understands how aphasia, and other cognitive deficits impact on their learning. Such "ramps," or strategies, embedded within the technology environment, will serve to narrow this digital divide through "support[ing] communicative access and participation regardless of individual capacity" (Law, Bunning, Byng, Farrelly, & Heyman, 2005, p. 171). Skills sustainability was clearly an issue with the notable loss of abilities without ongoing face-to-face support. Findings from this study highlight the need for widely available bespoke computer training with regular appropriate follow-on support to enable people with aphasia engage with computer-based technology in a meaningful way.

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