Scientific
Research
Publishing

# Design of Interactive Tutorials on Mobile Applications for Chinese Middle-Aged and Older Adults

**Xiaoou Chen[1], Fei Wang[1], Zhenwei You[1], Xiaochun Wang[1], Chunjing Tao[2], Jian Liu[3]**

[1]Beijing University of Posts and Telecommunications, Beijing, China
[2]National Research Center for Rehabilitation Technical Aids, Beijing, China
[3]Beijing University of Technology, Beijing, China
Email: cxo_design2016@163.com

## Abstract

With the rapid speed of development for information technology in China, Chinese middle-aged and older adults benefit from various of mobile applications and services. However, most of them have difficulty to learn to use these mobile technologies. Thus, the goal of research is to design an interactive tutorial for middle-aged and older adults, which can adapt to existing applications. By conducting a survey to investigate their requirements for smartphone mobile applications tutorials and doing empirical analysis of the survey, we designed "Help Center", which solves the problems we found from the survey study: 1) by implementing a fixed FAB (Floating Action Button) button as the access of help feature, the problem that users "can't find the help features in a mobile application" is solved; 2) by implementing a PIP (picture in picture) tutorial, which allows users to do operations while watching the instructions, the problem that users "can remember nothing but easy instructions of on-boarding tutorials" is solved; 3) "learning center" feature solves the problem that users "don't know how to express the problems that they are facing with"; 4) "icons and features" feature solves the recurrent problem of users "feeling confused with the meanings of icons and features".

## 1. Introduction

China is experiencing an accelerated increase in the older adults' population.

Statistics from the China National Committee on Aging (CNCA) show that by 2014, the percentage of the population over age 60 is about 15.5%, an amount of 212.42 million, while the population of 65 and older is about 10.1% of the total population (China National Committee on Aging (CNCA), 2015).

In parallel with the exponential growth of the aging population, the speed of development for information technology is rapid too. Various applications are influencing the lives of Chinese middle-aged and older adults. Social applications, such as Wechat, and shopping applications, such as Taobao, make people's lives more convenient. Previous studies have shown positive impact for older adults to use mobile applications, which have potential to improve their quality of life and maintain their independence for middle-aged and older people. Previous studies suggest positive impact of mobile applications for older adults—improving their quality of life and maintaining their sense of independence (Plaza et al., 2011) (Leung et al., 2012).

Though middle-aged and older adults may benefit from the various of applications and services, and may be willing to learn to use existing mobile technologies, most of them have difficulty doing so (Kurniawan, 2006). Due to impairment of cognition (cognitive abilities began to decay at the age of 50) (Squire, 1974), and impairment of physical abilities and a lack of experience, complex mobile applications may impede middle-aged and older adults from using a variety of unfamiliar, but beneficial mobile applications. However, studies contributing to mobile device learning and usage among individuals in early older adulthood (i.e., people in their 50s and 60s) are only a few (Piper et al., 2016). Thus, our research focuses on the group of middle-age and older people who are at the early stage of aging (50 - 69).

To prevent digitally disengaged middle aged and older adults from being socially excluded (Coleman et al., 2010), it is crucial to understand the factors that deter people from accessing unfamiliar applications (such as information-seeking problem) (Sharit et al., 2008) and improve the learnability of mobile devices for the middle-aged and older adults (Leung, 2009).

Many researches focus on improving application's learnability, such as optimizing user interface (Leung et al., 2010) and developing intuitive interfaces; (Gudur et al., 2014). However, to get access to necessary services, middle-aged and older adults have to use the existing universal-designed mobile applications, majority of which are not tailored towards the population.

Thus, to help older adults learn existing mobile applications, redesign of the help feature is more practical than approaches that focus on improving initial learnability of mobile applications designed for the older adults. As such, the goal of our research is to design an interactive tutorial for middle-aged and older adults that adapts to existing applications. This tutorial helps them to learn mobile applications more independently while feeling more easily to use the help function.

Procedure of our research is shown in Figure 1. First, this paper reviews related work and summarizes critical design principles for the interactive tutorial.
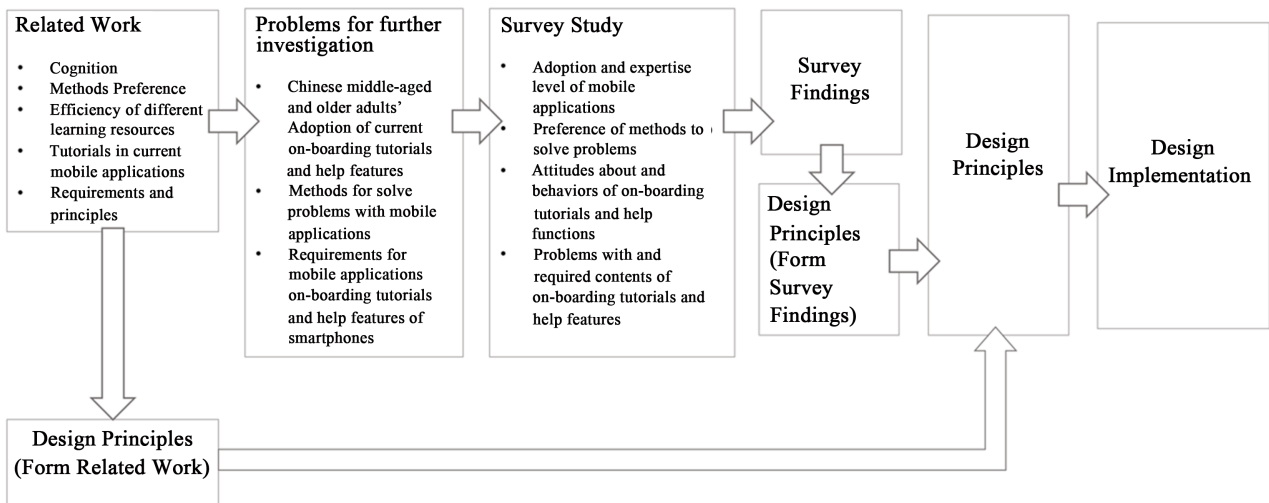
**Figure 1.** Research procedure.

