Exploring older adults' needs and preferences in learning to use mobile computer devices

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Abstract

Older adults have difficulty using and learning to use mobile phones, in part because the displays are too small for providing effective interactive help. We were interested in augmenting the small phone display with a larger display to support older adults' learning process, but it was not clear how to apply existing guidelines to design such an augmented display system. In this technical report, we present a comprehensive survey study of 131 respondents we conducted to better understand the learning needs and preferences that are unique to older adults. The results showed, among other things, that when learning, older adults want to learn to perform task steps and prefer using manuals.

1 Motivation

The proportion of older adults in developed countries is growing and many of them require support because of declines in perceptual, motor and cognitive abilities due to natural aging. As the number of older adults increases, there are proportionally fewer human care givers to provide this support, increasing the need for other types of support such as mobile computer devices (Goodman, Brewster, and Gray, 2004). Mobile devices can support older adults in many ways; for example, mobile phones can help older adults stay connected, innovative memory aids can help them to remember important information, and portable game systems can even offer them entertaining mental exercises (e.g., Nintendo Brain Age™).

Many older adults want to learn to use existing mobile applications and services but have difficulty doing so (Kurniawan, Mahmud, and Nugroho, 2006). For example, in a 2005 UK survey of 3200 adults (age 16+), adults who owned mobile phones were asked how confident they felt about performing a range of typical mobile phone tasks (Ofcom, 2006). Of the surveyed older adults (age 65+) who owned a mobile phone, 22% wanted to store a new contact on their phone and 25% wanted to send a text message, but could not confidently do so. In addition, the proportion of older mobile phone users who could perform these two tasks was much lower than the proportion of all surveyed mobile phone owners (51% and 29% compared to 88% and 81%, respectively). The difficulties that older adults experience in learning to use existing mobile phones may have contributed in part to the slower adoption of mobile phones by this population. Only 49% of surveyed older adults reported owning a mobile phone, compared to 82% of all

surveyed adults. The learning difficulties experienced by older adults can be attributed to several factors, including i) natural declines in their sensory, perceptual, motor and cognitive abilities (Fisk, Rogers, Charness, Czaja, and Sharit, 2009) ii) problems with devices' user interface (UI) (Kurniawan, 2006), and iii) a lack of experience with computers and mobile devices (Fisk et al., 2009).

Our research centred on the idea of providing supportive scaffolding to help older adults temporarily during the learning process. Mobile device users already have access to a number of supportive scaffolding resources, such as manuals, information on the Internet, and people in their social circle, but, given the difficulties older adults have with learning to use mobile devices, it is not clear how effective these resources are in helping older adults and whether older adults actually use them. Further, even if some resources are actually effective in helping older adults learn, these resources may not be used by older adults for one reason or another (e.g., they may not be convenient to access).

Our investigation into supportive scaffolding is further motivated by the networking capabilities of current mobile devices to easily connect to other devices and displays, offering an opportunity to overcome the limitations of a small screen and build new types of novel learning support resources. The mobile device's small screen limits the amount of interactive visual help, a feature that is pervasive in many desktop applications today, that the device can provide to the user. On a small screen it is very difficult to simultaneously display both the application to be learned and the related help content which may be required for learning. Augmenting the mobile's small display with a larger display, such as a desktop monitor or a wall display, helps to overcome this limitation. Researchers have already begun using mobile devices together with larger screens (e.g., (Greenberg, Boyle, and Laberge, 1999)). The two key questions for this investigation is: *How could this added display space be used to support learning?* and *Would older adults learn to use smart phones using an additional display?*

The literature offers some principles for the design of online help, manuals, and other resources (e.g., (Carroll, Smith-Kerker, Ford, and Mazur-Rimetz, 1987; Duffy, Palmer, and Mehlenbacher, 1992; Rieman, 1996), but it is unclear whether these principles are relevant to today's mobile phones (past work has generally focused on learning to use desktop computer applications), or whether they are appropriate for the unique needs of older adults. Further, past studies generally only involved university students and office workers, and not older adults (Carroll et al., 1987; Rieman, 1996). Of those studies that did involve older adults, many did not include younger adults, and consequently the findings do not give insight into the unique needs of older adults (Kurniawan, 2006; Mitzner, T., Fausset, C., Boron, J., et al.; 2008).

2 Objectives and Approach

Our survey study had two primary objectives. Our first objective was to better understand older adults' existing needs and preferences in learning to use mobile devices. Such findings could benefit organizations that support older adults and their use of technology, such as mobile phone carriers and hospitals. Our second objective was to identify ways to design more suitable and effective learning support resources for this population.

We chose to run a survey instead of using other research methods in order to rapidly gather responses from a large sample, so that the results are more likely to be representative of a larger segment of the older adult population. Surveys are commonly used to inform requirements and have been used specifically to gather older adults' self-reported learning preferences that have important implications for designing and deploying help/learning resources (e.g., (Selwyn et al., 2003; Rogers, Cabrera, Walker, Gilbert, and Fisk, 1996)).

We chose to create a more comprehensive questionnaire rather than one that focused solely on designing the augmented display system, in order to both inform our augmented display system design and also to obtain more generalizable results. We focused on mobile devices (e.g., digital cameras, cell phones, electronic organizers) instead of solely one type of device to obtain results that are more generalizable across mobile devices and to future mobile devices. We also surveyed younger adults, as well as older adults, to ground our findings.

3 Methods

3.1 Participants

We recruited participants from senior homes, community centers, and libraries in the Greater Vancouver Regional District, as well as online classifieds (http://vancouver.en.craigslist.ca/) and BCNAR's (BC Network for Aging Research) SMART program (Senior Mentors Assisting Researchers and Trainees). We sought individuals ages 20+ who had used mobile devices in the past, as specified on our call of participation posters/posting. Participants were offered a chance to be put into a draw for one of ten $20 Starbucks gift cards.

One hundred and thirty eight completed surveys were returned , but 7 were discarded because the respondent's age was less than 20 (2 surveys) or incoherent responses throughout the survey (5 surveys). We grouped respondents by age, creating one group of younger adults (ages 20-49), and two groups of older adults (ages 50-64, 65+). We separated adults ages 50-64 from those ages 65+, which is common in research studies with older adults (Smith, 2010), because these groups differ in the proportion of those still employed, a factor which is likely to affect their access to learning resources, and this difference was expected to affect their learning preferences. Older respondents refer hereafter to respondents ages 50+ unless specified.

Participants were asked to indicate their perceived mobile device expertise (see Table 1 for definitions given in questionnaire). Of the 131 respondents, the majority of those who self-reported being "advanced" mobile device users were younger users (12 out of all 22 advanced users), and the vast majority of self-reported "beginners" were older adults (14 out of all 15 beginners). In order to maximize the discovery of age-related differences, we analyzed the data from the respondents who reported being "novice" and "intermediate" mobile device users (N=94). The findings reported in this technical report are based on the questionnaires completed by these individuals.

Beginner:	starting to use and have no or very little experience
Novice user:	can use 1-3 programs or features on device/computer with help
Intermediate user:	can use several programs or features on device/computer without help
Advanced user:	can use "advanced" features on device/computer and/or install new programs

Table 1. Definitions used in questionnaire for different

After the exclusion of the beginners and advanced users, the three age groups were similar on many levels (see Table 2). We ran Kruskal-Wallis tests on the demographic data and did not find significant group differences with respect to gender, education, housing status, reported computer expertise, and years of experience with mobile devices. There was a significant difference with respect to employment status (χ^2=16, *df*=2, p<.001); as expected a larger number of younger respondents were students, while a larger number from the oldest group were retirees. Even after our attempt to minimize differences in reported mobile expertise, there was still a significant difference among the three groups (χ^2=6.4, *df*=2, p=.041), with more younger respondents classified as "intermediate" mobile device users than "novice" users. We argue that this difference in mobile device expertise is minimal, but it needs to be considered when interpreting the results.

