

EDUCATING PARENTS IN DEALING WITH CHILDHOOD OBESITY THROUGH THE USE OF THE BMI MONITOR APP

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Childhood obesity has now reached an alarming level among children. It affects one out of every ten children all over the world. While in Malaysia, overweight child is 38 percent of the child population. If it is not effectively curbed, childhood obesity will cause many problems. Previous studies have shown that parents are responsible for their children's well-being and their involvement is the most influential treatment to childhood obesity. With the advent of mobile technology, various mobile apps have been developed to manage people's daily lives. This paper elaborates on the development of the BMI monitor app, a mobile application which is intended to be used by parents to monitor their children's Body Mass Index (BMI). It uses the BMI Percentile method which is recommended by pediatricians worldwide. This app enables parents to store all the BMI records of the children and also provides advices to help parents to deal with the childhood obesity problems. This paper also discusses on the outcome of an evaluation that has been conducted among a sample of parents towards the use of the app. It is hoped that the use of the app will ease the parents in monitoring their children's BMI status and eventually formed them to be more responsible parents.

Keywords: Childhood obesity, Mobile healthcare, Body Mass Index, BMI monitor, parents

Introduction

Childhood obesity (CO) has been a critical issue in most developing countries. The World Health Organization (WHO) has declared that overweight or obesity affects one out of every ten children or teenagers all over the world (Segel, 2011) and an estimated 44 million of children under 5 years of age were overweight or obese in 2012 (World Health Organization, 2014). CO has rapidly becomes one of the prominent health challenges and spreads widely over the years (O'Dea & Eriksen, 2010). In Malaysia, as much as 30 percent of primary school children and 15 percent of toddlers and pre-school children are obese or overweight (HealthToday, 2013). The problem is getting worse where CO among Malaysian children is the highest in the Southeast Asia and ranked sixth among the Asian countries (Soliano, 2013).

In addressing this problem, parents should be responsible for their children's well-being and the effort has to start early when the children are still young (Adamo & Brett, 2014). An effective treatment of childhood obesity requires the involvement of the parents (Anderson & Whitaker, 2010). Therefore, parent's recognition of excess weight and its associated health risks in their children are likely to be the

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important steps towards successful intervention. Sufficient evidence supports the inclusion of parents in the interventions to prevent and treat childhood obesity; however, there is no consensus yet on which type of intervention is the most effective (Maynard, Baker, Rawlins, Anderson, & Harding, 2009). In encouraging parents to reduce their children's obesity level requires them to go through educational programs or counseling which encourage healthy behaviors and motor skills.

Nowadays, mobile-healthcare (m-healthcare) has been used by many individuals that wish to attain health benefits (Dayer, Heldenbrand, Anderson, Gubbins, & Martin, 2013). Examples of m-healthcare apps include; interventions that help people to quit smoking (Abroms *et al.*, 2012), control obesity (Rodrigues, Lopes, Silva, & Torre, 2012), self-management for diabetes (Waki, Fujita, Uchimura, Aramaki, Omae, Kadowaki, & Ohe, 2012), and behavioral monitoring of children (Luxton, McCann, Bush, Mishkind, & Reger, 2011). Mobile apps are increasingly becoming popular because they can be used by a great number of people and target different health issues or groups of patients (Karan, Bayraktar, Gümüşkaya, & Karlik, 2012). Mobile apps are beneficial and there are still many domains that must be attended to make it successful (Paschou, Sourla, Basagiannis, Sakkopoulos, & Tsakalidis, 2012). Even though mobile technology has been available for several years and various mobile apps for calculating Body Mass Index (BMI) have been in the market, the app specifically for monitoring children's BMI status that can be used by parents is still limited. Most mobile apps do not calculate and produce the BMI charts over time. In addition, the BMI values of multiple entries cannot be saved over time in the database to produce the on-demand charts. Moreover, there are no advices for food intake as well as exercises that can help the parents to deal with their children's obesity problems. This paper is structured as follows: Section 2 discusses the BMI Percentile Monitor Development, while Section 3 describes the user evaluation of the app among the parents. A discussion on educating the parents through the proposed approach is reported in Section 4 and finally Section 5 concludes this paper.

