Identifying Mobile Application Design to Enhance the Subjective Wellbeing among Middle-Aged Adults

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Abstract. Faced with life stress and peer competition, middle-aged adults increasingly are lacking happiness and well-being. The address this problem, this research studied current mobile applications for wellbeing and perceptions of Subjective Wellbeing (SWB) among middle-aged adults. In this study, questionnaires were administered with 100 middle-aged adults (aged 35-55) to understand their status quo of SWB, including the element of positive/negative affect, life satisfaction, as well as flourishing (i.e., overall life wellbeing). In the questionnaire, events that influenced the positive/negative affect were also investigated. Results of the study showed that the ratings for all SWB elements were at the average level and that they were positively correlated. Results also indicated that current wellbeing mobile applications did not have much effect on enhancing SWB. Results revealed that family relationships and job and life achievements were the key drivers for positive and negative affect. The outcome of the study made design recommendations for mobile applications for improving the SWB of middle-aged adults.

Keywords: Subjective wellbeing, middle-aged adults, mobile application.

1   Introduction

The Subjective Well-being (SWB) of middle-aged adults is generally low, which might be due to the breeding of children and parents, job and pressure from peer competition, etc. Middle-aged adults aged 35-50 stay at the lowest level of satisfaction [1]. Middle-aged adults are also in a state of "loss" (e.g., decline of physiological condition) and "gain" (e.g., enhancement in self-control capability) [2]. Jaques is the first person coining the term, "midlife crisis," happening among people in the middle age period [3]. Middle-aged adults generally are not satisfied with their current life situations [4]. The world happiness report found that among all ages, the subjective well-being of the middle-aged adults is the lowest [5].

Middle-aged adults have an important role in the entire social economy. Their well-being is therefore becoming critical to the status of economy. In fact, the suicide rate of middle-aged Americans increased 28% from 1999 to 2010 [6]. Research showed that large living pressure and depressive symptoms are probably the leading factors [7]. Meanwhile, economists start to investigate the correlation between

national policy and indicators for happiness [8] [9] [10]. Additionally, from the point of view of psychological and social science, a correlation exists between children's success and parents' well-being [11].To summarize, it is clear that the issue of low subjective well-being of middle-aged adults needs to be solved urgently.

With the advances of the mobile technology, people, including middle-aged adults use the Internet and smartphones to share their feeling and things they encountered with their relatives and friends. In fact, the need for improving the wellbeing/happiness of the public had got the attention from the industry and the academia. Studies were conducted and products were developed. For example, it was shown that using gaming and virtual reality could enhance wellbeing and happiness. Software and mobile applications (apps) were developed to make wellbeing/happiness happen among the users (e.g., *Happiness Quotes*, *Well-Being Plus,* and *Happiness Live Wallpaper, etc.*) [12].

SWB is a multi-dimensional concept, formed by affective components, cognitive components [13] [14], and flourishing (FS) [16]. In the literature, SWB and happiness are used interchangeably as they carried similar meanings. Little research has been done to verify the effectiveness of the mobile wellbeing apps in enhancing an individual's well-being from the perspective of user experience. Moreover, most of the wellbeing apps are not developed based on scientific evidence. Thus, the aim of this study was threefold:

(1) Examine the effectiveness of current mobile wellbeing apps with positive psychology literature.
(2) Evaluate the effectiveness of the current mobile wellbeing apps with middle-aged users
(3) Explore design possibilities for mobile wellbeing apps for the middle-aged adults.

2   Literature Review

2.1   Measurement of Enduring Happiness

Happiness (enduring happiness) = S + C + V [16]**.** S represents gene and cannot be changed by an individual. C represents an individual's living environment (the external environment), which includes social economic status, marital status, health, income and sex life, etc. V represents voluntary control factors. This is psychological strength that can be controlled actively, for example, concept and action, things related value, a view of life your life, habit of thinking social connection, understanding on things and capability to face and handle things, etc. From the view point of this equation, it is clear that for SWB, S in the equation cannot be changed. C is circumstance of life, which might fluctuate from time to time and vary from people to people. To enable the well-being of middle-aged adults, V might be the component that designers can leverage in the design of mobile apps.

