Applying Gamification and Social Network Techniques to Promote Health Activities

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Abstract

"Obesity" is the Civilized disease of many developed countries. Many people attempt to control daily diet and participate in related activities of health promotion in order to manage their weight, to improve body shape, or maintain self-health. However, there are lot of people fail to perform the related activities of health promotion continuously because of the lack of motivation. The purpose of this study is to develop a mobile application (App) for providing different motivational factors to trigger and to reinforce people in participating the activities of health promotion. Gamification and social-networking features are applied to the App based on the theories of psychological and behavioral science. This application composes by three main modules include diet diary module, public social group module, and health coach module. A Technology Acceptance Model (TAM) was applied to measure the perceived user experience when using the proposed system. User's behavioral intention to use and actual system use were also measured.

Keywords: Health promotion, gamification, social network, mobile app

Introduction

Obesity, or being overweight, is a common disease in developed countries. Many people are committed to maintaining their health and fitness through dietary management, exercise, and bodybuilding. At the same time, intelligent devices and mobile technologies have become widely available, and there are now several technology-based tools and mobile applications (apps) on the market to assist users in successfully managing their health and weight loss. However, users commonly face three issues when using this type of app: 1) Lack of self-motivation: the daily recording of diet and weight, calories burned during exercise, and water consumption are all required when using health management apps. However, the interaction in these apps is dull and it becomes difficult to maintain the user's interest and attention needed to record the various physiological and activity information, unless the user is strongly determined to lose weight. 2) Lack of sustained effort: A majority of weight-loss applications provide services based on the users' requirements. However, the process of weight loss and dietary management requires strong individual perseverance. The user could be encouraged to have stronger perseverance if the social community and friends can also encourage the users in their weight loss activities. 3) Lack of professionalism: A myriad of weight loss-related health programs can be found on the Internet, making it difficult to ensure the accuracy of weight loss methods and techniques. In addition, the same weight-loss programs may not be appropriate for all users. Therefore, it is necessary to tailor information according to the needs of the individual in order to guide the user to correct concepts in weight loss and body sculpting.

Wharton *et al* [1], from the University of Arizona, conducted a study to determine how different diet recording tools affect the recording behavior of users. The researchers recruited 47 volunteers for an 8-week weight loss program and divided them into three groups based on recording techniques: recording using smartphone apps, recording using phone memo functions, and recording using pen and paper. Results indicated that the body weight of participants in all three groups decreased. Among these participants, the smartphone app group showed better sustained motivation in recording their daily diet and had fewer instances of missing records, over the other two groups.

Based on these findings, this study attempted to design a similar type of health support app with some important differences. The app was designed to be able to play a role as a portable health management secretary by assisting users in recording their daily caloric intake, reminding users to drink water regularly, and recording and managing weight records. This app was also designed using social network technology to establish social and psychological support between weight loss application users, in order to provide additional support to boost the motivation of the users by participating actively and continuously in weight loss activities. In addition, through the use of interactive gamification design technology, a weight loss ranking was created to introduce a pleasant participation experience and enhance the individual's motivation to participate in weight loss activities. Our hope is that this system will boost people's motivation in body weight control and modify their actions and behavior, thereby achieving a positive and substantial effect on society.

Literature Review

A. Social Network

The so-called social network refers to a virtual organization on the Internet formed by a group of members of the public with common interests [2] When an individual identifies strongly with a community, a sense of belonging is generated in the participant, leading them to become more autonomous and driven to mobilize their social capital in order

to participate in community activities [3]. Nearly all emerging web application services have functions that support social communities that even extend to real-life social interaction outside the app, thereby promoting social activities of the players in the social communities [4]. Common social communities include Facebook, Google Plus, Twitter, Plurk and other emerging networks, accompanied by the current hottest social community trends. Social networks have become the largest breakthrough industry since Web 2.0. However, these social networks are mainly used for making friends, and not focused on applications for healthcare. This study attempted to use the characteristics of social networks, such as the competition and cooperation relationships between users, and the sense of belonging and obligation of users after joining the social community. We applied these characteristics to the study of healthcare to promote the user's motivation for change. In the past, social support from family, friends, and colleagues, has been recognized as being able to influence people's behavior and encourages them to achieve or maintain specific healthcare goals [5-6]. At the same time, this support has also been proven to be an important mechanism in assisting with weight loss through increasing external stimulation [7]. The support from friends and family could increase the individual's conviction in achieving specific goals, and enhance resistance to internal and external challengers. However, in the past, support from family, friends, and colleagues was restricted by geographical proximity. Hence, psychological and social support could not be provided anytime and anywhere. In addition, the general understanding of obesity is subjective as many people do not view obesity as a disease until it has caused significant damage, and therefore, do not actively try to gain concern or attention from family and friends.