The BMI Percentile Monitor Development

In this section we describe our experience in developing the BMI Monitor App and it involves four stages namely; i) requirements planning, ii) user design, iii) construction and iv) implementation. In the requirements planning stage, all the requirements for the development of the BMI Monitor App were listed based on three steps. The first step involves gathering of all information pertaining to the BMI and the BMI percentile charts for boys and girls. The second step involves collecting, editing and saving images (png format) to be used in the app so as to suit the screen of mobile devices. The third step involves recording and saving audio files at 128 kbps (mp3 format) for the advice and information. In the user design stage, an activity diagram as shown in Figure 1 was used as guidelines to

illustrate the sequence of events by the user. By referring to the activity diagram, designers can provide all the necessary functions of the app as required by the users. The construction stage describes the development of the app in the form of the APK file based on the prototyping approach (Laudon & Laudon, 2012). Emphasis was particularly given to the graphical user interfaces (GUIs) so that the app is able to provide all the functions as required by the users. The three most important GUIs of the app include the main menu (Figure 2 (a)), login menu (Figure 2 (b)), and function menu (Figure 2 (c)). The main menu enables user to choose between English or Malay language and the login menu allows user to login to the app and the new user to register prior to login. While the function menu enables the user to execute the functions available in the app.

The function menu is the most important menu of the app and it includes; BMI percentile calculation, BMI percentile chart viewing, updating data, deleting data, viewing current data and logout. For calculating the BMI percentile, user is required to input the weight in kilograms, the height in centimeters and the age in months as shown in Figure 2 (d). Then a colored bar chart will be displayed together with the BMI Percentile value, the time and date of reading as shown in Figure 2 (e). The bar charts have been assigned with various colors representing the BMI status, namely; underweight (yellow), healthy weight (green), overweight (orange), and obese (red). The data is stored automatically for each entry in the user’s database.

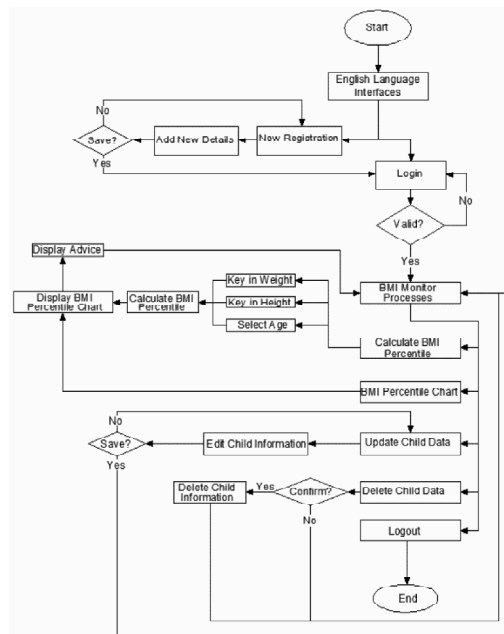


Figure 1: Activity diagram to illustrate sequence of events

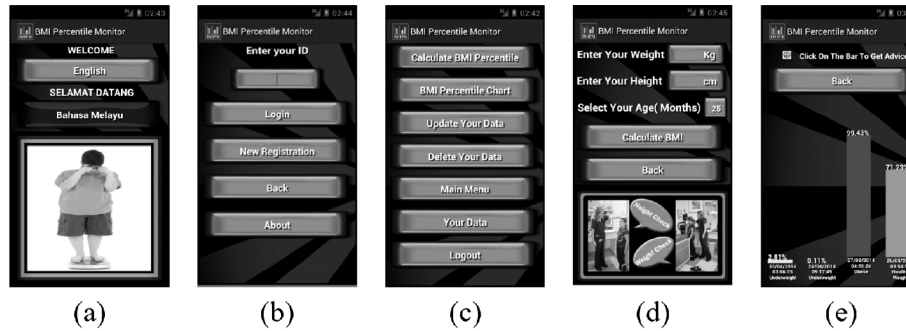


Figure 2: (a) Main menu, (b) login menu, (c) function menu (d) BMI Percentile calculation and (e) Percentile chart