2.2   Measurement of Subjective Well-Being

Wellbeing is defined as the state of being comfortable, healthy, or happy. Seligman [28] indicated that the best measurement standard of well-being is flourishing. Flourishing briefly defines that a psychologically healthy adult will own a high level of emotion well-being [18] and thus feeling happy and satisfied, and is purposive in viewing his/her own life. With respect to SWB, according to Diener [14] [15], it refers to how people experience the quality of their lives and includes both emotional reactions and cognitive judgments. SWB is consisted of positive affect (PA)/negative affective (NA), life satisfaction (LS), and flourishing (FS). From research, SWB equations developed with the adding of the concept of flourishing (FS). In this present study, Diener's definition of SWB was adopted to guide the evaluation of current mobile apps as it explains SWB more broadly.

2.3   Wellbeing and Middle-Aged Adults

Well-being is very important for middle-aged adults. From the physiological perspective, individuals with low cortisol content always have high-level positive affect [21]. Adults males have an increasing NA and high cortisol in the morning while low cortisol and relatively high PA in the afternoon. On the contrary, adult females show a decreased NA and an increased PA in the morning [22]. In addition, Gomez et al [23] showed that there is a strong correlation (one kind of personality trait, the trait will be more NA) between neuroticism and SWB. Among different age levels, middle-aged adults are more affected by negative life event for their SWB as compared to the old-aged adults. Fortunately, with regard to relevance between age of middle-aged people and Well-being, NA declines along with increase in age. The average correlation coefficient very low between the PA and NA (PA $r = -0.03$, NA $r = -0.01$), the age factor represents only explain less than 1% of the difference [24].

2.4   Recent Studies on Enhancing Wellbeing

In recent years, lots of studies were conducted on how to enhance Well-being. For instance, investigate possibility of influence of technology-mediated reflection (MRT) on well-being, establish an Echo, as well as use a Smartphone application to record everyday well-being and then make response by the system [12]. Some use therapeutic writing intervention method to ask to incubate sacred moments within three weeks, and the result shows that significant effect can be achieved in SWB related assessment [26]. In addition, for PA among elements of well-being and in the perspective of how the mental state affects the physiological health, the pain of Ankylosing Spondylitis [27] can be surmounted through 10 minutes of laughing.

3   Methodology

3.1   Research Approach

The purpose of this study was to propose design recommendations for mobile applications. It was achieved by the following four steps (Figure 1):

(1) Identify the relationships among the wellbeing elements (PA/NA, LS, and FS) existing in the middle-aged adult population.
(2) Investigate the events leading to PA and NA from the viewpoint of middle-aged adults
(3) Analyze the effectiveness of current mobile wellbeing apps with the literature.
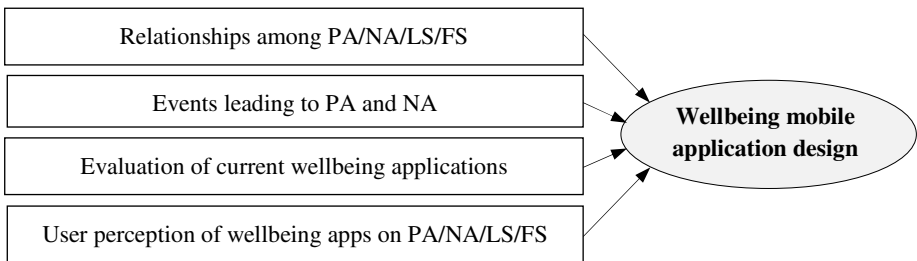(4) Investigate users' perceptions of PA/NA, LS, and FS after using the current mobile wellbeing apps.

Fig. 1. Research approach

3.2   Participants

Convenience sampling was used in this study. One hundred middle-aged adults (50 males, and 50 females) were recruited to fill out the questionnaire the (with the PA/NA, LS, and FS scales). The mean age of the male participants was 42.74 (SD = 5.5). The mean age of the female participants was 42.55 (SD = 5.38). The proportion distribution of the age was 35-39 (29%), 40-44 (37%), 45-49 (18%) and 50-55 (16%). The questionnaire was administered in public space, such as train stations, shops and fast-food restaurants in the Tainan and Chiayi cities in Taiwan. In addition, snowball sampling was used to recruit participants. Eight volunteered married middle-aged adults agreed to evaluate our selected wellbeing mobile apps. The age range is 35 to 55 years old.