Second, we conducted a survey based on problems that needed further investigation from the related work. Third, we analyzed the survey results, and summarized other design principles from the survey findings. Finally, we designed our interactive tutorial by implementing these design principles.

## 2. Related Work

According to Fisk, the most fundamental level of designing training and instructional programs is what to teach and how to teach it (Fisk et al., 2009). Given that our goal is to design a type of interactive tutorial that helps the middle-aged and older adults to learn mobile applications, the following five aspects are discussed: 1) the cognitive abilities of older adults; 2) how middle-aged and older adults solve problems; 3) researches on the efficiency of different learning resources; 4) tutorials in existing mobile applications; and 5) requirements and principles of designing tutorials for older adults learning mobile applications.

### 2.1. Cognition

When designing for older adults, age-related changes in cognition can be important to consider (Fisk et al., 2009). According to Fisk, some aspects of memory show age-related declines. To facilitate the mobile-application-learning process of middle-aged and older adults, consideration should be given to cognitive load, which may undermine the role of working memory and long-term memory when it exceeds current memory resources (Chandler & Sweller, 1991).

Attention is another component of cognition, which is often captured by highly salient events in the environment. Selective attention is required when searching for things during interactions with products (Fisk et al., 2009). Furthermore, information seeking performances are distinct between the field dependent (FD) participants and field independent (FI) participants. Contrast to the FI cognitive style, FD cognitive style is associated with a worse search performance (Palmquist & Kim, 2000).

## 2.2. Methods Preference

To find new ways to support seniors in their learning process, Leung et al. (2012) investigated how older adults learn to use mobile devices, including learning method preferences. The investigation found that help feature, learning alone, step-by-step instructions, note-taking, demonstrations, practice and feedback are preferred methods while Internet and help agents are not. Furthermore, trial-and-error is more preferred among middle-aged participants than older adults. Among all the methods, going through the instruction manual is most strongly preferred by older respondents despite challenges.

## 2.3. Researches on the Efficiency of Different Learning Resources

Efficiency of different learning resources, such as textual tutorials, graphical tutorials, instructional videos and interactive tutorials are discussed in literatures. While graphical tutorials are more efficient than textual tutorials (Digmayer & Jakobs, 2012) and actual pictures (Fisk et al., 2009), real videos are more efficient than graphical tutorials (Toyota et al., 2014). However, no significant differences are found between the efficiency of instructional videos and interactive tutorials (Ribeiro & Barros, 2014).

Digmayer et al. reported that graphical tutorials are more effective than textual tutorials (Digmayer et al., 2012), while Fisk et al. indicate that graphics are sometimes better than actual pictures (e.g., photographs and real videos) because of graphics' succinct feature. (Fisk et al., 2009) Toyota et al. found that real videos were better than graphics for senior subjects, for the reason that the older participants may find it hard to understand the instruction only via graphics and text (Toyota et al., 2014).

The efficiency of an instructional video and an interactive tutorial were also compared in teaching older adults to interact with smartphones. However, no significant differences between the two instructional methods were found (Ribeiro & Barros, 2014).

Additionally, manuals are reported to be preferred by older adults, (Leung et al., 2012) and a novel help system with succinct step-by-step feature, Help Kiosk, is designed to support older adults to use mobile devices. However, another display is needed when using Help Kiosk, making it inconvenient to use when they encounter a problem while using the mobile application. Therefore, our design requires an interactive tutorial feature displayed within the mobile application.

## 2.4. Tutorials in Current Mobile Applications

On-boarding tutorials, "help feature" and interactive tips and tricks are three main forms of interactive tutorial in current mobile applications.

Though some mobile applications tend to encourage users to adopt an exploratory usage and discovery features by themselves without instructions, some mobile applications use on-boarding tutorials (Figure 2) to give the users not
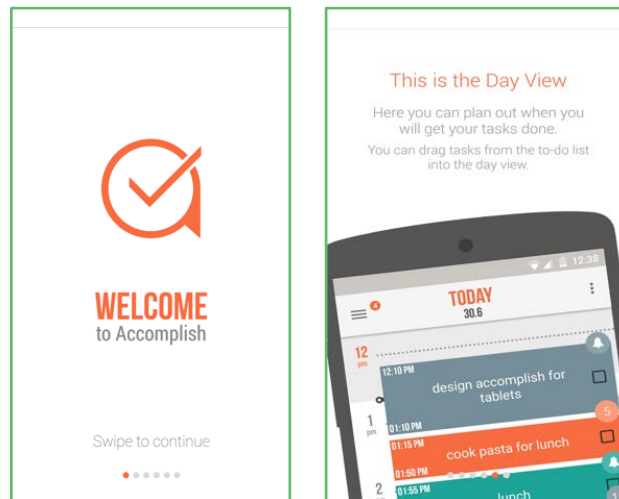
**Figure 2.** Screenshots of the on-boarding tutorial of "Accomplish".

only an overview of the application, but also demonstrate specific features. Some of the applications may render a short task for the users to get familiar with their applications through interactive instruction (Figure 3). However, researches on the efficiency, especially Chinese middle-aged older adults' adoption, of on-boarding tutorials are scarce.

Usually, help features of current mobile applications support searching for questions, showing questions which are commonly asked by users, and providing related questions to the questions that are frequently searched (Figure 4). For help features of some mobile applications, questions may be grouped by topics and organized in hierarchy as a manual, which is consistent with the older participants' preferences in Leung's research. However, help features are not available in some applications because of the tendency of not making tutorials, and these may pose problems for the older adult users (Williams, 2014).