Parents Evaluation

A user evaluation was conducted to determine the parents' perception on the usability aspect of the BMI Percentile Monitor app. The evaluation was conducted among 30 parents who have been selected based on the convenient sampling technique. They consist of 16 male (53.3%) and 14 female (46.7%) parents. In terms of age, 1 of the parents is between 21-25 years, 10 are between 26-30 years, 10 are between 31-36 years, 4 are between 36-40 years and 5 are over 40 years. The parents were categorized into male and female parents. The instrument used in this evaluation was adapted from the previous studies and covers five dimensions which include; Usefulness, Ease of use, Hedonic Motivation, Satisfaction and Outcome/Future Use. Usefulness is defined as the extent to which a user believes by using a specific application would raise the user's performance level (Davis, 1993). Ease of Use is defined as the degree a user believes that using a particular system would be free of effort (Davis, 1989; Zins et al., 2004). Hedonic motivation represents the way that can be followed to motivate the user to use a specific application and how this application can influence on the results (Venkatesh et al., 2012). Satisfaction is defined as the level of satisfaction of the user with the whole application and contents (Lewis, 1995). Finally, Outcome/Future Use is defined as the degree a user is expecting to use the application (Davis, 1989; Zins et al., 2004). A Likert scale (5-point) from "Strongly Disagree" to "Strongly Agree" was used (Likert, 1932).

This study utilizes Descriptive statistics, reliability analysis and t-test. The data was analyzed using the SPSS version 18 for Windows. The following sections discuss the results from the reliability, descriptive statistics and t-test analyses. The Cronbach alpha values were calculated to ensure the reliability of all the dimensions as shown in Table 1. The Cronbach alpha for Usefulness is 0.885, Ease of Use is 0.826, Hedonic Motivation is 0.714, Outcome/Future Use is 0.826, and Satisfaction is 0.827. Since the Cronbach alpha values for all the dimensions

are greater than 0.7, the dimensions satisfy the reliability criterion as suggested by Nunnally (1978).

TABLE 1: CRONBACH ALPHA VALUES FOR ALL DIMENSIONS

<i>Dimension</i>	<i>Number of items</i>	<i>Cronbach Alpha</i>
Usefulness	6	0.885
Ease of Use	5	0.826
Hedonic Motivation	3	0.714
Future Use	4	0.828
Satisfaction	3	0.827

Table 2 presents the descriptive statistics for all the dimensions and items. Items that are bolded have mean values of more than 4.0 which mean that these items were agreed by the parents. Only one item has a mean value of less than 4.0 and has been marked with an asterisk (*).

TABLE 2: DESCRIPTIVE STATISTICS FOR ALL ITEMS

<i>Item</i>	<i>Mean</i>	<i>Std. Deviation</i>
Usefulness		
1. Using the BMI percentile monitor would enable me to accomplish tasks more quickly in knowing my child’s BMI status	4.47	0.571
2. Using the BMI percentile monitor would make it easier for me to monitor my child’s BMI status	4.47	0.571
3. I find the BMI percentile monitor useful in determining my child’s BMI status	4.50	0.572
4. BMI percentile monitor is suitable for both experienced and inexperienced parents in determining the child’s BMI status	4.10	0.759
5. I find the BMI percentile monitor adequate as needed	4.13	0.776
6. Overall, i find that the BMI percentile monitor is useful	4.37	0.556
Ease of use		
1. Learning the BMI percentile monitor is easy for me	4.27	0.640
2. My interaction with the BMI percentile monitor is clear and understandable.	4.23	0.568
3. I find the BMI percentile monitor is flexible to use.	4.23	0.568
4. I find the BMI percentile monitor is satisfying to use	4.20	0.714
5. Overall, I find the BMI percentile monitor easy to use	4.20	0.714
Hedonic motivation		
1. I find that using the BMI percentile monitor on my mobile device was fun and appealing to me.	4.20	0.551
2. Monitoring the child’s BMI status by using the BMI percentile monitor is enjoyable.	4.10	0.548
3. I would recommend other parents to also use the BMI percentile monitor	4.37	0.490

