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The Study of Smartphone Usage Competency Assessment and Training for the Elderly

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Abstract

This study aimed at developing an assessment of smartphone usage competence and constructing a training program for the elderly. A list of smartphone usage competencies with 34 items was defined through expert survey and panel. Based on the competence and previous literature, a training program and learning aids were designed in this study. There were 41 participants in our program. The results of self-administrated smartphone usage ability questionnaire indicated that all competencies were significantly improved after training. However, the results also demonstrated that some items were still difficult for the elderly to comprehend. Overall, this study provided a first exploration of defining smartphone usage competency and built a training program for the elderly. With strong suggestion, future mobile health (mHealth) services can follow this study to insure the smartphone usage ability of the elderly.

Keywords:
Aged, Education, Smartphone

Introduction

Noncommunicable diseases (NCDs) have become the leading cause of death around the world and caused 38 million deaths in 2012 [1]. Furthermore, higher prevalence of NCDs among older adults has been reported [2]. Due to irreversibility of NCDs, slowing down the process of the diseases and keeping healthy lifestyle have become the main targets of treatment. Under this situation, technology tools became important assistants for controlling the chronic diseases.

Mobile health (mHealth) represents a subset of telehealth. On account of rapid progress in mobile technology and widespread wireless network, mHealth became a novel model of health care service. Since the smartphone appeared, it has been quickly accepted by all ages around the world. Multisensory, wireless transmission and powerful computing power make smartphones a major mHealth device, and many smartphone-based health care services and research projects are ongoing [3,4].

Nevertheless, according to Aaron Smith's report, the smartphone adoption rate is relatively low in the aging population [5]. Many factors were identified as barriers for older adults to use smartphone, including decline of cognition, reduction of hand motor control, tardiness of information processing, and limited attention[7,8]. Furthermore, the elderly are rarely the main target of technology applications [9,10]. All above reasons are responsible for the lower smartphone adoption rate among the elderly.

In contrast, several researches have indicated that the obstacle of using smartphones for the elderly is not aging process or decline of learning ability but lack of proper training. If seniors can be provided with suitable training, they can develop greater ability of using information technologies and increase their willingness to use [9]. Therefore, the first task of serving the elderly with mHealth service is smartphone training programs.

Competency-based learning has been widely applied to design of training programs for workplace newcomers, medical students, as well as informatics literacy education [11]. The core value of competency-based learning is task-specific. Only highly task-related competence should be involved and all content of training program should base on the competence. Because the elderly do not need to be familiar with all functions and knowledge of the smartphone, the features of competency-based learning make it a strategy for developing training program.

Thus, the objectives of this study are: 1) define the essential smartphone usage competency for the elderly and 2) established a competency-based smartphone usage assessment and training program for the elderly.

Methods

The research divided into three parts: 1) define smartphone usage competence, 2) develop a smartphone usage training program and learning aids, and 3) apply the training program and evaluate the outcomes.

Define smartphone usage competence

Online expert surveys were applied to build the initial competencies. The questionnaire was designed with two open-ended questions to investigate what functions and knowledge of smartphones are needed for the elderly in mHealth. There were five experts surveyed, including three senior researchers in mHealth and two mobile application programmers. All functions and knowledge from the expert survey were analyzed by the research team and listed out to make up the initial smartphone usage competence for the elderly.

To validate the competencies, three senior researchers in health science of aging populations and one scholar who is a master in mobile healthcare system engineering were invited to constitute an expert panel. In the panel, each item of the initial smartphone usage competencies was reviewed for validity and readability. According to experts' opinions, smartphone usage competencies were proposed and used in constructing the smartphone usage training program for the elderly.

Develop smartphone usage training program and learning aids

Based on the competencies developed in previous stages, a smartphone usage training program was constructed for older adults. Each item in the competence list was put into the program. Acknowledging previous studies, our program follows four principles as stated below [10,12]:

- Include essential context
- Manage with task and scenario practice orientations
- Arrange the course according to the relations between each unit
- Design for levels ranging from easy to hard

The learning preferences of seniors were considered. The training strategy followed the principles as described below [6,12,13]:

- Allow learners with time to practice in the class
- Avoid using technical terms in the lecture
- The interval between sessions should not be long
- Provide several class dates for the elderly to choose

The learning aids were also designed following the suggestions of previous research. Previous studies have several recommendations for mobile phone instructions for seniors, such as [14]:

- Provide pictoral instructions, using words for aid
- Maximize the figures and words
- Make sure all contents are covered in the instructions
- Allocate all controls that will be used
- Start from the same view and never miss a step

Apply the training program and evaluate outcomes

We recruited a convenience sample of older adults from a metropolitan hospital in Taipei, Taiwan. We posted the information for our study and accepted applications from interested participants. Prospective participants were eligible to participate in the study if he/she was: more than 50 years old, and not hospitalized. All prospective participants were informed of the research procedure before recruited.