Additionally, for some mobile applications, tips and tricks to introduce the functions may be shown as users interact with the mobile applications, involving introductions of functional gestures, accesses of special functions, new features, etc. (Figure 5).

## 2.5. Requirements and Principles of Designing Tutorials for Older Adults Learning Mobile Applications

### 2.5.1. Requirements for Mobile Device Tutorials

Investigation of older adults' requirements for mobile devices tutorials are documented in the research of Michele A. Washington (Washington, 2015).

In Washington's investigation, requirements for a mobile device (iPad) for older adults were gathered by both quantitative and qualitative methods, including task and feature requirements for learning a mobile device; preference for methods and resources for learning mobile device; frequency of learning, forgetting, and problems with using mobile devices and how the users would like the tutorial to be designed. However, this investigation only focused on the usage of iPads, and questions of the survey about on-boarding tutorials are not
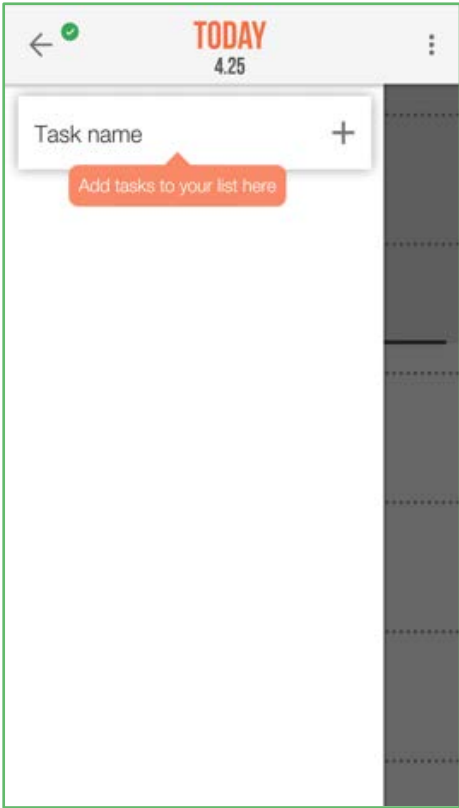
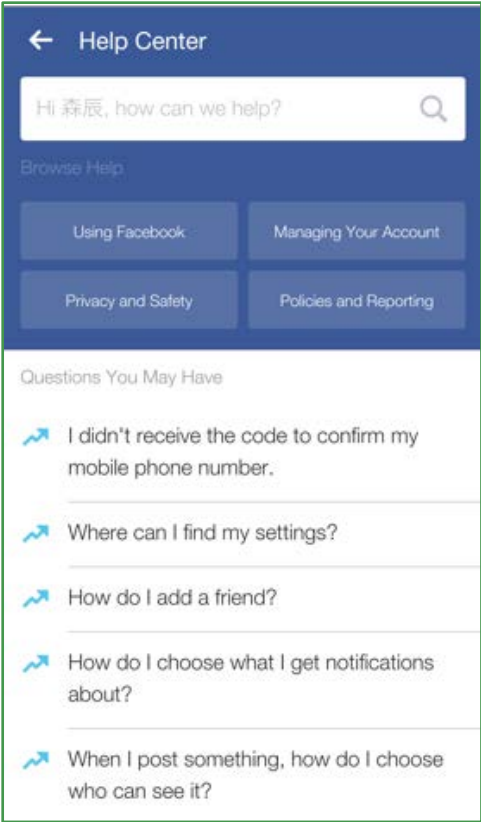**Figure 3.** A screenshot of the Interactive Instruction of "Accomplish".



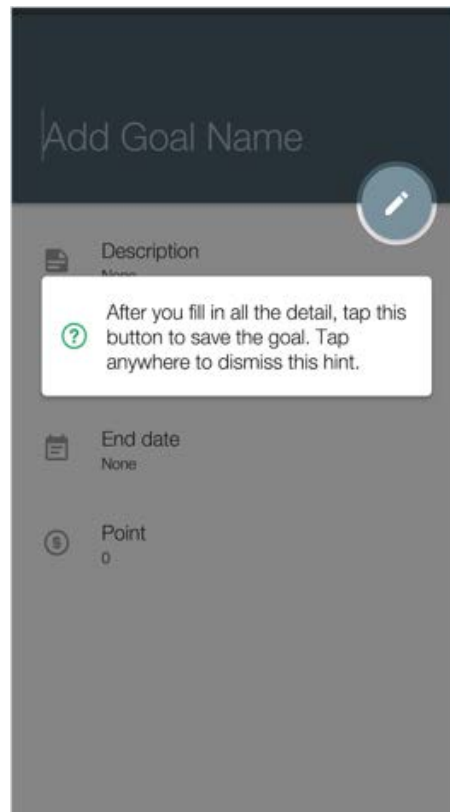**Figure 4.** A screenshot of the help feature of "Facebook".

**Figure 5.** A screenshot of the Tips and from of "Incentive".

involved. Thus, in our investigation, we enriched the survey by asking participants (Chinese middle-aged and older adults) about the requirements for mobile applications tutorials (including on-boarding tutorials and help features) of smartphones.

### 2.5.2. Principles for Designing Mobile Device Tutorials

Fisk et al. (2009) summarized many principles for the design of training and instructional programs, the following are some of the aspects being argued:

Cognitive limitation:
- Minimize demands on working memory and reducing cognitive load;
- Provide cues and memory aids;
- Encourage repetition of the procedural elements of the task in short period;
- Appropriate feedback:
- Allow the learner to make errors, and provide proper and immediate feedback.

Organized Information:
- "How-to" information should be in step-by-step format;
- Spatial tasks are best trained using a visual medium;
- Links between items of information should be organized.

