(i-COME'20)
INTERNATIONAL CONFERENCE ON COMMUNICATION AND MEDIA 2020

THE EFFECTIVENESS OF A PERSUASIVE MOBILE APP TO INFLUENCE HABIT CHANGE

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Abstract

Failure in changing bad eating habit as well as constant practice of poor lifestyle lead to major health issues among Malaysia citizens. As a result, the number of overweight citizens keeps raising at an alarming rate. Malaysian government has launches several campaigns urging Malaysian to conduct healthier lifestyle as well as taking healthier diets but to little or no avail. Apparently, bad habit is difficult to be changed. Even if some measures were taken to form a new and better habit, unfortunately, new habit is difficult to sustain. This study attempts to investigate the possibility of influencing habit change using a persuasive mobile application that monitors the users when adopting new habit. For this purpose, a mobile application prototype with recommended healthy habits and diets was develop and tested with six volunteers. The participants installed and used the mobile app daily for a week, and their interactions with the app were tracked and monitored. On the last day of the testing period, a semi-structured interview was conducted to record their experiences and opinions about the mobile app. The result of the study indicates the potential of monitored mobile application in inducing changes in daily habit, specifically in exercising and taking healthier diet.

Keywords: Communicative design, Habit change, mobile application, persuasive design

1. Introduction

Obesity is one of the major health issues among Malaysian. Obese Malaysians are likely to suffer from diabetes and other health related issues. In 2017 alone, up to 3.4 million Malaysia were found to have diabetes, and the number is estimated to keep increasing (Mafauzy et al., 2020). Ministry of Health (MOH) launched several campaigns, such as less sugar campaign, prevent diabetes campaign, 10000 steps campaign, and many more (Rosli, 2017), hoping to influence Malaysian to change their bad eating habit and sedentary lifestyle, but to no avail.

Obesity has become an uprising issue even among university students. The empirical study by Wan Mohamed Radzi et al. (2019) has revealed that 23% and 17.6% out of 940 undergraduate students were either overweight or obese, respectively. Their findings also shows that sedentary lifestyle, such as the use of social media which was mostly done while sitting or lying down, and unhealthy food like fast food and soft drink have the greatest effect on the student's Body Mass Index (BMI).

Habit influences human behavior, and consequently influences health, well-being and quality of life (Stoewen, 2017). Habit is defined as "learned impulses to perform a particular behavior, triggered outside of conscious awareness by a particular context" (Pinder et al., 2018, p. 2). As such, habit is expected to not be easily changed, especially if not properly monitored (Hermsen et al., 2016). People's failure to accept and maintain good habit in eating and living styles was due to failure in changing habit (Wood and Neal, 2016). Contrarily, well adopted good habit ensures that people voluntarily and persistently act in healthy ways. Healthy habits such as the practice of proper diet, exercise, sleep and relaxation are much useful in reducing the prevalence of health problems (Mansor & Harun, 2014).

Charles Duhigg, the author of 'The Power of Habit', classifies the loop of habit into three parts, i.e. a cue, a routine and a reward (Duhigg, 2020). A cue is like a motivational trigger for the behavior to start unfolding. A routine is the habit itself, i.e. the action of doing the habit. Lastly, there is a reward as the outcome of the completed action. However, most of healthy habits requires many loops of routines before a significant reward can be redeemed. As the result, most people will give up before a new habit is firmly achieved. Thus, in order to motivate people to adopt a habit for a longer period, it is importance to influence their decisional balance on exercising (Kien et al., 2020). Decisional balance can be achieved by constantly reminding them about the benefits of keeping fit and healthy, and the same time, reduce the barriers that keep them from exercising.

Ever since Fogg (2003) introduces persuasive technology, it has gained much attention from researchers and practitioners worldwide, leading to many digital tools or applications developed to influence either behavior change, attitude change, motivation, change in worldview, or compliance. Numerous research works that focus on influencing behavior and attitude in the area of health and wellness can also be found. Orji and Moffatt (2016) discover that the majority of the research reported a positive outcome from using persuasive technology to impact specified health behavior. They conclude that the effectiveness of persuasive technology is highly significant when it is targeted at eating habit and exercising.

2.   Purpose of the Study

The purpose of this study is listed below:

- To investigate the effectiveness of a persuasive mobile application in influencing habit change
- To identify the motivational cues that can influence the behavioral action of the habit itself.

3.   Research Methods

This study completes the normal phases of user centred design method, which involves iterative phases of analysis, design, evaluation, and implementation. Potential users were invited to evaluate and share ideas throughout the design phases and amendments to the prototype were made according to their suggestions.