		Younger Adults	**Older Adults**	
		ages 20-49	**ages 50-64**	**ages 65+**
	N	28	34	32
Age*	mean (SD)	27.7 (7.7)	57.1 (3.9)	73.1 (5.5)
Gender	# male	8	11	15
	# female	20	23	17
Employ. status*	# student	11	0	0
	# working	17	23	2
	# retired	0	11	30
Computer expertise	# "novice"	2	4	3
	# "intermediate"	18	23	26
	# "advanced"	8	7	3
Mobile expertise*	# "novice"	7	19	16
	# "intermediate"	21	15	16
Mobile experience	# 0-5 years	7	11	25
	# 6-10 years	18	13	11
	# 10+ years	3	10	6

**: significant difference among age groups*

Table 2. Characteristics of the three age groups (*N*=94).

3.2 Questionnaire Design

Our *Learning Methods for Mobile Devices Questionnaire* that we created for this study (see Appendix X for paper version) has five main sections. The first section has demographic-related questions (Q1-Q5) on age, education, gender, housing, and work status. Question wording is similar to those used in our past studies (Leung, McGrenere and Graf, 2008; Leung, Findlater, McGrenere, Graf, and Yang, 2009).

The second section has questions related to participants' mobile device experiences and needs in learning to use mobile devices (Q6-Q10). This section includes questions on what types of mobile devices the participant currently uses or had used (e.g., cell phone, digital camera/music player, personal digital assistant), how often they wanted to learn something new on their mobile device or forgot something they

had learned, and their perceived mobile device expertise. We also ask a related question (Q16), placed outside this section, on how important it was, on a scale from 1-6 (1=not at all important, 6=very important), for participants to i) figure out the exact steps to perform, and ii) gain a general understanding of how the software works, when learning to use a mobile device.

The third section consists of one question (Q11) that focused on the qualities/features in a learning resource that are important to participants. Participants were asked to rate on a scale of 1-6 how important various qualities and features were to them (1=not at all important, 6=very important). Qualities include: "is very affordable (e.g., free)", "is easy to understand (e.g., clear, simple language)", and "is friendly and patient (e.g., not condescending or intimidating)". Learning resource features include: "Allows me to learn in a group", "Demonstrates how to perform task", and "Provides step-by-step instructions".

The fourth section focuses on participants' reasons for or against using each of 11 learning methods. A participant could optionally add one other learning method of their choice if desired. The learning methods consisted of trial & error, using resources provided by device manufacturer or seller (i.e., device's help feature, device's instruction manual), getting help from domain experts (i.e., phone customer/IT support, take class), searching Internet for help, talking to people in participants' social network (i.e., partner/spouse, children, family/friends from their/younger generation, work colleagues). This list includes all the learning methods identified by Mitzner et al. (2008) and almost all learning resources listed by Selwyn et al. (Selwyn, Gorard, Furlong, and Madden, 2003). We did not include talking to "neighbours" or "other member of household" (Selwyn et al, 2003, p. 574), as Selwyn et al. found that these methods were almost never used by their older adult respondents.

Assessing participants' motivations for using learning methods is a key aspect of our questionnaire and we ask four questions (Q12-Q15) to explore this from different angles. For each of the 11 learning methods, participants were asked to indicate on a scale of 1-6 how likely they would use this method (1=very unlikely to use, 6=very likely to use) and explain in a few words why they would or would not use the method (Q12). If no such resource existed for a participant (e.g., participant has no children) or was not accessible (e.g., participant does not have access to Internet), the participant was asked not to give a likely-to-use score but was asked instead to explain in a few words why they would or would not use method if they actually had access to the learning resource. In two follow-up questions, participants were asked to list the 3 learning methods they would most prefer using if they had easy access to all methods (Q13), and the 3 learning methods they that best helped them retain what they learned (Q15).

In designing our questionnaire, we expected that a learning method's perceived helpfulness would greatly impact a person's preference for that method, but we acknowledged there might be other factors beyond helpfulness that affect this preference. While some people may prefer learning methods that are helpful, others may prefer ones that are most convenient, and are not necessarily ones that most effectively help them to learn. Therefore, we asked participants to rate how *helpful* each of the 11 learning methods were, on a scale of 1-6, in learning to use a mobile device (Q14; 1=not at all helpful, 6= very helpful).

The fifth section of the questionnaire focused on getting participants' feedback on using a hypothetical augmented display learning system, particularly perceived benefits and drawbacks of using the system and whether they would use it. We described in text an imaginary system that enabled participants to connect their mobile device to their home computer, and this system guided users step by step through the types of mobile device tasks that they would want to carry out. We stated that the system "could be designed to act pretty much like the most helpful person you know." This section, consisting of one question with many subparts (Q18), asked participants about their perceived benefits and drawbacks of the system, how easy it would be to operate both the device and home computer at the same time, and whether they would use such a system.

We note that the questionnaire had another question (Q17) that asked participants whether they use hand written notes when using mobile devices. This was a secondary question that we do not analyze or discuss here.

3.3 Materials

To increase the accessibility of our questionnaire, we created both an online version and a paper version. Other than the manner in which they were presented and filled out, the online and paper versions were exactly the same. Both versions of the questionnaire began with consent infomation; a person's consent to participate in this survey was assumed if that person completed and submitted/mailed the questionnaire to us. Both versions of the questionnaire also ended with a page/screen on which participants could enter their contact information if they wanted to take part in the gift card draw and/or wanted to take part in a follow-up interview. Of the 94 questionnaires we analyzed, 74 were completed online and 20 were completed on paper. (Follow-up interviews have not been conducted, but are planned as future work.)

The paper questionnaire is shown in Appendix X. Questions were presented in a readable text size (13-point Arial font). The paper questionnaire consisted of 13 pages, including the 2-page consent information pages, each printed on one side of a piece of paper. This questionnaire was given to participants with a stamped envelop that was addressed to the first author.

The online questionnaire was delivered through UBC's officially supported survey system, Enterprise Feedback Management (EFM). This system survey solution stores and backs up all data in Canada and thus complies with the BC Freedom of Information and Protection of Privacy Act. Respondents' contact information was collected in a separate survey following the main research questionnaire. The main online questionnaire consisted of a total of 9 web forms (see Figure 1 for a screen capture).

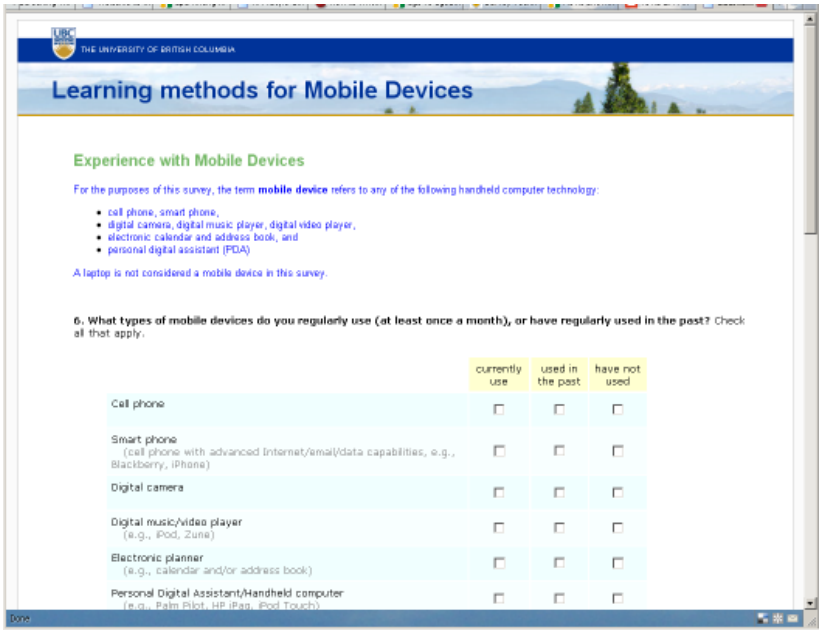

Figure 1. Screen capture of the online questionnaire.

3.4 Design

A between-subjects design, where Age group (20–49, 50-64, 65+) was the independent variable, was used to analyze most of the survey questions. The only time a within-subjects design was used was when we compared respondents' reported importance of step-by-step learning vs. gaining a general understanding for each of the three age groups (see Section 4.2): in this case Learning need (step-by-step learning, gaining general understanding) was the independent variable.