Learning motivation and anxiety alleviation:
- Learning procedure should be self-paced,
- Make them confident and not to be punished.

Though the "step-by-step" feature is argued in design tutorials for older adults, (Fisk et al., 2009; Leung et al., 2012), training materials for older adults should also be designed to render them learn independently rather than being merely reliant on the tutorials (Hickman et al., 2007).

## 2.6. Conclusion of Design Principles for Interactive Tutorials

From the related work, we concluded the following design principles, which need to be followed in our interactive tutorial design:

1) Consider cognitive limitations of the middle-aged and older adults:

- Reducing their cognitive load and minimizing demands on working memory;
- Directing attention to the changes of the user interfaces.

2) Following features are required in the design of the interactive tutorial:

- Interactive and visual instructions;
- Well-organized and related information with demonstrations;
- Step-by-step instructions.

3) Motivate older adults to learn and alleviate their anxiety:

- Self-paced learning procedure;
- Appropriate feedback.

Though several principles are summarized from related work, specific requirements of Chinese middle-aged and older adults for mobile applications (of smartphones) tutorials are unknown. Therefore, in our research, we conducted a survey among Chinese middle-aged and older participants to investigate their requirements, including the following aspects:

1) Adoption and expertise level of mobile applications;

2) Preference of methods to solve problems;

3) Attitudes towards and behaviors of on-boarding tutorials and help functions;

4) Problems with and required contents of on-boarding tutorials and help features.

## 3. Survey Study

With the purpose of designing an interactive tutorial that could adapt to existing applications and help middle-aged and older adults use an unfamiliar mobile application more independently, the goal of our survey is to investigate the requirements of Chinese middle-aged and older adults for mobile applications (of smartphones) tutorials.

### 3.1. Procedure

As we stated, our research focuses on the group of Chinese who are at the early stage of aging (50 - 69), so that we recruited participants in this age group (n = 64) from local communities and created both a paper version and an online version survey for them, in case that some older participants may not be adept to use the online version survey.

### 3.2. Survey Contents

A hierarchical task analysis is done to predict the errors that may happen during

the process of middle-aged and older adults using mobile applications, on-boarding tutorials and help features:

- What problems participants may meet when using mobile applications;
- What methods are preferred to solve these problems, and whether they prone to use help features;
- What problems participants usually encounter while using on-boarding tutorials and help features;
- How they rate the helpfulness of on-boarding tutorials and help features;
- Which aspects of content of the on-boarding tutorials the participants care about.

Based on the questions above, quantitative questions are set in the survey, and the following five aspects are of focus as we have mentioned in Section 2.6.

*Adoption and expertise level of mobile applications*: this set of questions aim to find out about mobile applications' current adoption rate and people's expertise level among Chinese middle-aged and older adults.

*Preference for methods to solve problems*: this set of questions aim to find out what methods Chinese middle-aged and older adults prefer to use when solving problems with mobile applications and what methods they feel helpful. Further, these questions are set to examine whether the population prefers to use the current help features.

*Attitudes towards and behaviors of on-boarding tutorials and help functions*: this set of questions aim to find whether on-boarding tutorials and help features are preferred by Chinese middle-aged and older adults, and their behaviors of using these features.

*Problems and required contents about on-boarding tutorials and help functions:* this set of questions aim to find out what problems the Chinese middle-aged and older adults often face when using mobile.

## 4. Result

### 4.1. Adoption and Expertise Level of Mobile Applications

*Finding* 1: *The result of the survey shows that no participants are unwilling to try an unfamiliar mobile application.* The majority of the participants (n = 34, 78%) are willing to use an unfamiliar mobile application, 34% of the participants are even strongly willing to use an unfamiliar application. Nonetheless, 22% of the participants (n = 14) are indifferent about using an unfamiliar mobile application, detailed reasons are discussed in Section 4.4.

*Finding* 2: *Although it is reported that* 69% *of the participants* (n = 44) *have* 3 *years and above smartphone experience, when asked to rate their own expertise level of using mobile application, 81% of the participants* (n = 52) *rated their expertise level as either a novice user* (n = 32, 50%) *or an intermediate user* (n = 20, 31%). (Definitions used for expertise levels in using mobile applications are shown in Table 1.

The above two findings suggest that though the percentage of participants (n = 34, 78%) willing to use an unfamiliar mobile application is high, the percen-

**Table 1.** Definitions used for expertise levels in using mobile applications.

| Expertise level | Definition |
| --- | --- |
| Beginner | Starting to use and have no or very little experience. |
| Novice user | Can use mobile applications with help. |
| Intermediate user | Can use mobile applications without help. |
| Advanced user | Can use "advanced" features on mobile applications and install new mobile applications. |

tage of participates who rate themselves as novice or intermediate user is also high, so designing mobile application tutorials is potentially benefit for Chinese middle-aged and older adults.

## 4.2. Preference for Methods to Solve Problems

*Finding 3*: *Older participants rely more on others to solve the problem while younger old participants tend to solve problems more independently.*

Based on analysis of the frequency of each of the 6 methods (learning by asking others, let others to solve it, trial-and-error, temporarily give up, use help features, search on the internet) that participates resort to (on a scale with 4-points: 1 = never use it, 2 = the last resort, 3 = sometimes, 4 = always), participants aged 50 - 54 mostly preferred "trial and error" (M = 2.69, SD = 1.38) and "use help feature" (M = 2.69, SD = 1.45); participants aged 55 - 59 mostly preferred "ask others for help" (M = 3.29, SD = 1.07), and this method is also preferred by participants aged 60 - 64 (M = 3.55, SD = 0.83); Participants aged 65 - 69 mostly preferred "let others solve the problem" (M = 2.31, SD = 1.14).