B. Gamification Design

The interactive process of games brings many pleasant experiences, and people enjoy immersing themselves in this process, even resulting in a loss of self-control. The interactive elements in games have already been shown to be a motivating factor for strengthening the participation of the individual in Internet activities [8]. The concept of gamification refers to the use of traditional attractive features and mechanisms from games for applications in other non-gaming contexts [9]. Examples include using games to improve the learning motivation of learners [10-11], using games to promote the level of participation in sales activities [12], and using games to enhance the degree of engagement of office workers [13]. The main aim of introducing gamification is to establish incentives in crowdsourcing social networks for participants. Sufficient incentive is required as a driving factor for user behavior, such that it can promote users to participate in social activities on the Internet.

The use of gamification mechanisms can effectively induce change in human behavior. In practical operations, Kevin Webach from the Warton Business School [1] proposed six design principles for gamification as: define business objectives, delineate target behaviors, describe your players, devise your activity loops, don't forget the fun, and deploy the appropriate tools. Chou [14] proposed the Octalysis framework for gamification that included eight core drives in game design. These eight core drives include: epic meaning and calling, development and accomplishment, empowerment of creativity and feedback, ownership and possession, social influence and relatedness, scarcity and impatience, unpredictability and curiosity, and loss and avoidance. These drives can be used to regulate people's psychological needs to affect their behavior.

Professor Fogg from Stanford University proposed a human behavioral model that includes three elements of motivation, capability and trigger. All three elements must occur at the same moment for human behavior to occur [15]. Social networks and gamification technology are used in the design of this application to link these behavior-associated factors as a form of persuasive technology, to increase the initiative and sustainability for executing behavior.

System Development

The healthcare app system proposed in this study consists of three modules:

A. Individual diet diary module

The aim of this module is to allow users to record their daily diet using photography and manually input water intake and daily weight data. This module also provides historical records for the users to access.

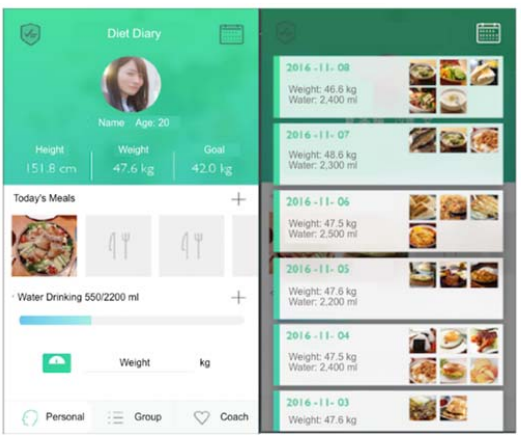

Fig. 1 personal diary module and historical record

B. Open community module

After each user has downloaded and used the app, they would be included into this preset module. In this channel, users can share and view records of other weight-loss cyber-pals on that day. They can also establish ranking systems to build a competitive atmosphere in order to help cyber-pals to actively use the app for recording and participating in weight loss activities.

C. Private trainer community module

This community is formed by professional coaches on healthy diet and weight loss. Each community consists of one coach and dozens of students. The coach can obtain the diet, water intake, and weight change records of each student that are related to the weight loss activities of the user. The coach

 ISBN 978-1-5090-4897-7

can then provide professional knowledge, personalized guidance and supervision.