3.1. Development of Habit Day

A mobile app prototype called Habit Day that monitored human's daily habits was developed in order to achieve the purpose of this study. Habit Day was designed with cues and routines, in which the users can record and share their daily achievements in social media, as well as monitor their daily physical activity levels and daily diet meal plan. Figure 01 shows some screenshots of Habit Day mobile application. The user interface (UI) of Habit Day is very simple to avoid complexity and cognitive overload when the user interact with the mobile application. As such, sufficient white space is arranged for better comprehension of the UI. In addition, the navigation menus were structured according to Gestalt's principles of similarity and proximity. Thereby, different shapes or colour themes are used to distinguish different sections, and related menus are group together in one location whereas unrelated menus are placed farther apart.

There are eight habit routines provided in this application, which are inclusive of four healthy meal plans, three exercise plans, and one hydrating plan. Four motivational cues were also included, i.e. the function to post an image (e.g. of daily progress or selfie) to Instagram, pay punishment fee (for missing a routine), find a companion to do pair routine, and one function to proceed without needing any motivational action. The pay punishment fee requires the user to transfer the punishment fee to a friend, so that the friend can keep the money for her/him until the cycle of the set routines are completed. In this case, the reward at the end of the routines cycle includes recollection of punishment fee. The find a companion function was designed with the intention to promote peer effects, in which a friend helps to motivate another friend. Part of the motivational cues were designed based on the recommendation by Ibrahim et al. (2016). They propose that social influence principles by Cialdini (2009) can be applied as a motivational cue on a user interface as the cue can be persuasive if it is well-designed. In this case, the study employed the principles of liking, social proof and consistency when designing the motivational cues for Habit Day application. For example, 'find a companion' cue is meant to metaphorically portray the liking principle. Liking principle is the belief that people like others who they perceive as friends/peers. In this manner, connecting friends/peers with mutual interest to perform a task will increase the likelihood of the task to be well accomplished. Similarly, the function to upload an image to

Instagram represent the social proof principle as it is related to the assumption that anything that is approved by majority is better than a single opinion. In this case, the image in the Instagram that is well 'liked' by many others will influence the user to keep uploading more images in the future, and therefore motivates the user to keep doing the routines set in the Habit Day mobile application. In contrast, the consistency principle is not visually represented as it is associated with people's voluntary commitment to stick to their initial goal. Hence, once the user intentionally installed the Habit Day mobile application, indirectly he/she has already set his/her goal to commit to the routines in the application.

3.2. Data Collection

Six Malaysians (age between 20-40 years old) were recruited to participate in this study which included two training and wellness consultants, one medical student, and 3 undergraduate students. Training and wellness consultants and the medical student were selected due to their expertise and experiences in human nutrition and fitness. Meanwhile, the undergraduate students were assumed to represent the final user. Once their consent was obtained, participants were asked to install the Habit Day application on their smartphones and complete the habit tasks for seven days. Participants were specially asked to try all eight habits provided in the application (i.e. eat breakfast, eat lunch, eat dinner, eat fruits, running, leg workout, abs exercise and drink water). Their daily interactions with the application were recorded every day until the seven days limit was over. During the data collection period, habit progression was monitored using the habit trackers. On the last day, each participants were interviewed to obtain their opinion about the overall design of Habit Day application.
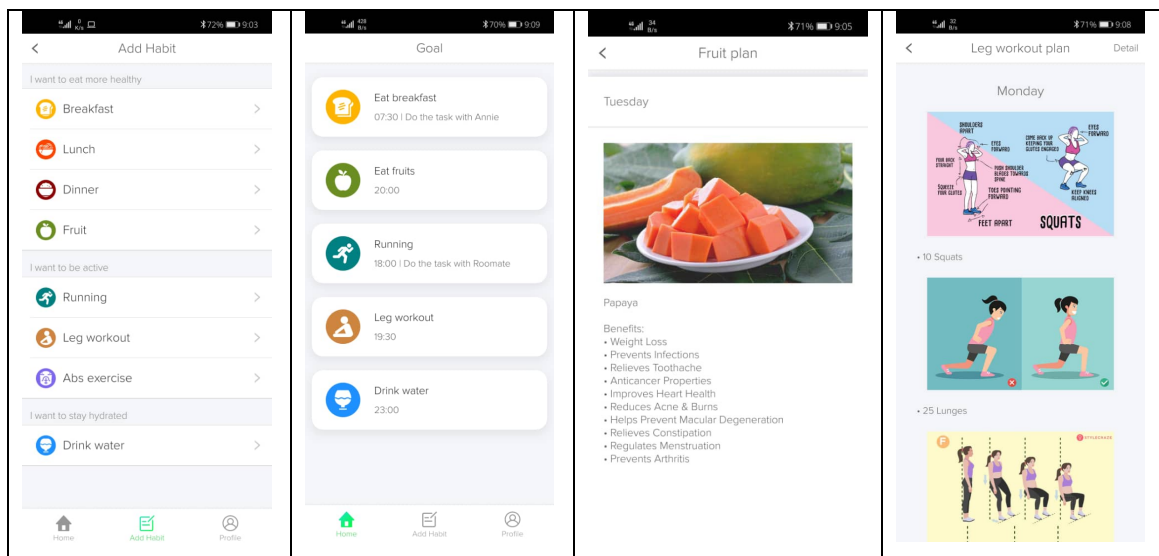