By focusing on the frequency of resorting to help features for solving problems, and how participates rate its helpfulness, we get the following finding:

*Finding 4*: *The frequency of resorting to help features for solving problems and the rated helpfulness of help features by the participants are correlated.*

When examining the frequency of each of the 6 methods preferred by participates, and their helpfulness rated by the participants, by using Pearson correlation, we found that the two factors are correlated ($\gamma$ = 0.657, $p$ < 0.01). This finding suggests that people may resort to help feature more when they find it helpful, so that they may use the mobile applications more independently. Thus, the reasons why some of the participates rate it as "always unhelpful" (n = 16, 25%) or "seldom helpful" (n = 18, 28%) need to be discussed (see in Section 4.4), and we may avoid these drawbacks when designing our interactive tutorial.

## 4.3. Participates' Attitudes about on-Boarding Tutorials and Help Features and Behaviors of Using Them

By focusing on participants' attitudes about and behaviors of on-boarding tutorials and help features, we get the following findings:

*Finding 5*: *The majority of participants* (n = 52%, 82%) *rate on-boarding tutorials as* "*very helpful*" (n = 26, 41%) *and* "*sometimes helpful*" (n = 26, 41%);

***Finding* 6**: *Most of the participants read on-boarding tutorials and about half of the participants* (n = 23, 51%) *may follow the instructions of on-boarding tutorials at once.*

It is reported that 38% of the participates "always read the on-boarding tutorials carefully" (n = 24); 33% of the participates "read the on-boarding tutorials sometimes" (n = 21). However, 19% of the participates have "never seen on-boarding tutorials before" (few of them reported downloading mobile applications by themselves) or "do not notice that" ("I am not sure whether I have seen it before, I knew some hints appeared, but I didn't pay attention to it." from a 65-year-old participate.).

Meanwhile, half of participates chose "skip the on-tutorials sometimes" (n = 21, 33%), or "always skip the on-tutorials" (n = 7, 10.94%), thus the reasons of why they skip these tutorials need to be well discussed (See in Section 4.4).

***Finding* 7**: *As to the aspects of on-boarding tutorials' content, "accesses of the functions of mobile applications" are most cared* (n = 34, 76%), *followed by "gesture introduction", "special feature introduction" and "general overview".*

### 4.4. Problems with and Required Contents of on-Boarding Tutorials and Help Features

#### 4.4.1. Problems with on-Boarding Tutorials

***Finding* 8**: 44% *of participants reported that they "basically know what the on-boarding-tutorials introduce", 42% of the participants reported that they prefer "doing trial-and-error" to "reading on-boarding tutorials immediately".*

***Finding* 9**: *half of the participants* (50%) *reported that they "can remember only easy instructions of on-boarding tutorials", followed by "can remember all the instructions"* (27%); *"cannot remember"* (23%).

These findings indicate that on-boarding tutorials for middle-aged and older adults need to be accessible at anytime rather than only appear at the first time of usage. This not only allows the participants to do trial-and error first, but also help them when they forget about the instructions.

#### 4.4.2. Problems with Help Features

Given that the reasons why half of the participants (n = 34, 53%) rated help features as "always unhelpful" or "seldom helpful" need to be discussed, we divided the participants into two groups according to whether they rated help features as helpful ("always helpful" or "sometimes helpful"), or unhelpful ("always unhelpful" or "seldom helpful"). We named the former group "Rate Helpful", and the latter group "Rate Unhelpful".

The results show that most encountered problems with help features vary from "Rate Helpful" Group to "Rate Unhelpful" Group (Due to "problems with help feature" can be multiple-chosen, so the sum of times of the "problems" chosen by the participates are not equal to the total number of the participates.) (Figure 6).

***Finding* 10**: *"Can't find the help features in a mobile application" is the most common problem faced by "Rate Unhelpful" Group; "Reading the instructions*
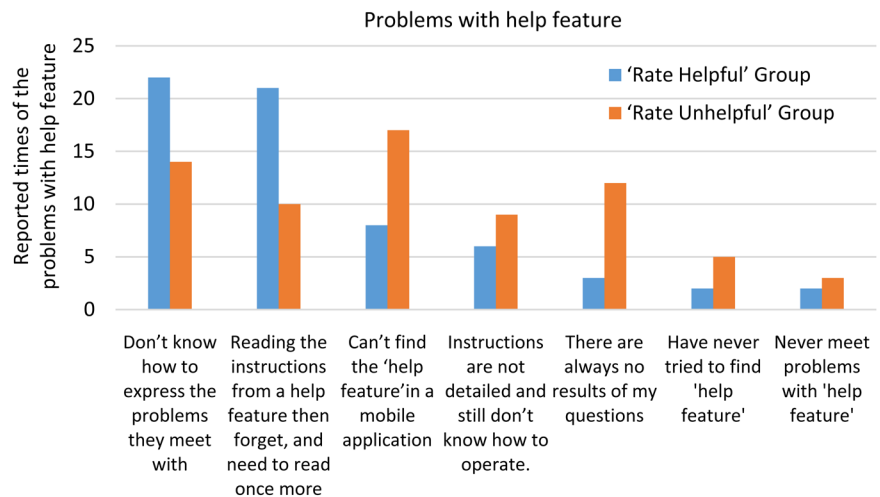
Figure 6. The statistic figure of the comparison of "Rate Helpful" Group and "Rate Unhelpful" Group's problems with help features.

from a help feature then forget, and need to read once more" is the most common problem faced by "Rate helpful" Group; "Don't know how to express the problems they faced with" are the most common faced by both of the two groups.

### 4.4.3. Problems with Mobile Applications

*Finding* 11: "*Features*" *meaning and* "*icons*" *meaning,* "*what features are involved in a mobile application*", "*in which interface feature is settled*" *are the most common problems meet by participates when using mobile applications.*

## 5. Design Implementation

According to the summarized principles from related work and findings from our survey study, we designed "Help Center", an interactive tutorial for Chinese middle-aged and older adults, which can adapt to the existing applications. Design principles are summarized firstly, and by implementing these principles, a high-fidelity prototype of "Help Center" is presented.