3.3   Procedure

This research contains Part A, the questionnaire (including open-ended and close-ended questions) and Part B, the selection process of mobile apps, and Part C, the user evaluation of mobile apps.

• **Session 1:** Investigations of the wellbeing status (close-ended questions) and events leading to the PA and NA (open-ended questions). The researcher sent paper questionnaires (including electronic questionnaires, http://www.mysurvey.tw/) to people in public space. Through two-week data collection, 112 samples were recruited. After removing invalid samples, 100 effective samples are left.

• **Session 2 (the selection of mobile apps):** Mobile apps related to well-being were search in the Android play store. Only popular mobile apps were included in this

study. The selection criteria were (1) key word search (wellbeing and happiness), and the number of application downloads and user ratings. The mobile apps used in this study were shown in Table 1.

• **Session 3 (user feedback on current welling apps):** The selected mobile apps were installed into a smart phone, each of which was demonstrated to the participants. Participants were allowed to use as much time as they needed to manipulate the apps. After the manipulation of every app, participants were asked to provide a score (1 to 5, low to high) for PA, LS, and FS, individually. Participants were also required to provide simple explanations on their ratings.

Table 1. Six well-being apps receiving the highest reviews and # of download (Source: the Android play store)

Type/ Category	App Name	Description	Review (out of 5) (# of downloads)
Recording	Secret of Happiness	Enter 3 good things into the app right after you get up in the morning and just before you hit the bed in the night. Repeating it for 30 days will train your brain to think positively.	4.3 (50,000 - 100,000)
Planning	Happy Habits: Choose Happiness	This app uses the techniques of cognitive-behavioral therapy (CBT) and provides you with detailed results and suggestions to affect happiness.	4.4 (10,000 - 50,000)
Quotes	Happiness Quotes	Save your favorite quotes for later viewing. Share via Facebook, Twitter, SMS, email and all your social apps.	4.4 (10,000 - 50,000)
Meditation	Simply Being Guided Meditation	It allows you to choose from 4 meditation times and gives you to option to listen with/without music/nature sounds.	4.3 (10,000 - 50,000)
Tips	101 How To Be Happy Tips	The simple solution is these 101 quick, easy and free happiness ways to make you feel happy right now.	4.4 (100,000 - 500,000)
Moments Share	Moments - Making You Happier	Use photos, voice and/or text to capture beautiful happy moments as they happen.	4.7 (1,000 - 5,000)

3.4   Instrument

Open-ended and close-ended type questions were used:

• **Events leading to positive/negative affect (open-ended questions):** There were 2 questions included in the questionnaire, one asking participants to list 2 events leading to positive affect, and the other asking participants to list 2 events leading to negative affect in the past 4 weeks.

- **Measurements of PA/NA/LS/FS (close-ended questions):** The close-ended questions included questions from: (1) the scale of Positive/Negative Experience (SPANE) [19], to know middle-age people's past experiences in positive affect and negative affect of SWB; (2) the satisfaction with life scale (LS) [20], designed to measure individual life satisfaction. This score represents the level of satisfaction of an individual on his/her own life; (3) the flourishing scale [19], designed to measure the individual self-perceived success in differing area. This score represents the number of psychological resources and strengths available for an individual.

3.5   Data Analysis

• **Events leading to positive/negative affect (open-ended questions):** In this research, Affinity Diagram is used for categorization and analysis in an attempt to understand what events lead to the PA and NA of middle-aged adults.

• **Measurements of PA/NA/LS/FS (close-ended questions):** For close-ended questions, Pearson correlation analysis of SPSS software is used to understand the correlation among key elements of PA, NA, LS and FS for well-being of middle-aged adults.

4   Results

4.1   The Wellbeing Status Quo: PA/NA/ FS/LS

The average scores for PA/NA/LS/FS are as following: SPANE: The mean score is 1.104 (SD=6.69), close to the mean zero. Such result indicates middle-aged group is in a moderate state of affect. Overall, their affect was neither too positive nor too negative in the past four weeks. LS: All items score M=4.88, SD=6.85. **FS:** Every participant scores M=43.22.