3.5 Procedures

Most paper questionnaires were distributed to the front desk of community centres, senior homes and libraries. A community centre and a senior home also allowed us to hand out questionnaires directly to their members who expressed interest in the study. People who took a paper questionnaire could fill out the questionnaire in any location, at their own pace, and mail back the completed questionnaire.

The online questionnaire could be accessed by going to http://tinyurl.com/UBCMobileSurvey. After filling out the main learning needs and preferences questionnaire, participants were invited to submit their contact information in a completely separate and optional questionnaire. We estimated, based on pilot studies, that participants took around 20-40 minutes to complete either questionnaire version.

3.6 Data Analysis

We analyzed our quantitative data using non-parametric tests (i.e., Kruskal-Wallis, Mann-Whitney U, Wilcoxon signed-rank). The alpha was set to 0.05. Medians are reported unless specified otherwise.

We also analyzed respondents' qualitative responses. A coding scheme was created based primarily on salient concepts identified in the literature (e.g., learning styles (Truluck and Courtenay, 1999) usability (Fisk et al., 2009)), as well as on reoccurring concepts found in the data (e.g., control over

learning). Each text response was given a single code to represent the dominant idea expressed in the response. Responses that were ambiguous, blank or incoherent were coded as not answering the question. The coding scheme and instructions (see Appendix) were found to be reliable: two members of the team (an undergraduate researcher and the first author) coded the responses from a random 20% sample of the surveys, and a substantial degree of interrater agreement was found (K=0.80, p<.001). After this reliability check, one of these two coders (the undergraduate researcher) coded all of the remaining text responses.

4 Results

We present key survey findings here, focusing primarily on older adults' needs and preferences and how they differ from those of younger adults.

4.1 Older adults need to learn and relearn more frequently

To assess our participants' needs for learning to use mobile devices, we asked participants to indicate how frequently they i) needed or wanted to learn to perform something new, ii) encountered a problem or error that they were not sure how to recover from, and iii) forgot how to perform a task that they had previously learned.

A trend in the data suggested that older respondents wanted/needed to learn more frequently than younger respondents (Kruskal-Wallis test, χ^2=5.9, df=2, p=.051). Inspection of the data showed that more than half of older respondents report needing or wanting to learn to perform something new more than once a month (shown by conmbing the “regularly” and “frequently” bars in left chart of Figure 2), while only a quarter of younger respondents report wanting to do so. This finding may be due to the fact that older respondents have difficulty learning mobile device tasks and their learning need remains.

With respect to recovering from problems, most respondents (both younger and older) reported encountering problems/errors less than once a month that they were not sure how to recover from. No significant effect of age was found on this measure (χ^2=1.3, df=2, p=.535).

In addition, older adults were found to forget more frequently than younger adults how to perform a previously learned mobile device tasks. A significant age-effect was found on this measure (χ^2=6.1, df=2, p=.047), and two post-hoc Mann-Whitney U test show that older respondents forgot learned tasks much more often than younger respondents (ages 20-49 vs. 50-64: U=329, p=.014, ages 50-64 vs 65+: U=463, p=.478). Almost half of the older respondents, compared to only one fifth of younger respondents, regularly forgot how to perform a previously learned mobile task (i.e., this happened at least once a month). Findings from these three questions support our initial speculation that older adults want to more frequently learn and relearn to use mobile devices to perform tasks compared to younger adults, making it more important to improve the learnability of mobile devices and associated learning resources.

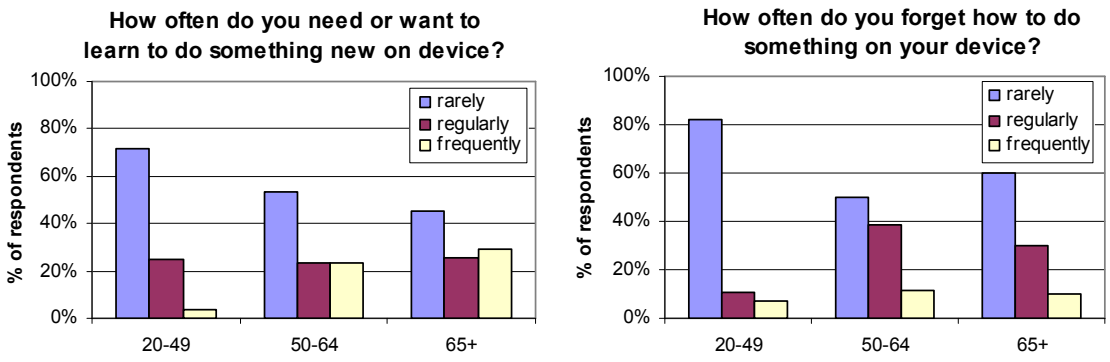

Figure 2. Respondents' self-reported frequency of needing/wanting to learn to perform new tasks (*N*=93, left) and forgetting how to perform learned tasks on their mobile device (*N*=94, right). Frequency: "rarely" = <1/month, "regularly" = 1-3/month, "frequently" = 1+/week.

4.2 Older adults most want to learn to perform task steps

Respondents were asked about how important it was for them during the learning process to i) figure out the exact steps required for a task, and to ii) gain a general understanding of how the software works. Respondents from both older adult groups reported that figuring out the steps was very important and significantly more important than gaining a general understanding (Wilcoxon signed ranks test, ages 50-64: Z=-3.6, p<.001; ages 65+: Z=-3.8, p<.001). In contrast, younger adults reported that both options were similarly important (Z=-0.18, p=.86). The top chart in Figure 3 highlights this pattern of preferences across the age groups.

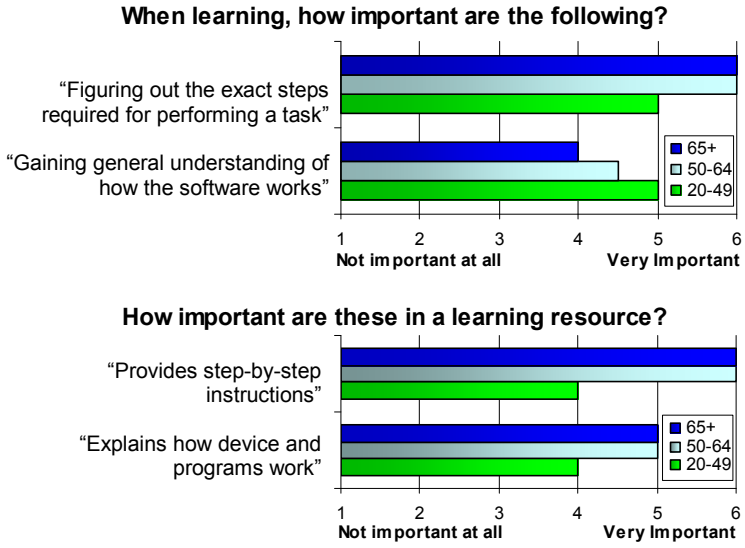

Figure 3. Importance of learning exact task steps vs. gaining general understanding (*N*=94, top) and importance of having learning resources provide step-by-step instructions vs. explain how device and programs work. (*N*=94, bottom).

Respondents were also asked to indicate how important it was for *learning resources* to provide step-by-step instructions and explanations on how the device and software work. Consistent with the above

results, the data showed that respondents from both older adult groups felt it was very important for learning resources to provide step-by-step instructions, and that it was significantly less (but still) important for learning resources to explain how the device and programs work (Wilcoxon signed ranks test, ages 50-64: Z=-2.0, p=.0495; ages 65+: Z=-2.9, p=.004). Younger adults, by contrast, rated these two learning resource qualities as being equally important (Z=-0.12, p=.22).

We note that older respondents' ratings on the importance for learning resources to provide both step-by-step instructions and explanations on how the device works were generally higher than those of the younger respondents. As we show later, younger adults strongly prefer learning independently through trial & error over using any learning resources, which may explain younger respondents' weaker desired support from learning resources.

The findings presented in this section show an age-related difference in learning needs and suggest that learning resources for older adults should be designed primarily to help them to learn the exact steps required for performing a task.