### 5.1. Design Principles

Design principles summarized from the related work (in Section 3.6) and other design principles from the survey study are integrated as following:

1) Improve the accessibility of help features;
2) Tutorials need to be accessible at anytime rather than only appear at the first time of usage. This not only allows the participants to do trial-and error first, but also help them when they forget about the instructions;
3) Improve the convenience of searching for troubleshooting with well-organized and related information and demonstrations;
4) Contents of the interactive tutorial may include: features introduction, meanings of icons and features, features' access;
5) Users are allowed to operate their applications with the interactive, step-by-

step, self-based and visual instructions on the same interface;

6) Get users' attention to the changes of the user interfaces;

7) Offer appropriate feedback;

8) Motivate older adults to learn and alleviate their anxiety.

## 5.2. Interactive Tutorial Design

Mobile application in shopping category is reported to be the most difficult for Chinese middle-aged and older participates among all categories in our survey study, and 51% of the participants who have ever used this category of mobile applications (n = 35, 55%) find it difficult. So choose Taobao (one of the most popular mobile application in shopping category in China) to practice our interactive tutorial design as an example. In this paper, we only present the English version of our interactive tutorial design.

Main interface of Help Center is shown in Figure 7. Due to Principle 1 (improve the accessibility of help features), and Principle 2 (tutorials need to be accessible at anytime rather than only appear at the first time of usage), a fixed FAB (Floating Action Button) button is made so that the middle-aged and older users can press it to get access to Help Center at anytime when they meet problems, and the Help Center may show at the top parts of the interfaces.



**Figure 7.** Main interface of "Help Center".

Due to Finding 11 ("Features" meaning and "icons" meaning, "what features are involved in a mobile application", "in which interface feature is settled" are the most common problems), three main features are created by implementing these principles:

1) Learning Center;
2) Questions Classification;
3) Meanings of Icons and Features.

### 5.2.1. Learning Center

Learning Center help users learn how to use the mobile application, including three features: "Discovery", "Tasks" and "Collections" (Figure 8).

In "Discovery" feature, users can read notifications of new features, and follow instructions of the interactive tutorials to do operations (Figure 9).

Due to Principle 6 (tutorials need to be interactive, step-by-step, self-based and visual), tutorials are displayed on the small floating screen and users are allowed pause it at their own pace, so that users can do operations on the mobile applications while the tutorial is playing. They can also adjust the scale of the tutorial display by press the "plus" and "minus" on the top of the interface, and drug the display if it shelters important components (Figure 10).

In "Task" feature, users can learn and practice by several mini tasks, which is created based on main features of the mobile application. User can also scroll
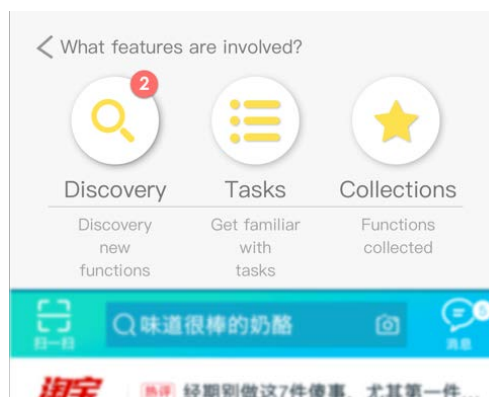


**Figure 8.** "Discovery" feature of "Learning Center" feature (2).
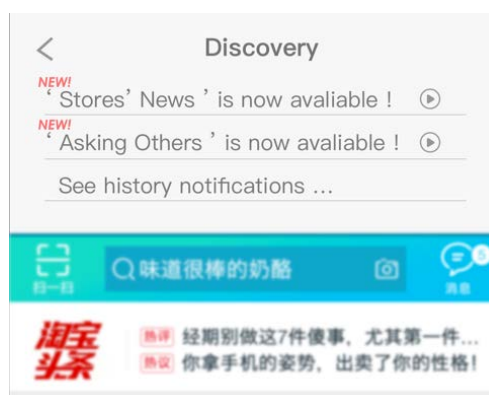


**Figure 9.** "Learning Center" feature.

Figure 10. "Discovery" feature of "Learning Center" feature (1).

down on the Help Center interface for the full screen. Due to Principle 8 (users should to be motivated to learn and their anxiety should be alleviated), the tasks are based on virtual interfaces so that users may feel free to learn. Moreover, a "tick" icon appears on a task icon to give the users confidence when a task is finished (Figure 11).

In "Collection" feature, users can find the features they collected in "Discovery" feature and "Task" feature, allowing them to review the features they have learned (Figure 12).

### 5.2.2. Questions Classification

Due to Principle 4 (information should be well-organized and related with demonstrations), questions are classified into hierarchies, and tutorials can also be displayed on the small floating screen (Figure 13 and Figure 14).