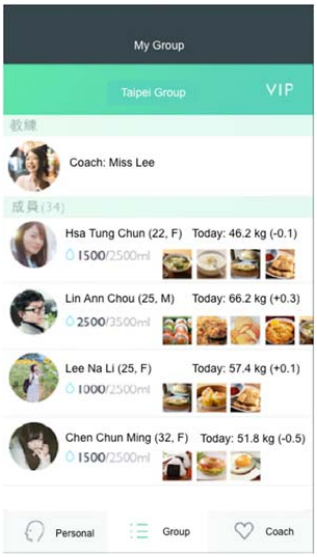

Fig. 2 the community interface

Usability Evaluation

59 subjects (50 females and 9 males) with an average age of 21 years participated in this experiment. Subjects were required to view the interface operation of the app and fill in survey forms to express their personal opinions. Subjects also filled in their personal information that included the user's gender, height and weight. The user's BMI was calculated to investigate the relationship of BMI and the usability of this system. The Technology Acceptance Model (TAM) was used to quantify the user's emotions in four areas: perceived usefulness (3 items), perceived ease of use (5 items), attitude toward using (3 items), and behavioral intention to use (1 item). This study employed independent t-test and regression analysis to further investigate the relationship between users and various interactive experiences.

Results and Discussion

The independent t-test was first used to determine the effects of gender on the four different themes of the TAM model. Results showed that female users had significantly higher ratings than male users in perceived usefulness (($t(57) = 2.455$, $p < 0.05$)), behavioral intention to use ($t(57) = 2.549$, $p < 0.05$)), and their actual use behavior was also significantly higher than males (($t(57) = 2.150$, $p < 0.05$)). These results showed that this product has higher motivation needs and persuasiveness in female users, while some males do not have any need for the use of this product. There were no significant differences between male and female users in the evaluation of usability ($p = 1.17$). From the mean evaluation scores (females=3.88, males=3.49 points) given by both genders, it can be seen that the interface and interactive design of our system is highly accepted by both indicating it is of high standards. There were no significant differences between the two in this regard.

Regression analysis was used to analyze the relationship of the four main elements of the TAM model. First, perceived ease of use ($\beta = 0.647$; $p < 0.001$) was found to significantly affect perceived usefulness (adjusted-$R^2 = 0.409$), showing that the usability of the interface could convince users whether the functions are good or bad. Both perceived ease of use ($\beta = 0.686$; $p < 0.001$) and perceived usefulness ($\beta = 0.199$; $p < 0.05$) significantly affect the attitude toward using (adjusted-$R^2 = 0.676$) at the same time. These results show that our app fulfilled the requirements of users simultaneously in demand and operation, and hence, increased the user's motivational tendencies. At the same time, attitude toward using ($\beta = 0.844$; $p < 0.001$) was observed to significantly affect the user's behavioral intention to use (adjusted-$R^2 = 0.707$). This shows that besides increasing the motivational tendencies of targeted users, this product also drives users to act on their behavioral intention to use. Finally, we found that perceived usefulness ($\beta = 0.656$; $p < 0.001$) also directly affects the behavioral intention of use (adjusted-$R^2 = 0.556$), but the effect of perceived ease of use was not significant. This result shows that when users actually use the product it can directly affect whether this product could help users achieve their healthcare management goals. In addition, the user-friendliness of the interface is an important reason for consideration. The overall analysis is shown in the following figure.

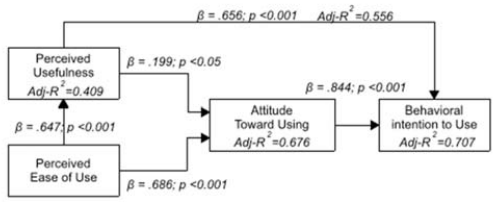

Fig. 3 Regression analysis of the TAM model

Conclusion

This study attempted to use social networks and gamification-based interactive technology to develop a mobile app system to help people achieve their health and weight loss goals through use of dietary management and assistance from professionals. The use of the TAM model has proven that this system could indeed increase the motivation of users. This will aid users to continuously participate in weight loss and diet management related activities, which will help them achieve their goals in health management. In the future, further study will focus on using human-system interaction results to

develop a personalized interactive and recommendation model to establish a personalized healthcare support mechanism.

Acknowledgment

This partial work was supported by the Ministry of Science and Technology (MOST), Taiwan, under grant number: MOST 105-2221-E-141 - 006.

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 ISBN 978-1-5090-4897-7