After being recruited, all participants completed a questionnaire that inquired about their demographic information (e.g. age, gender, education background, career) and their smartphone usage ability. The smartphone usage ability questionnaire was based on our smartphone usage competence and used a 5-point Likert scales to evaluate each item in the competence list. A competence score of 5 represented excellent competence, and 1 represented very poor competence. Next, each participant received an android phone and learning aids. All participants were asked to complete the whole training program. We offered 2 different time slot for each class, and all participants were asked to attend each class for one time. After all courses had completed, the elderly were required to self report their smartphone usage ability by the same questionnaire as beginning. The pre-test and post-test score were analyzed as the outcome of our training program. This study was approved by the Taipei City Hospital Institutional Review Board.

Results

The smartphone usage competency

There are ten smartphone functions and seven smartphone concepts that were proposed by the experts. The common reported-functions were calling (n=4), accessing internet (n=4), and system preferences setting (n=4). Other essential smartphone functions included SMS messaging (n=3), switching the phone into on, off, or standby modes (n=2), download applications from Google Play or other platforms (n=2), manage contacts (n=1), switching GPS on or off (n=1), and operating the touch keyboard (n=1). The frequently reported knowledge of smartphones included meanings of gestures (n=3), concept of network data flow (n=2), awareness of smartphone applications (n=2), conceptual understanding of the smartphone exterior and the position and function of each button (n=2), the difference between 3G and Wi-F i(n=1), the meanings of icons on the notify bar (n=1), and conceptual understanding of the android home screen (n=1). By analyzing and organizing the sub-functions and related knowledge of 17 items, we listed out 41 core competencies of smartphone usage.

An expert panel was conducted to validate the smartphone usage competence. The suggestions of experts were 1) divide some items that contain two concepts or functions, 2) combine some similar items into a single item, 3) eliminate redundant items, 4) and simply and clarify the description of items to make it plain for the elderly. Besides, experts recommended that application downloaded through a text message should be added into the list. Refering these suggestions, 34 items were included in the final competence of smartphone usage and categorized in 7 groups (Table 1).

Smartphone usage training porgram

Based on the competencies, a smartphone usage training course and a series of learning aids were developed. The training course contained 12 units to cover all smartphone usage competencies. In order to shorten the course time, the course was separated into two classes and each class was no longer than 1 hour. The sequential order of the content in each class were based on the difficulty in each unit. Therefore, the first class began with introducing the fundamental knowledge and functions of smartphone, containing 1) introducing the appearance of smartphone and how to install the SIM card and battery, 2) switch smartphone to on, off, or standby mode, 3) turn the volume up or down, 4) answer and make a phone call, 5) maintain the address book, 6) send and receive SMS messages, 7) manage the home screen, 8) and take a photo and record video. The second class was more advanced. The topics were: 1) switch 3G, Wi-Fi and GPS on or off, 2) introduce the concept of network data flow, 3) introduce Google Play and how to download an app, 4) and download applications from a SMS message. All participants must attend each class and finished all courses in two weeks. The classes were lecture-based and the lecturer performed each of function step-by-step with the participants. After the demonstration, plenty of scenarios were given to participants and all participants were required successfully solve problems in these scenarios.

Smartphone usage learning aids

The learning aids contained two parts: a learning instruction with colorful comic strip (Figure 1) and a text-based manual booklet. The colorful instruction included all smartphone functions that were introduced in our training program. All functions were shown step by step and all essential controllers were pointed out on the instructions. In order to make the

instructions easier to read for older adults, the features of instruction were listed as follows: 1) all functions start from the same screen, 2) mainly show using pictures and assist with simple sentence, and 3) text size was 18px and pictures were as big as the smartphone used in this study.

Second, the text-based manual booklet focused on introducing the essential knowledge of using the smartphone (e.g. the functions of physcical buttons, the meanings of icons, the concept of home screen, and concept of a network). Since the concepts were hard present by picture, the manual booklet mainly consisted of 14px text.