### 5.2.3. Meanings of Icons and Features

In the mode of "Meanings of Icons and Features" feature, users can tap an icon or a feature to learn what it used for. Due to Principle 6 (Get users' attention to

the changes of the user interfaces) and Principle 7 (Offer appropriate feedback), a shadow is created to make the users focus on the icon (or feature) and its introduction, while offer an "OK" button for them when they finish reading (Figure 15).
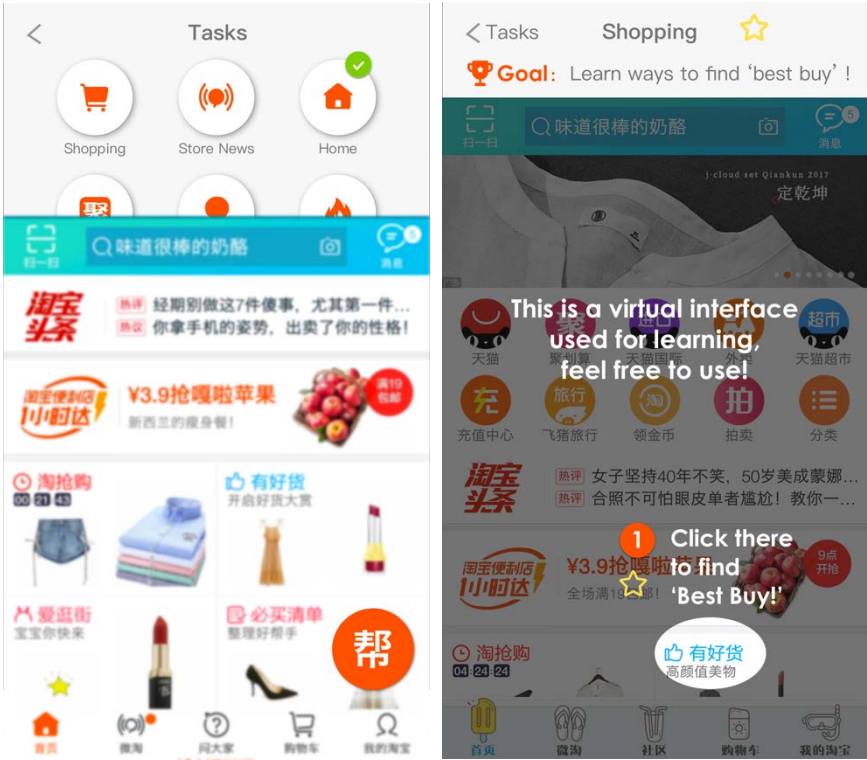


**Figure 11.** "Tasks" feature of "Learning Center" feature.



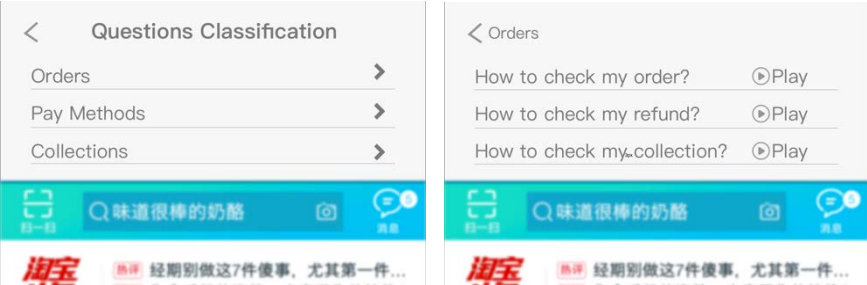**Figure 12.** "Collections" feature of "Learning Center" feature.



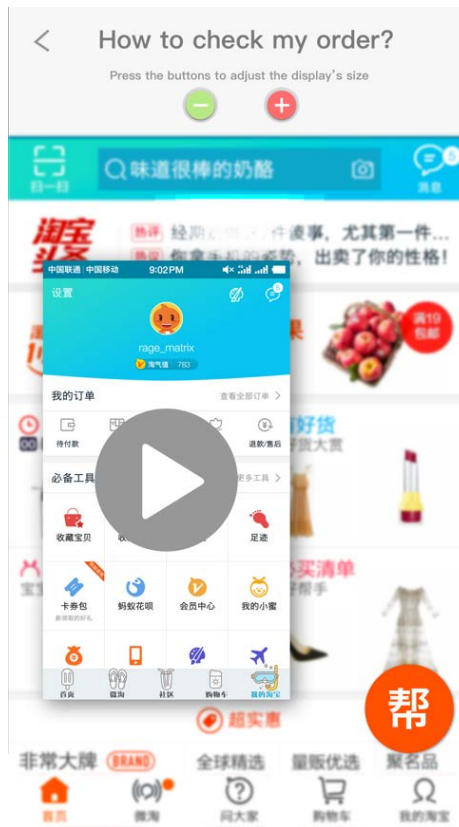**Figure 13.** "Questions classification" feature (1).
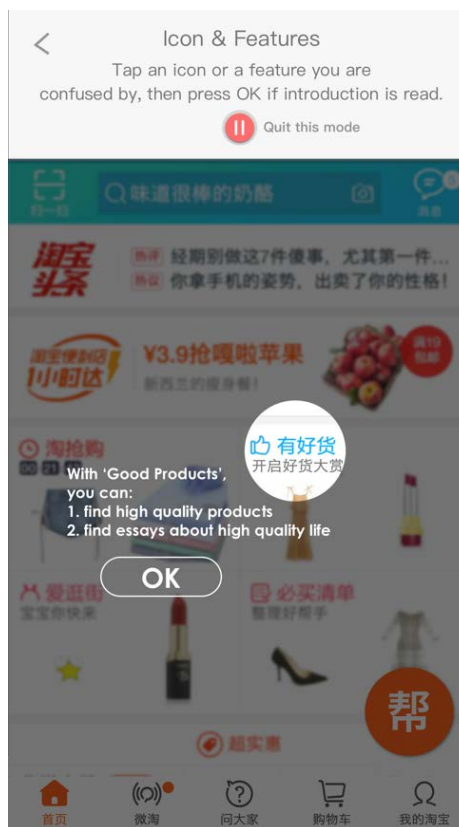
Figure 14. "Questions classification" feature (2).



Figure 15. "Meanings of icons and features" feature.