4.3 Older adults want demonstrations, opportunities to practice, and to learn individually

Respondents were also asked to indicate how important it was for learning resources to have a number of qualities and features (beyond providing step-by-step instructions and explanations on how the device works). The results generally showed that older adults, relative to younger adults, placed greater importance on a variety of learning resource qualities and features. As shown in Figure 4, older respondents, compared to younger ones, placed significantly more importance on having learning resources which demonstrate how to perform tasks (Kruskal-Wallis test, χ^2=17, df=2, p<.001), and provide opportunities for practicing tasks (χ^2=29, df=2, p<.001). Older respondents also placed significantly more importance than younger adults on the interactive nature of a learning resource ($\chi^{2=}$19, df=2, p<.001).

We found that, our older respondents, as well as younger ones, placed much importance on support for individual learning but little importance on support for learning in a group (median scores of 5 and 2 out of 6, respectively; no significant effect of age). This finding supports Selwyn et al. (2003) and Mitzner et al.'s (2008) finding that older adults prefer learning by themselves rather than with family or friends.

Our survey also revealed that respondents from all age groups felt that it was important for a learning resource to be accessible (median score: 6/6), understandable (6/6), friendly and patient (5/6), affordable (5/6), and provide detailed information (5/6) (see Appendix for wording used in survey). These findings are consistent with the literature. No significant effects of age on these measures were found.

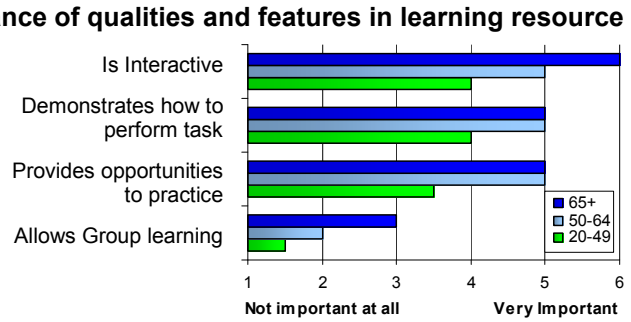

Figure 4. Importance of having learning resources be interactive, demonstrate task, provide practice opportunities, and support group learning (*N*=94).

4.4 Older adults prefer manuals, younger adults prefer trial & error

To assess respondents' learning method preferences, we asked a number of questions that elicited both quantitative data scores and qualitative responses to provide additional insights into respondents' quantitative scores.

4.4.1 Quantitative results

Respondents were asked four related questions to assess their learning method preferences. One of these questions asked participants to choose from our list of 11 learning methods their 3 most preferred choices (i.e., "if you had access to all of the listed methods, which 3 methods would you chose"). Participant responses to this question revealed age-related differences in their learning method preferences.

As shown in Figure 4, respondents, regardless of age group, generally chose as one of their top 3 choices learning methods that allowed them to *learn alone* (i.e., trial and error, search Internet, use device's help feature, device's instruction manual, Figure 5 top chart) over methods that involved *learning with others* (Figure 5 bottom chart). This preference is consistent with an earlier finding that respondents place much importance on learning independently (see Section 4.3). We note that an exception to this finding is older adults' preference for IT support, which appears to be stronger than their preference for searching the Internet for help.

Looking specifically at the four methods that support learning alone, older adults reported different preferences than younger adults. Older respondents most frequently chose the device's instruction manual as one of their 3 preferred learning methods (see Figure 4, top), followed by the device help feature and trial & error. In contrast, the vast majority of younger respondents chose trial & error as one of their 3 preferred learning methods, followed by searching the Internet. In fact, significantly fewer older respondents chose trial & error as one of their 3 preferred learning methods compared to younger respondents (significant effect of age: χ^2=16, *df*=2, *p*<.001; Mann-Whitney U ages 20-49 vs 50-64: *Z*=-2.7, *p*=.006; ages 50-64 vs 65+: *Z*=-1.6, *p*=.117). A trend was also found in the data suggesting a possible age-effect on respondents' preference for the Internet (χ^2=6.0, *df*=2, *p*=.0503) suggesting that older adults have

a lower preference than younger adults for searching the Internet for help. No significant age-related differences were found on manual and device help preferences.

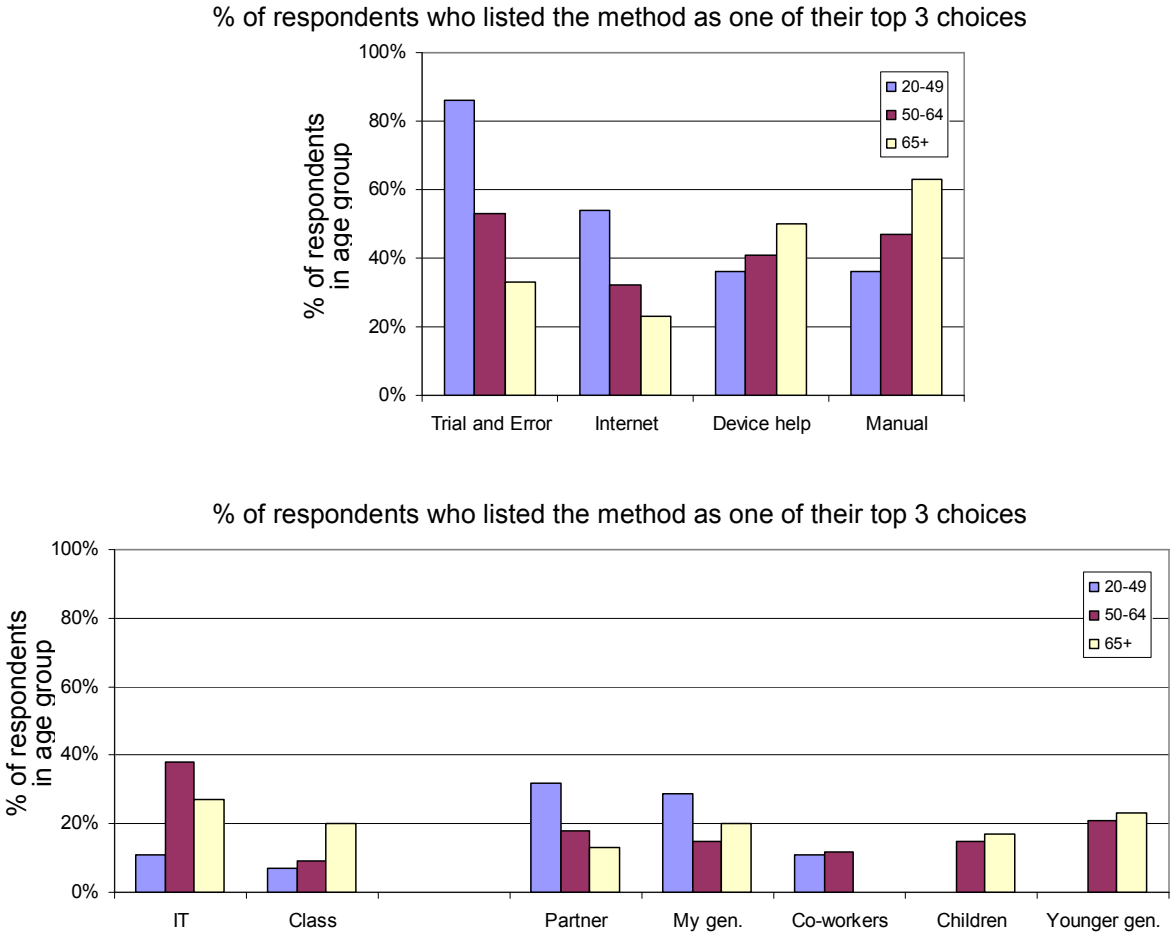

Figure 5. Respondents' learning method preferences (*N*=94).

Analyzing the 7 learning methods that involved meeting with someone to get help, a number of older respondents reported a preference for getting help from the younger generation (i.e., their children, family/friends), while no younger respondents expressed this preference. This difference was likely due to the fact that younger respondents' children and family/friends from a younger generation were too young to be knowledgeable about mobile devices to help the respondents. In contrast, fewer older respondents, compared to younger ones, reported a preference for getting help from their partner/spouse and friends/family from their generation, although this difference is not significant. Our qualitative analysis below sheds some light on these preference differences between older and younger respondents.