Table 1 - Smartphone usage competencies

Items
1. Fundamental knowledge of smartphone system
1.1 Install SIM card and Battery
1.2 Switch on the smartphone
1.3 Turn smartphone into standby mode
1.4 Wake smartphone from standby mode
1.5 Know when the battery need to be charged
1.6 Know how to charge the battery
1.7 Know the meanings of touch, press and hold, and drag when using the smartphone
1.8 Know the position and function of power, volume, menu, home and back button.
1.9 Know the position and function of microphone, speaker, back camera, and USB slot.
1.10 Know the meaning of icons (e.g. status of internet, battery, GPS, and reception) on the notify bar
1.11 Know the meanings of Standby, GPS, Google Play, and Wi-Fi
1.12 Able to discern buttons and text fields
1.13 Able to turn the volume up and down
1.14 Able to use touch keyboard to input data
2. Calling
2.1 Able to enter the phone number and make a call
2.2 Able to find a contact person from the address book and make a call
2.3 Able to make a call from communication records
2.4 Able to answer or hang up the phone
3. SMS messaging
3.1 Able to send and receive a short message
3.2 Able to download a application from a short message
4. Contact management
4.1 Able to add a new contact
4.2 Able to maintain contact information
4.3 Able to delete a contact
5. Take photo and record video
5.1 Able to take a photograph
5.2 Able to record a video
5.3 Able to browse the photo and video on the smartphone
5.4 Able to delete the photo and video
6. Manage home screen
6.1 Able to create and remove a shortcut of application
6.2 Able to create and remove a widget
6.3 Able to operate the widgets
7. Access internet and download applications
7.1 Able to switch the 3G wireless on and off
7.2 Able to search and download applications in Google Play
7.3 Able to switch GPS on and off
7.4 Know the meanings of network data flow

Figure 1 - Colored comic strip learning instruction

Implementation and evaluation of the smartphone usage training program

A total of 49 subjects participated in the study during July 2012 to November 2012, and 41 subjects completed the training program and self-reported questionnaire of smartphone usage ability. The age of participants were mostly between 60 to 69 years (65.9%), and were 39% male and 61% female. Participants reported variation of smartphone usage experience: 60.5% had not used smartphone, 12.2% had used smartphone less than one year, 19.5% had 1-3 years of smartphone experience, 2.4% had 3-5 years of smartphone experience, and 10.5% did not reply the question. The characteristics of the subjects and their previous experience of using smartphones is demonstrated in Table 2.

Pretest of smartphone usage ability

Overall results are shown in Table 3. The average pre-test score of smartphone usage ability was 1.91±1.39. Most participants evaluated themselves with poor or very poor in using smartphone. Participants reported higher score in calling (2.18±1.67), contact management (2.05±1.54), and fundamental knowledge of the smartphone (2.02±1.47). In contrast, accessing the Internet and downloading applications (1.54±1.08), managing the home screen (1.68±1.18), and SMS messaging (1.91±1.34) were reported with lower score.

Table 2 - Characteristics of study sample (N=41)

Variable	Freqency	%
Gender		
Male	16	39%
Female	25	61%
Age		
50-59 years	7	17.1%
60-69 years	27	65.9%
70-79 years	6	14.6%
Over 80 years	1	2.4%
Education		
Illiterate	1	2.4%
Primary	2	4.9%
Secondary	19	46.3%
Undergraduate	14	34.1%
Graduate	5	12.2%
Smartphone experience		
None	23	60.5%
Less than one year	5	12.2%
1-3 years	8	19.5%
3-5 years	1	2.4%
No reply	4	10.5%

Post-test of smartphone usage ability

After training, the average score of smartphone usage ability among participants was 3.16±1.00. Participants were inclined to score their smartphone usage as average or good. Calling, fundamental knowledge of the smartphone, and contact management were still evaluated with higher score (3.70±0.87, 3.64±0.74, 3.15±1.08). Manage the home screen, accessing the Internet and downloading applications, and SMS messaging were relatively lower (2.76±1.10, 2.90±0.96, 2.89±1.12). Comparing to the pre-test scores, all scores significantly raised (P<.0001).