## 6. Conclusion and Future Work

In this paper, we present our interactive tutorial "Help Center", which is designed for Chinese middle-aged and older adults, based on the findings of our survey study and principles summarized from the related work. "Help Center" has 4 main special features:

1) A more direct access. By implementing a fixed FAB (Floating Action Button) button, middle-aged and older users can get access to the help feature more easily;

2) Interactive, step-by-step, self-based and visual instructions, which allow users to do operations while watching the tutorial. This feature prevents them from forgetting the instructions' content;

3) Learning Center. This feature gives middle-aged and older users chances to learn to use the mobile application over times;

4) Icons and features. This feature solves a recurrent problem of middle-aged and older users that they feel confused with the meanings of icons and features.

Though survey study was conducted among 64 participates, the sample size is still too limited, more participates need to be involved in the future research. Moreover, to examine the usability and learnability of our design, we will conduct a usability testing for our interactive tutorial, then revise our design according to the experimental results in the future.

## Fund Project

## References

Chandler, P., & Sweller, J. (1991). Cognitive Load Theory and the Format of Instruction. *Cognition and Instruction, 8,* 293-332.
https://doi.org/10.1207/s1532690xci0804_2

China Economic Demography: The Expedition of Social Aging Population. (2015). Retrieved June 26, 2017, from CNCA.
http://www.cncaprc.gov.cn/contents/37/69715.html

Coleman, G. W., Gibson, L., Hanson, V. L., Bobrowicz, A., & McKay, A. (2010). Engaging the Disengaged: How Do We Design Technology for Digitally Excluded Older Adults? In *Proceedings of the 8th ACM Conference on Designing Interactive Systems* (pp. 175-178). New York, NY: ACM.
https://doi.org/10.1145/1858171.1858202

Digmayer, C., & Jakobs, E. M. (2012). Help Features in Community-Based Open Innovation Contests. Multimodal Video Tutorials for the Elderly. In *Proceedings of the 30th ACM International Conference on Design of Communication* (pp. 79-88). New York, NY: ACM.

Fisk, A. D., Rogers, W. A., Charness, N., Czaja, S. J., & Sharit, J. (2009). *Designing for Older Adults: Principles and Creative Human Factors Approaches*. Boca Raton, FL:

CRC Press. https://doi.org/10.1201/9781420080681

Gudur, R. R., Blackler, A. L., Popovic, V., & Mahar, D. P. (2014). Adaptable Interface Model for Intuitively Learnable Interfaces: An Approach to Address Diversity in Older Users' Capabilities. In *DRS 2014: Design's Big Debates Pushing the Boundaries of Design Research* (pp. 374-387).

Hickman, J. M., Rogers, W. A., & Fisk, A. D. (2007). Training Older Adults to Use New Technology. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 62,* 77-84. https://doi.org/10.1093/geronb/62.special_issue_1.77

Kurniawan, S. (2006). An Exploratory Study of How Older Women Use Mobile Phones. In *International Conference on Ubiquitous Computing* (pp. 105-122). Berlin Heidelberg: Springer. https://doi.org/10.1007/11853565_7

Leung, R. (2009). Improving the Learn Ability of Mobile Device Applications for Older Adults. In *CHI'09 Extended Abstracts on Human Factors in Computing Systems* (pp. 3125-3128). New York, NY: ACM.
https://doi.org/10.1145/1520340.1520443

Leung, R., Findlater, L., McGrenere, J., Graf, P., & Yang, J. (2010). Multi-Layered Interfaces to Improve Older Adults' Initial Learn Ability of Mobile Applications. *ACM Transactions on Accessible Computing, 3,* 1.
https://doi.org/10.1145/1838562.1838563

Leung, R., Tang, C., Haddad, S., Mcgrenere, J., Graf, P., & Ingriany, V. (2012). How Older Adults Learn to Use Mobile Devices: Survey and Field Investigations. *ACM Transactions on Accessible Computing, 4,* 11.
https://doi.org/10.1145/2399193.2399195

Palmquist, R. A., & Kim, K. S. (2000). Cognitive Style and On-Line Database Search Experience as Predictors of Web Search Performance. *Journal of the American Society for Information Science, 51,* 558-566.
https://doi.org/10.1002/(SICI)1097-4571(2000)51:6<558::AID-ASI7>3.0.CO;2-9

Piper, A. M., Garcia, R. C., & Brewer, R. N. (2016). Understanding the Challenges and Opportunities of Smart Mobile Devices among the Oldest Old. *International Journal of Mobile Human Computer Interaction, 8,* 83-98.
https://doi.org/10.4018/IJMHCI.2016040105

Plaza, I., MartíN, L., Martin, S., & Medrano, C. (2011). Mobile Applications in an Aging Society: Status and Trends. *Journal of Systems and Software, 84,* 1977-1988.

Ribeiro, J., & de Barros, A. C. (2014). Efficiency of a Video and a Tutorial in Teaching Older Adults to Interact with Smartphones. In *International Conference on Universal Access in Human-Computer Interaction* (pp. 34-45). Berlin: Springer International Publishing. https://doi.org/10.1007/978-3-319-07446-7_4

Sharit, J., Hernández, M. A., Czaja, S. J., & Pirolli, P. (2008). Investigating the Roles of Knowledge and Cognitive Abilities in Older Adult Information Seeking on the Web. *ACM Transactions on Computer-Human Interaction, 15,* 3.
https://doi.org/10.1145/1352782.1352785

Squire, L. R. (1974). Remote Memory as Affected by Aging. *Neuropsychologia, 12,* 429-435.

Toyota, Y., Sato, D., Kato, T., & Takagi, H. (2014). Easy Handheld Training: Interactive Self-Learning App for Elderly Smartphone Novices. In *International Conference on Universal Access in Human-Computer Interaction* (pp. 203-214). Berlin: Springer International Publishing. https://doi.org/10.1007/978-3-319-07446-7_20

Washington, M. A. (2015). *Gathering the Requirements for a Mobile Device Tutorial for Older Adults.*

Williams, D. W. (2014). *Designing an Educational and Intelligent Human-Computer Interface for Older Adults.*