The above findings are based on participants' preferred learning methods if they had access to all of them, but these findings are also supported by the responses given to the three other questions related to learning method preference. These three questions asked participants to i) rate on a 6-point Likert scale how likely they would use a particular learning method, ii) how helpful they perceived the method to be, and iii) their three preferred methods to help retain what they learned. To see how well scores from the

three questions support participants' 3 most preferred methods scores, we calculated the correlation between the participants' 3 most preferred methods scores and the scores from each of the three questions. We found significant correlations for almost all learning methods (see Table 3) suggesting that answers from these three questions support the above findings.

	Preferred method if accessible										
	Trial & error	Internet	Device help	Manual	IT	Class	Partner /spouse	My Gen.	Co-worker	children	Young. Gen.
Likely to use	.534**	.450**	.515**	.447**	.254*	.234	.319*	.317*	.421**	.356**	.379**
Perceived Helpfulness	.373**	.348**	.324**	.303**	.487**	.394**	.560**	.225	.374**	.244*	.195
Preferred method retention	.534**	.597**	.739**	.514**	.501**	.497**	.764**	.355**	.561**	.563**	.457**

** Correlation is significant at the 0.01 level (2-tailed)

* Correlation is significant at the 0.05 level (2-tailed)

Table 3. Correlations between responses on learning-preference-related questions

To assess the impact of a method's perceived helpfulness on respondents' preferrence, we calculated the correlation between i) scores on how likely they would use a method, and ii) scores on how helpful a method was perceived to be. We found significant correlations (p<.001) for all 11 learning methods, confirming our expectation that perceived helpfulness is a key reason why respondents chose to use a learning method. However, as we will present next, other qualities such as cost to access resource also affect preference and can explain the lower correlations for learning methods such as contacting IT support, and getting help from children and other family/friends from a younger generation.

	Likely to use										
	Trial & error	Internet	Device help	Manual	IT	Class	Partner /spouse	My Gen.	Co-worker	children	Young. Gen.
Perceived Helpfulness	.573*	.575**	.519**	.656**	.463**	.610**	.718**	.650**	.619**	.571**	.542**

** Correlation is significant at the 0.01 level (2-tailed)

Table 4. Correlations between responses on learning-preference-related questions

4.4.2 Qualitative results

Participants' qualitative responses shed additional light into the age-related differences in learning method preferences. Through our analysis of the qualitative data, we uncovered the reasons respondents' most frequently gave for using and not using a particular learning method assuming they had access to it. To filter out infrequently given reasons, we only list reasons that were captured by at least 1/3 of the responses and given by at least three respondents.

In our summary of the qualitative data, we include the number of respondents who gave a particular reason for using (or not using) a particular method. We also state the total number of respondents who gave reasons for using (or not using) a particular method. We show these numbers as a ratio: "(<# of respondents who gave a particular reason>/<total # of respondents who gave reasons>)". The greater the ratio, the more important a particular reason was for explaining why a method was or was not used. We

note that around one half of qualitative responses did not offer a clear enough reason for using or not using a learning method, and were not used in our analysis; we discuss this in the Limitation section.

We summarize the qualitative result findings here:

- Older respondents' preferred using the device's manual primarily because the manual supported their learning styles. Of all the reasons why older respondents use the device's manual, almost half of the responses (50-64:5/12, 65+:3/6) were related to learning style. One older respondent (age 59) explained, "If I have directions I can usually figure it out" and another (age 72) wrote "[I] like to read to understand." While using the manual was the overall preferred learning method by older respondents, respondents in all age groups (18/31) also indicated that the manual's key shortcoming was unhelpful content (e.g., not enough detail to address specific issues, not written clearly). One older respondent, age 67, wrote, "lack of detail is biggest problem…. too much left out. [very] frustrating." Older adults' preference for manuals over trial & error is consistent with Mitzner et al.'s findings [] and helps to clarify the mixed findings from Selwyn et al. (2003) and Kurniawan (2006).
- Similarly, younger respondents' preferred using trial & error because this method supported their learning style. Of all the reasons why younger and older (ages 50-64) respondents use trial & error, a strong majority of the responses (20-49: 12/16, 50-64:14/16) were related to learning style. One respondent age 25 expressed, "I like to test things out for myself", and another age 26 wrote, "You learn better from failure than success." A number of older adults age 50-64 also preferred using trial & error because it fit their learning style. Of all the reasons for why older respondents do not use using trial & error, almost half of responses were related to negative past experiences, including frustration ("I get frustrated when it 'doesn't work' at once!") and unwanted changes ("I…think I could 'mess it up'"). Our data appears to support past studies that have shown evidence that learning styles can differ by age (Wynen, 2001; Truluck and Courtenay, 1999). We discuss this finding in Section 5.1.
- Respondents of all ages prefer searching the Internet for help but some older respondents do not use it because they think this method takes too much time and often does not help. The main reason why respondents from all age groups (15/32) searched the Internet for help on learning to use mobile devices was because the Internet had much useful information on using their device. However, many older respondents avoided using this learning method because it took them much time to find desired information ("usually too time consuming", respondent age 58) and they often could not find the information they needed. One respondent age 67 wrote that while she often searched the Internet, it provided her "about 50/50 help to dead ends & useless info."
- Respondents did not use IT support or took classes because of high access and time cost. Cost was the most frequently given reason for not contacting IT support (30/41) and taking a class (26/35). Regarding IT support, one younger respondent, age 28, wrote, "This [method] is a

last resort for me. I hate waiting on hold" and an older respondent, age 77, wrote similarly, "[this method is] a last resort. Many IT telephones put the customer on hold for several minutes when I'm looking for an immediate answer." In a similar way, respondents from all age groups expressed that taking a class required too much time and money, and that classes were often not available.

- While younger people were seen as having helpful knowledge about mobile technology, they were often not easily accessible to older adults. Many older adults also reported that they did not know many younger people and the ones they did know were often not easily accessible. One older respondent, age 63, indicated "finding [people from a younger generation is] not so easy." Younger respondents did not have this access problem, which helped to explain their relatively strong preferences for asking their partners/spouses and people from their generation for help.

4.5 Older adults would use an augmented display for learning

Respondents were asked to give feedback on a hypothetical augmented display help system. The vast majority of older participants (89% of responses) responded that they would try to use such a system. In sharp contrast, the majority of younger participants (65% of responses) responded that they would not, based on the conviction that they would not need such help to learn to use mobile device applications.

We also asked respondents whether they thought it would be easy to operate both the mobile device and the desktop computer software. Half of the respondents felt that it would be easy, while one third of the respondents thought that this would depend on a number of factors, such as the complexity of the tasks being learned and overall usability of the system. Responses were similar across age groups.

Respondents were asked to comment on the perceived benefits and drawbacks of this hypothetical system. The ability for more control over the learning process was a key benefit; one respondent (age 71) wrote that the system would allow one to “go @ [sic] your own speed & repeat if necessary”. However, some caution was expressed by older respondents about difficulties being able to communicate their questions to the described system in order to access desired learning content.

5 Discussion

5.1 Effect of learning styles on learning method preference

5.1.1 Preference for learning alone

We found that older adults had a stronger preference for learning alone than we expected. This finding is contrary to studies that suggest that older adults prefer learning in traditional classroom settings (Van Wynen, 2001) or with peers (Kurniawan, 2006). This preference for learning independently may be due to older adults' preference to learn at own pace (Fisk et al., 2009), and because getting help from someone, particularly IT support or a teacher, takes more time than they want to spend on getting help,. Further,

based on respondents' comments, many older adults do not seek help from people in their social circle because many in their circle are less knowledgeable than they are.