Table 3 - Self-administed smartphone usage ability

Item	Pre-test Mean±SD	Post-test Mean±SD	t-test t	t-test p-value
Item1	2.02±1.47	3.64±0.73	-7.93	0.000*
Item2	2.18±1.66	3.71±0.87	-6.32	0.000*
Item3	1.81±1.34	2.89±1.12	-4.45	0.000*
Item4	2.05±1.54	3.15±1.08	-4.77	0.000*
Item5	1.96±1.48	3.10±1.15	-5.19	0.000*
Item6	1.68±1.18	2.76±1.10	-5.79	0.000*
Item7	1.54±1.07	2.90±0.96	-8.11	0.000*

**P<.0001; Item1-7 are referenced to table 2.*

Discussion

Our study proposed a list of smartphone usage competencies and a training program to promote smartphone usage abilities of the elderly. Previous research has focused on training strategies, learning outcomes, and technology usage pattern of older adults [10,15,16]. Few studies, however, have emphasized the content of training programs and its advantages for elderly to receive mobile health care services. To our knowledge, our study is the first to investigate the smartphone usage competency needs and build a competency assessment, as well as training model for the elderly by ascertaining expert opinions.

The prerequisite for the elderly to participate in mHealth services is smartphone usage ability. The benefits of the services will be greater when seniors can master with all smartphone functions used in a certain service. Our smartphone usage competencies contain all functions that were frequently utilized in mobile health care services. According to the report by Free et al. (2013), calling, SMS massaging, GPS tracking, and downloading applications were the most widely used functions in mHealth services [4]. This demonstrates that our smartphone usage competencies can significantly match the needs required for mHealth services.

The contents of our smartphone usage training program were based on our smartphone usage competency. Therefore, it can be confirmed that well-designed programs can promote smartphone usage ability among the elderly. However, our program did not consider what the elderly is actually interested in. They are particularly interested in social applications include Line, Facebook and other entertainment applications. Although their needs may have no relation with the mHealth service, some previous studies have demonstrated that it will increase the motivation for adopting and learning among seniors when the technology fits their needs [17]. Thus, it is advised to moderately involve applications that interest the elderly, because these applications will motivate them to learn.

Our smartphone usage ability pre-test data show that most older adults evaluate their smartphone usage ability as poor or very poor. This finding is consistent with past research, which states that older adults often grade them self with low self-efficacy of technology use [6,18]. It also shows that the importance of smartphone usage training for the elderly before receiving the mHealth services.

After training program, post-test data illustrates that the usage ability of all functions included in our competence list were significantly improved. This finding provides with the insight that our training program and learning aids can positively promote the smartphone usage of older adults. Our findings also indicate that older adults still have ability to learn technologies, and this outcome is consistent with several previous reports [10,15,16].

Results also demonstrate that some specific functions and knowledge still are difficult for older adults to understand after training. Managing the home screen, accessing the Internet and downloading applications, and SMS messaging were the functions that were reported with lower scores. The possible explanation of the result could be an unfriendly interface design for the elderly. Although many studies have been started to give priority to interface design for the elderly, a senior friendly smartphone has not yet been produced [9]. Moreover, it is hard for the elderly to comprehend the concept of specific functions and knowledge because they have not had prior experience. Therefore, our study suggests that future programs for smartphone usage training among older adults should put more efforts on these functions and concepts.

There are several limitations needed to be considered in our study. Since our participants were convenience samples selected from a metropolitan hospital in Taipei, Taiwan, the majority of them live in the same region. The demographic features (i.e., education, economy, health status, and technology experience) of our samples may be dissimilar from older adults who live in another region. This aspect may limit our findings' generalizability. Additionally, it is difficult to highlight that all improvements of smartphone usage ability among the subjects were due to our training program since our study did not include a comparison group. Finally, past studies have indicated that a small class is better for the elderly [10]. However, under the consideration of teaching consistency and research resources, large classes (maximum 20 participants at once) were conducted for our study. The effect of class size on our outcome of training program was not examined.

Conclusion

Our study defines smartphone usage competencies for older adults and applies the competency-based learning as a strategy to build a smartphone usage training program. According to expert suggestions, our smartphone usage competencies cover all functions that have been frequently utilized in mobile health care services. The result of smartphone usage ability reported among our participants indicates that our training program can significantly improve the smartphone usage ability for older adults. With the ability to use a smartphone, the elderly can collect the health parameters through the smartphone and ensure the reliability of the data. We suggest that future smartphone-based health care services or studies can make reference to our research to make sure the data collected from the elderly are meaningful.

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