The correlation among Gender and FS, Marriage and FS, Marriage and Age, SPANE and Age is very low or of non-existence, for the detailed score, please see Table2. SPANE and LS were moderate positive correlation, r=.526, p<0.01. SPANE and FS were moderate positive correlation, r=.539, p<0.01. LS and FS were high positive correlation, r=.680, p<0.01. Therefore, the key elements PA/NA, LS and FS of SWB are of high or middle correlation to each other.

Table 2. Results of the correlation analysis of the questionnaire

Variable	Gender	Marriage	Age	SPANE	LS	FS
Gender	1	-.173	-.010	-.126	-.147	-.234*
Marriage		1	.168	.154	.185	.293*
Age			1	.205*	.103	.122
SPANE				1	.526*	.539*
LS					1	.680*
FS						1

* denotes $p < .05$.

4.2   Affinity Diagrams of PA/NA

Open-Ended Question Items: after summarizing participants' answers and implementing affinity diagram, following results are obtained (Table 3):

180 events resulting in positive affect and 157events resulting in negative affect are collected. The following includes top three positive and negative events ranked in terms of percentage in the table3. Other events leading to positive affect are: Stay and interaction with friends (7.6%), help or serve for others (6.5%), accomplishment of something, and the feeling of achievement in the work (5.9%), full of hope to the future (1.8%), unexpected happiness (1.8%) and others (8.8%). Other events leading to negative affect are: Unfortunate things on relatives and friends (7.6%), friction with others or displeasure (7%), illness on the body (6.3%), others (including dissatisfaction on politics and policy, viewing of negative news, dissatisfaction on unfair things in the society, 22.9%).

Table 3. Top three positive and negative event categories

Positive events	Percentage	Negative events	Percentage
Family relation	38.8%	Family relation	30.0%
Relaxation & satisfaction from leisure activities	17.6%	Work problem	14.7%
Security sense from stable economy, job & income	11.2%	Pressure from environment/self	11.5%

4.3   User Feedback on Current Mobile Apps

Apps with the highest number of download and the highest review scores among all categories were selected and shown in front of 8 middle-aged adults. Questions for the level of PA, LS, as well as FS after using the given apps were asked. The ratings are shown in the following (Table 4):

Table 4. User feedback on six popular mobile apps

App Name	Average score results (out of 5)			Rank
	PA	LS	FS	
Secret Of Happiness	3.9(SD=0.62)	3.8(SD=0.64)	3.9(SD=0.64)	1
Happy Habits: Choose Happiness	3.3(SD=0.43)	3.5(SD=0.62)	3.9(SD=0.53)	2
Simply Being Guided Meditation	3.3(SD=1.10)	3.3(SD=1.06)	3.5(SD=0.89)	3
Moments - Making you happier!	3.2(SD=0.58)	3.3(SD=0.64)	3.4(SD=0.71)	4
101 How To Be Happy Tips	3.0(SD=0.62)	3.4(SD=0.71)	3.2(SD=0.71)	5
Happiness Quotes	2.9(SD=0.57)	2.9(SD=0.69)	2.8(SD=0.34)	6
Average scores	3.3(SD=0.35)	3.4(SD=0.29)	3.5(SD=0.42)	

5   Discussion

There are lots of rooms in PA/NA, LS and FS for improvement. In this research, it was understood that middle-aged adults has medium value of SPANE (M=1.104, SD=6.69), and the emotion of middle-aged adults is not so positive. For LS, the score of all items M=4.88, SD=6.85, which represents that our participants feel slightly satisfied on their life. Finally, the result of FS issues (M=5.4, SD=7.9) shows that middle-aged adults have some psychological resources and strengths.

According to the result of Pearson correlation analysis that we can find elements of SWB (PA / NA, LS and FS) showed moderate or high positive correlation with each other. That is; when middle-aged adults have more positive affect, FS within them will be expected to be higher. If FS is high, LS will not be low either. If the middle-aged adults have more positive affect in their daily life, their life satisfaction will be higher.