5.1.2 Manual vs. Trial & Error

The age-related difference that we found in learning method preferences are consistent with past studies that show that learning styles differ by age group (Van Wynen, 2001; Truluck and Courtenay, 1999). Older adults have been found to become less active and hands-on while learning, and more reflective and observant while learning (Truluck and Courtenay, 1999). We found that younger respondents strongly preferred trial & error and searching the Internet, which are more hands-on and active, while older respondents were found to prefer reading a manual and liked demonstrations, which are more reflective and observational, respectively.

Our survey data suggests that older adults do see value in using trial & error and searching the Internet, but the key reason why older adults do not use these methods is because of past negative experiences using these methods. Many older adults have expressed past frustration when using trial & error; although the exact cause of frustration was not identified in our study, past literature has found that older adults can get more easily lost in navigating mobile device UIs (Ziefle et al.) and are more negatively affected by errors (Birdi). Many of our older respondents expressed that they cannot find answers they are looking for on the Internet. We suspect that older adults could benefit more from trial & error and searching the Internet if they had better support (e.g., through the web browser, online help) to find the information they need and reduce errors.

5.2 Help resources more suitable than training

Our survey suggests that traditional training approaches (e.g., in-person classes, structured online courses) may not be suitable for helping people learn to use mobile devices. Much past research on how to help older adults learn to use technology has focused on designing formal training programs and materials, but our study found that the majority of our respondents did not want to learn in a class nor did they ask to take any type of course (e.g., online).

An alternative to traditional training and teaching resources are help resources, which primarily provide on-demand help to enable learners to perform new tasks. Although classes and courses on learning to use desktop computers and programs are common, help resources (e.g., online help, minimal manual (Carroll et al., 1987)) may be more suitable for helping older as well as younger adults learn to use mobile devices. Mobile user interfaces and tasks are generally less complex than those on desktop computer, so formal training may offer more than enough support but too high of a time cost to make them worth taking. Further, mobile device UIs differ much more across devices and mobile applications than desktop computers, making it harder to create a course that will help people learn to use different devices. Help resources are conveniently available and can offer enough support for the user to perform tasks.

5.3 Inter-related factors that affect learning method preference and effectiveness

Designing our survey and analyzing the data helped us identify many key factors that affect a learner's learning method preference and how well the method helps that person to learn. Many of these factors have been identified in the literature (e.g., (Fisk et al, 2009)) but we identified a number that, to our knowledge, have not been discussed in the literature. We list in Figure 6 factors that one should consider when developing learning/help resources and supporting technology for older adults. This list is not comprehensive but is a step towards creating one that is.

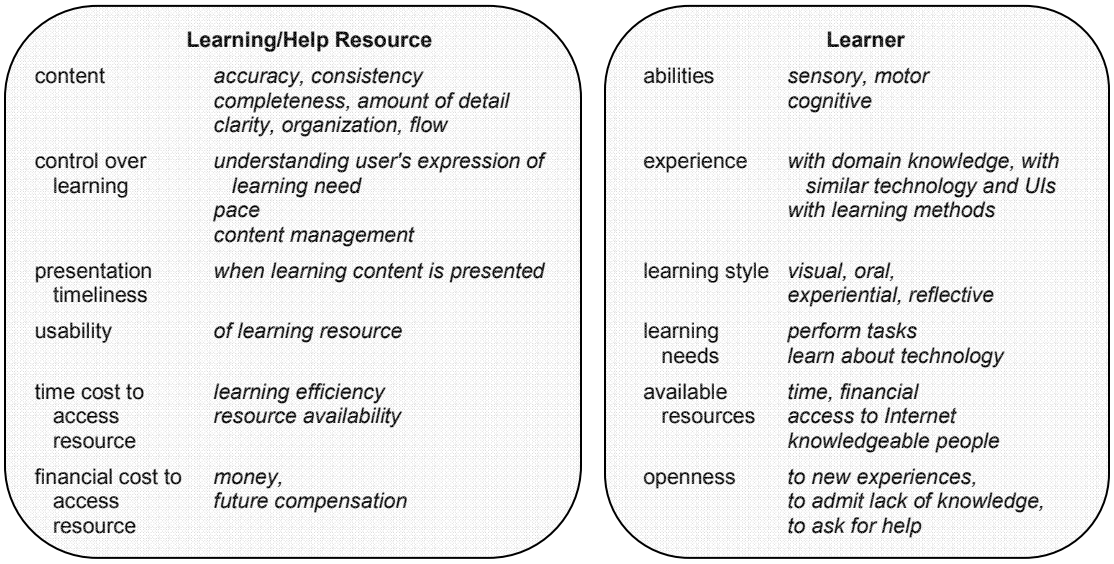

Figure 6. Aspects of learning resource and attributes of the learner that impact learning effectiveness and usage preference. A learning resource designer should consider these attributes during the design process.

We briefly describe factors that have received less attention in the literature:

- Understanding user's expression of learning need: Learning resources designers should be aware of the variety of challenges novices, particularly older adults, may have with expressing what they want to learn. Novices not familiar with the technology or the task domain may not know the correct technical terms (e.g., "Bluetooth", "browser", "wallpaper") related to what they want to accomplish. Further, novices may have difficulty expressing their learning need according to the learning resource's interface. For example, a novice may not know how to phrase their learning need into a question they can ask a teacher, or have difficulties coming up with search terms for an online search engine.
- Pace of learning: Self-paced learning is important to older adults. Interactive help/learning systems should allow users to easily navigate to, pause, and repeat content.
- Presentation timeliness: Designers of interactive systems should consider when to present particular help content. For example important concepts can be introduced when user needs it,

such as in a formal training course, or only when the user can use this information, such as a tutor.

- Financial cost to access resource: We expected that the money required to access a resource might be a barrier to using that resource. However, a number of our older respondents also expressed that getting help from certain people in their social circle might make them feel like they "owed" them a favour in the future, which was also a barrier to getting help from those individuals.

5.4 Limitations

One limitation of our survey study is that participants were current mobile device users and were self-selected (i.e., not randomly chosen). The findings may not capture the needs and preferences of people who have had much difficulty learning to use mobile devices that they were unable to become users. Participants, especially those that filled out the online questionnaire, may have had more computer experience and interest than the general population. We expect that our findings will generalize somewhat to the general population but more work is needed to confirm.

We acknowledge that self-report data can be different from actual behaviour. Our survey study produced many rich findings that we could use, along with guidelines from the literature, to design and prototype our augmented display help system. Because of the novelty of the augmented display approach, we decided to quickly move forward with designing, prototyping and evaluating the augmented display help system without spending more effort gathering additional data. However, more observational data is needed to confirm and build on our self-report-based findings.

One of the known limitations inherent in survey studies is that researchers have less control on encouraging participants to complete surveys fully, compared to other research tools such as in-person interviews, in exchange for administering the survey to a larger population. To minimize this inherent drawback, we set our online questionnaires to force participants to enter data into all required fields including free-form text fields, but we found that a number of respondents typed one or two characters into the text field (i.e., did not answer the question) in order to move onto the next question. Respondents who filled out paper surveys also often left questions that asked for free-form answers blank, likely because of the effort involved.

One key part of our study was that we asked open ended questions (18 total) throughout the survey to capture rich qualitative data. For example, participants were asked to "explain in a few words why you are (or are not) likely to use this particular method or resource" (12 methods/resources total). Although we received many insightful responses, about half of the responses did not answer this question well or provide enough details to be useful. We suspect that the survey may have been too lengthy for some participants to complete, which discouraged them from spending time on the open ended questions.

6 Summary

Our study findings support many existing guidelines for the design of training, and help to prioritize them for our context. For example, we found that older adults place more importance than younger adults on having learning resources provide demonstrations and opportunities to practice, which is also recommended by Fisk et al. (2009) and other researchers. Our findings also help us determine which ones are more important to help older adults learn to use mobile devices.

In summary, we found that older adults:

- primarily want to learn to perform the steps of mobile device tasks and felt it was very important for learning resources to support this type of learning;
- appear to prefer using resources that allow them to learn to use mobile devices by themselves, rather than with other learners;
- compared to younger adults, thought it was more important that learning resources provide extra guidance, such as demonstrations, opportunities to practice and more feedback;
- primarily preferred to use manuals, as well as trial & error and the help provided on the device, to learn to use mobile devices; and,
- were open to using an augmented display system for learning.