Figure 1. Example of Habit Day user interfaces

4.   Findings

One male and five females participated in the study. Only one of them is overweight (i.e. based on BMI cut-off for Asians) while the rest of the participant are having a normal BMI. Table 01 shows the

traces of BMI for each participant during the seven days period. Based on the data from the table, four participants show tiny decrement of BMI indexes while the other two shows no changes of BMI indexes at all. A closer look to the data shows that the participants with fixed BMI, one was a training and wellness consultant that happen to stay fit with regular exercise, while the other skipped some of the routines program set in Habit Day app. This finding shows that activities that were recommended in the mobile app may have beneficial effects on an individual wellness, but benefits vary depending on each individual. Furthermore, seven days period for the study is too short for a significant reduction of BMI to be achieved. Normally, a weight loss program will only achieved a significant result after 3-6 months of behavioural treatment (Butryn et al., 2018).

Table 1. Traces of BMI for each participant

Day	Participants					
	A	**B**	**C**	**D**	**E**	**F**
Sunday	18.82	17.67	21.57	22.96	20.75	23.18
Monday	18.82	17.67	21.57	22.96	20.75	23.01
Tuesday	18.82	17.67	21.57	22.89	20.75	23.01
Wednesday	18.82	17.67	21.36	22.89	20.75	22.84
Thursday	18.79	17.67	21.36	22.81	20.75	22.84
Friday	18.79	17.67	21.36	22.81	20.75	22.84
Saturday	18.79	17.67	21.36	22.81	20.75	22.84

Among the meal plans set in the Habit Day application, daily fruit plan shows the highest accomplishment while the other meal plans (i.e. breakfast, lunch, and dinner) shows moderate accomplishment. These findings show that Malaysian takes irregular meals consumptions, which is known as one of the cause for metabolism to slow down and consequently increase difficulties in losing weight. The habit trackers data shows that all three exercise plans and the hydrating plan in the mobile app are well completed. Notably, some participants were motivated to perform the physical routines on the first 3 days but got less enthused on the next day. However, they regained the motivation to perform habit routines after self-regulation. From interview data, it was revealed that they feel obligated to commit to their initial goal of using the application, and that what drove them to resume using the Habit Day mobile application.

Distribution of motivational cues preferences can be seen in Table 02. The most preferred cue is 'find a companion'. Tracked data shows that the participants chose 'find a companion' mostly for meal plans and exercise plans. From this data, it can be concluded that peers play significant role in motivating others to adopt healthier habits and lifestyles. Contrarily, no motivational cue is required for adopting regular drinking water habit. In overall, every participant was satisfied with the mobile app and happy to recommend the Habit Day app to their clients/colleagues.

Table 2. Distribution of motivational cues preferences

Routines	Motivational cues			
	Post on Instagram	**Punishment fee**	**Find a companion**	**No action**
Breakfast	2	1	2	1
Lunch	0	0	6	0
Dinner	1	0	3	2
Fruit	2	0	2	2
Running	1	1	4	0
Leg workout	1	0	3	2
ABS	0	0	4	2
Hydrating	0	0	0	6

5. Conclusion

In this study, Habit Day mobile application was developed to help user building a healthy habit and maintain a healthy lifestyle. Six participants volunteered to test and evaluate the mobile application and data was recoded using tracking system and an interview.

Firstly, the researchers want to highlight the importance of UI visual design (i.e. including visual text) as it is the only medium that allows communication to happen between the users and the application. Well-designed UI allows the user to comprehend information easily and thus enable them to proceed with the predefined tasks in the application. As a result, user's satisfaction of the application was easily obtained.

Secondly, the motivational cues applied in the study were well received by the users. The cues that represent the liking, social proof and consistency principles of social influence help the user to be engaged and loyal to the mobile app. This finding is in line with the previous work that implies persuasive visual design motivates user to become a loyal user of a computing technology (Ibrahim et al., 2016).

The findings also highlight the role of peer effects in adopting good habits. Undergraduate students are those who are in the process of learning to be independent from their family, thus they exchange family bond with friendship (Yusof et al., 2020). As a result, they rely more on their friends/peers when doing daily activities.

The researchers also found that it is important to design a well monitored fitness plan in order to encourage people to change their sedentary or unhealthy food consumption habit. It is presumed that the students were used to being mentored and guided throughout their school life, and thus forming the habit to be well informed and monitored while performing structured activities. Based on the findings, it is estimated that prolonged uses of monitored habit management application will effectively help people to adopt and sustain good habits, and consequently living a healthier lifestyle. However, future work should provide empirical evidence to further verify the findings of this study.

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