5.1   Affinity Diagram for Events Leading to Positive and Negative Affect

Affinity diagram analysis results lead us to the events leading to positive and negative affect. In the family and family member items (38.8%) among the events leading to positive affect, "things related to children" occupy a percentage about 22.5%, and such data shows that for middle-aged adults, family is the major source affecting the positive affect, and it is especially true in children. After summarizing events leading to the negative affect of middle-aged adults, some belong to external environment (The part of circumstance of your life in the equation), for example, economic recession, expectation of stable job and the pressure causing by low income and high expense, since they are not within self-controllable range because they involve too many variables, hence, they will not be investigated for design direction in this research.

5.2   User Perceptions on Mobile Wellbeing Applications

In addition, after real operation test performed on well-being application currently available in the market, it was found that the real effectiveness of apps is low. Besides, current apps are more or less of indirect type. Among the SWB key elements, PA/NA (M=3.3, SD=0.35), LS (M=3.4, SD=0.29) and FS (M=3.5, SD=0.42) have very uniform score, that is, no single element showed high or low scores. It was also found that the apps (ranked from #1 to #3 in Table 1) have relatively higher score in the FS element, showing that the middle-aged participants concerned with self-development, work, life, fulfillment, purpose, and meaning, rather than short-term happiness. In addition, some participants mentioned that they did not have high intention or motivation using the apps that simply provide tips and happiness quotes. Some indicated that these tips and quotes were too general and did not reflect and fit their life situations. Some participants suggested that mobile apps should help them keep track on their children's status and show relationships growing among family members, etc. Some participants cared more about their work pressure and suggested that mobile apps should help them relieve from work pressure.

5.3   Recommendations for the Mobile Application Design for Wellbeing

According to the results and the analysis of the questionnaire, the following mobile application design recommendations for middle-aged adults are summarized:

- Mobile apps for wellbeing do not necessarily need to address the differences of gender, age, and marital status.
- Family connections/communications should be emphasized, especially building relationships with children.
- Mobile apps designed to help manage/fulfill leisure activities are likely to make positive affect happen.
- Mobile apps designed to demonstrate or reflect work/job achievement would enable positive affect and sense of wellbeing.
- Mobile apps that help enable interactions and maintain relationships with close friends are expected to be appreciated by the middle-aged adults.
- Mobile apps that provide flexibilities to store family moments and events would help the middle-aged adults develop a sense of wellbeing.
- Mobile apps that are designed to help relieve life pressure are desired.
- Old school quotes/tips were not generally appreciated. Mobile apps could provide hands-on tips that help middle-aged adults manage/develop family/friend relationships, or work achievements, or options to build leisure activities.
- Mobile apps that attempt to demonstrate an individual's wellbeing status quo should use easy questions or criteria to collect user data.

6   Conclusions

The purpose of this study was to (1) examine the effectiveness of current mobile wellbeing apps with positive psychology literature, (2) evaluate the effectiveness of the current mobile wellbeing apps with middle-aged users, and (3) explore design possibilities for mobile wellbeing apps for the middle-aged adults. Questionnaires were distributed and administered with 100 middle-aged adults in the public space. The wellbeing status (consisting of scores of PA/NA, LS, and FS) and the life events leading to positive and negative affect were investigated. User evaluations of 6 popular wellbeing mobile apps were also conducted. Results of the questionnaire indicated that the average scores for PA, NA, LS and FS for the middle-aged participants were around the medium level, meaning that their wellbeing status may be merely acceptable, thus, having room for improvement. In addition, our study also found that middle-aged adults generally had pressure from differing sources, e.g., family, work, economy, life achievement/fulfillment, and deteriorations of body and physical capabilities, etc. The user evaluation for six popular mobile apps for wellbeing showed that providing old school tips to users was considered inappropriate in leading people to wellbeing; guiding people to develop good habits was also considered an indirect way to enhance wellbeing as it deviate from the major life concerns of middle-aged adults. Thus, to improve the wellbeing/happiness status quo of middle-aged adults,

pressure management or psychologically relief from the tension of family relationships and workload becomes design directions and also a challenge for mobile app designers. Future research is required on the motivation and adoption issues of wellbeing mobile apps. The outcomes of this study may be limited by the small sample size. It is our expectation that the wellbeing mobile design communities can benefit from our research outcomes.

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