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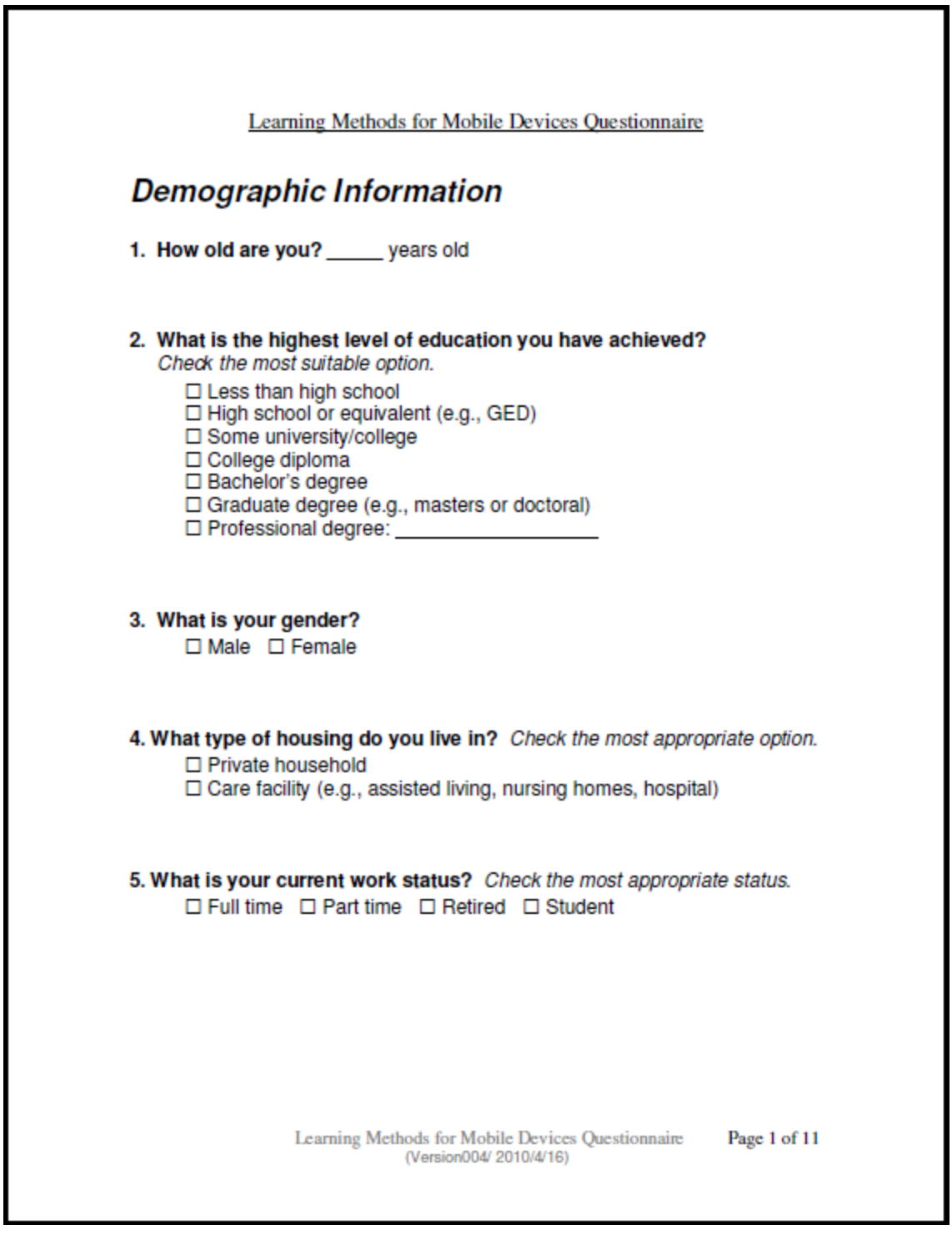
Appendix

Learning Methods Survey



Learning Methods for Mobile Devices Questionnaire

Demographic Information

1. **How old are you?** _____ years old

2. **What is the highest level of education you have achieved?**
   Check the most suitable option.
   - ☐ Less than high school
   - ☐ High school or equivalent (e.g., GED)
   - ☐ Some university/college
   - ☐ College diploma
   - ☐ Bachelor's degree
   - ☐ Graduate degree (e.g., masters or doctoral)
   - ☐ Professional degree: _____

3. **What is your gender?**
   ☐ Male ☐ Female

4. **What type of housing do you live in?** *Check the most appropriate option.*
   - ☐ Private household
   - ☐ Care facility (e.g., assisted living, nursing homes, hospital)

5. **What is your current work status?** *Check the most appropriate status.*
   ☐ Full time ☐ Part time ☐ Retired ☐ Student

Learning Methods for Mobile Devices Questionnaire Page 1 of 11
(Version004/ 2010/4/16)

Experience with Mobile Devices

For the purposes of this survey, the term *mobile device* refers to any of the following handheld computer technology:

- cell phone, smart phone,
- digital camera, digital music player, digital video player,
- electronic calendar and address book, and
- personal digital assistant (PDA).

A laptop is not considered a mobile device in this survey.

6. What types of mobile devices do you regularly use (at least once a month), or have regularly used in the past? *Check all that apply.*

	currently use	used in the past	have not used
Cell phone	☐	☐	☐
Smart phone (cell phone with advanced Internet/email/data capabilities, e.g., Blackberry, iPhone)	☐	☐	☐
Digital camera	☐	☐	☐
Digital music/video player (e.g., iPod, Zune)	☐	☐	☐
Electronic planner (e.g., electronic calendar and/or address book)	☐	☐	☐
Personal Digital Assistant / Handheld computer (e.g., Palm Pilot, HP iPaq, iPod Touch)	☐	☐	☐
Other (please specify): _____	☐	☐	

7. Have you ever acquired a mobile device and abandoned it shortly thereafter?

☐ Yes ☐ No

If yes, state what kind of device it was, and explain in 1-2 sentences why it was abandoned: _____

_____

_____

8. How often do you experience the following?
In each row, check one box that best applies.

	< 1 time a month	1-3 times a month	1 time a week	2-4 times a week	1 time a day	1+ times a day
I need or want to learn to do something new on my mobile device	☐	☐	☐	☐	☐	☐
I forget how to do something on my mobile device	☐	☐	☐	☐	☐	☐
I encounter a problem or error on my mobile device and am not sure how to recover	☐	☐	☐	☐	☐	☐

9. How would you characterize yourself in terms of being able to use mobile devices and computers?
In each row, check one box that best applies.

	beginner	novice user	intermediate user	advanced user
Mobile devices	☐	☐	☐	☐
Computers	☐	☐	☐	☐

Examples of different users' abilities:
- Beginner: starting to use and have no or very little experience
- Novice user: can use 1-3 programs or features on device/computer with help
- Intermediate user: can use several programs or features on device/computer without help
- Advanced user: can use "advanced" features on device/computer and/or install new programs

10. How many years have you used a mobile device?
☐ 0-1 years ☐ 1-5 years ☐ 6-10 years ☐ 10+ years

Preferred Methods and Resources for Learning

When people want to learn to use new technology, they often try to use one or more methods (e.g., work it out by trial and error) or resources (e.g., instruction manual, friend) to help them learn.

The next three questions focus on what methods and resources you prefer to use.

11. The following are qualities and features of different methods/resources for learning to use a mobile device.
How important is each of the qualities and features to you?

In each row, circle a number (1=not at all important, 6=very important).

	not at all important					very important
Is very affordable (e.g., free)	1	2	3	4	5	6
Is easy to access (e.g., convenient, readily available)	1	2	3	4	5	6
Is easy to understand (e.g., clear, simple language)	1	2	3	4	5	6
Is friendly and patient (e.g., not condescending or intimidating)	1	2	3	4	5	6
Is interactive (e.g., gives feedback, answers your questions)	1	2	3	4	5	6
Allows me to learn by myself	1	2	3	4	5	6
Allows me to learn in a group (e.g., with friends, classmates)	1	2	3	4	5	6
Demonstrates how to perform task	1	2	3	4	5	6
Explains how the device and programs work	1	2	3	4	5	6
Provides detailed information	1	2	3	4	5	6
Provides opportunities to practice performing task	1	2	3	4	5	6
Provides step-by-step instructions	1	2	3	4	5	6
Does not require much time to use	1	2	3	4	5	6
Other (please specify): _____	1	2	3	4	5	6

12. How *likely* are you to use any of the following learning methods and resources to learn to use a mobile device?

For each method or resource, choose one of two following options depending on whether you have easy access to it:

1) I have access:	2) I do not have access or not applicable:
- circle a number (1=very unlikely, 6=very likely), and - explain **in a few words** why you are (or are not) likely to use this particular method or resource.	- check the box "NA", and - explain **in a few words** why you would (or would not) use a particular method or resource if you actually had access to it.

	NA	very unlikely to use					very likely to use
a) I try working it out for myself by trial and error		1	2	3	4	5	6
Why use (or not use) this method?:							
b) I use the device's help feature	☐	1	2	3	4	5	6
Why use (or not use) this resource?:							
c) I use the device's instruction manual	☐	1	2	3	4	5	6
Why use (or not use) this resource?:							
d) I phone customer or IT support	☐	1	2	3	4	5	6
Why use (or not use) this resource?:							
e) I search the Internet for help	☐	1	2	3	4	5	6
Why use (or not use) this resource?:							
f) I take a class (e.g., at library, community centre)	☐	1	2	3	4	5	6
Why use (or not use) this resource?:							

This question continues on the next page...

12. (continued from previous page)

	NA	very unlikely to use					very likely to use
g) I talk to my partner/spouse	☐	1	2	3	4	5	6
Why use (or not use) this resource?:							
h) I talk to my children	☐	1	2	3	4	5	6
Why use (or not use) this resource?:							
i) I talk to family/friends from my generation	☐	1	2	3	4	5	6
Why use (or not use) this resource?:							
j) I talk to family/friends from a younger generation	☐	1	2	3	4	5	6
Why use (or not use) this resource?:							
k) I talk to my work colleagues	☐	1	2	3	4	5	6
Why use (or not use) this resource?:							
l) Other (please specify): _____	☐	1	2	3	4	5	6
Why use (or not use) this method or resource?:							

13. If you had easy access to all the methods and resources listed in the previous question, which would you most prefer for learning to use a mobile device?

Enter your top 3 choices using the corresponding letter(s) (e.g., a, b, ...).

Preferred choices: _____ _____ _____

Helpfulness of Different Learning Methods

The next question is similar to question 12, which asks about which methods/resources you currently use. This next question focuses on the **helpfulness** of the different learning methods and resources.

We are looking at helpfulness because some people may choose to use learning methods and resources that are the most helpful. Others, however, may instead choose to use ones that are most **convenient** to access (or some other reason) but are not necessarily the most **helpful**.

14. How helpful are the following methods and resources in learning to use a mobile device?

Go through each method or resource below.

If you have easy access:
- circle a number (1=not at all helpful, 6=very helpful), and
- check one or both boxes to indicate whether that particular method/resource helps you to:
  - figure out the exact steps to perform a task, and/or
  - gain a general understanding of how the software works

If you do not have easy access or not applicable:
- check the box "NA" and skip to the next method/resource

	NA	not at all helpful					very helpful
a) I try working it out for myself by trial and error	☐	1	2	3	4	5	6
☐ to figure out the exact steps to perform a task ☐ to gain a general understanding of how the software works							
b) I use the device's help feature	☐	1	2	3	4	5	6
☐ to figure out the exact steps to perform a task ☐ to gain a general understanding of how the software works							
c) I use the device's instruction manual	☐	1	2	3	4	5	6
☐ to figure out the exact steps to perform a task ☐ to gain a general understanding of how the software works							
d) I phone customer or IT support	☐	1	2	3	4	5	6
☐ to figure out the exact steps to perform a task ☐ to gain a general understanding of how the software works							

This question continues on the next page...

14. (continued from previous page)

	NA	not at all helpful					very helpful
e) I search the Internet for help	☐	1	2	3	4	5	6
☐ to figure out the exact steps to perform a task ☐ to gain a general understanding of how the software works							
f) I take a class	☐	1	2	3	4	5	6
☐ to figure out the exact steps to perform a task ☐ to gain a general understanding of how the software works							
g) I talk to my partner/spouse	☐	1	2	3	4	5	6
☐ to figure out the exact steps to perform a task ☐ to gain a general understanding of how the software works							
h) I talk to my children	☐	1	2	3	4	5	6
☐ to figure out the exact steps to perform a task ☐ to gain a general understanding of how the software works							
i) I talk to family/friends from my generation	☐	1	2	3	4	5	6
☐ to figure out the exact steps to perform a task ☐ to gain a general understanding of how the software works							
j) I talk to family/friends from a younger generation	☐	1	2	3	4	5	6
☐ to figure out the exact steps to perform a task ☐ to gain a general understanding of how the software works							
k) I talk to my work colleagues	☐	1	2	3	4	5	6
☐ to figure out the exact steps to perform a task ☐ to gain a general understanding of how the software works							
l) Other: _____	☐	1	2	3	4	5	6
☐ to figure out the exact steps to perform a task ☐ to gain a general understanding of how the software works							

15. Which of the above methods and resources (listed in question 14) better help you to retain what you've learned (i.e., remember longer)?

Enter your top 3 choices using the corresponding letter(s) (e.g., a, b, …).

Preferred choices: _____ _____ _____

Explain in 1-2 sentences why the methods/resources you listed above better help you to retain what you've learned:

_____

_____

16. When you are learning to use a mobile device, how important is it for you to:

a. *figure out the exact steps* to perform a task, and
b. *gain a general understanding* of how the software works?

Circle a number (1=not at all important, 6=very important) in each row.

	not at all important					very important
To me, figuring out the exact steps to perform a task is:	1	2	3	4	5	6
To me, gaining a general understanding of how the software works is:	1	2	3	4	5	6

17. Do you use hand written notes to sometimes perform tasks on your:

mobile device? ☐ Yes ☐ No
computer? ☐ Yes ☐ No

If yes, who made the notes (e.g., yourself, your son): _____
and what is on the notes?:

☐ Step-by-step text instructions
☐ Hand-drawn images of the mobile device or program
☐ Other: _____

Hypothetical Computer System for Learning

If you need more space to answer the questions below, please write on the back side of this page.

18. It is possible to build a computer program for teaching you how to use your mobile device. With such a program, you would connect your device to your home computer, and it would guide you step by step through the kinds of mobile device tasks that you want to carry out. For example, the program could help by telling you what button to press next and give you encouraging feedback (e.g., "Well done!", "Try pressing this button instead") as you are performing the task on the mobile device. The program could be *designed to act* pretty much *like the most helpful person* you know

What *benefits* do you think this type of computer program would have over getting help from someone (including the most helpful person you know)? _____

_____

What *drawbacks* do you think this type of computer program would have over getting help from someone (including the most helpful person you know)? _____

_____

How easy/difficult do you think it would be to operate both a mobile device and desktop computer program at the same time?

_____

_____

Would you use such a computer program to learn to use a mobile device? Why or why not? _____

_____

Additional Comments?

19. If you have any other comments about how you learn to use mobile devices (e.g., what helps/hinders), please write them here: _____

_____

_____

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Future Involvement

This page will be stored separately in order to ensure anonymity of your responses.

20. We may want to ask you a few more questions, based on your responses, to better understand how you learn to use mobile devices. **Do you give permission for us to contact you for a brief follow-up phone interview?**

☐ Yes ☐ No

21. **Do you give us permission to keep your contact information on file to contact you about future studies related to aging and the use of computer technology?**

☐ Yes ☐ No

22. **If you answered "Yes" to either of the above two questions, or are interested in entering the gift card draw, please provide us with your email address or phone number.** *Your contact information will only be used for the $20 gift-card draw, and to contact you for an interview or future studies if you have given us permission above.*

Email address/phone number:_____