contd. table 2

<i>Item</i>	<i>Mean</i>	<i>Std. Deviation</i>
Outcome / future use		
1. I could effectively complete my tasks using the BMI percentile monitor.	4.10	0.662
2. I was able to efficiently complete my tasks using the BMI percentile monitor.	3.90*	0.803
3. From my current experience with using the BMI percentile monitor, I think I would use it regularly.	4.00	0.743
4. I would recommend to others the BMI percentile monitor.	4.20	0.664
Satisfaction		
1. I felt comfortable using the BMI percentile monitor.	4.23	0.626
2. I enjoyed using the BMI percentile monitor.	4.07	0.740
3. Overall, I am satisfied with BMI percentile monitor.	4.30	0.535

The descriptive statistics were further investigated to determine whether female parents are more concern of their children's well-being compared to the male parents. An independent-sample t-test was conducted to compare the mean scores for male and female parents for all the dimensions in order to signify the differences statistically. The results indicated that there is no significant difference between the two groups for all the dimensions since all the significant values are greater than 0.05 (George & Mallery, 2003) as shown in Table 3.

TABLE 3: MEANS, STANDARD DEVIATIONS AND PAIRED T-TEST FOR ALL THE DIMENSIONS

<i>Measure</i>	<i>Gender</i>	<i>N</i>	<i>Mean</i>	<i>Std. Deviation</i>	<i>Std. Error Mean</i>	<i>Sig.</i>
Usefulness	Male	16	4.2500	0.50918	0.12729	0.802
	Female	14	4.4405	0.51311	0.13713	
Ease Of Use	Male	16	4.2375	0.58066	0.14517	0.085
	Female	14	4.2143	.39586	0.10580	
Hedonicmotivation	Male	16	4.2083	0.48496	0.12124	0.199
	Female	14	4.2381	0.35635	0.09524	
Outcome/Future Use	Male	16	4.0938	0.60467	0.15117	0.622
	Female	14	4.0000	0.58012	0.15504	
Satisfaction	Male	16	4.2083	0.56928	0.14232	0.729
	Female	14	4.1905	0.55028	0.14707	

Educating Parents Through The BMI Percentile Monitor App

The BMI Monitor App has been developed with the intention to educate parents to be more responsible to their children. This can be done by monitoring the children's BMI status from time to time and taking appropriate action in controlling the children's food intake. A study by Rietmeijer Mentink, Paulis, Middelkoop, Bindels, and Wouden (2013) reported that more than 60% of the parents failed to recognize their child is overweight. While in another study, 79% of the parents did not perceive

their child’s weight to be a health risk (Park, Falconer, Saxena, Kessel, Croker, Skow, & Kinra, 2013). The BMI Percentile values of multiple entries can be saved over time in the database to produce an on-demand BMI chart which allows the parents to monitor their children’s BMI status. Parents can use the app to create a more systematic diet program for their overweight or obese children. This app helps parents to check the progress of their children’s BMI status in order to determine the effectiveness of the weight control measures that have been taken by parents. Parents need to touch the colored bar chart in order to retrieve advices on the recommended food intake based on their children’s BMI status as shown in Figure 3 (a), (b) and (c). Beside advices on the food intake, this app also provides advices on the exercises that are suitable for the children based on their BMI status as shown in Figure 3 (d) and (e). These will guide the parents to choose a suitable exercise program that suits to their children’s requirements. Overall, the BMI Monitor App provides advices to help parents to deal with the childhood obesity problems and if they continually used this app, it will be able to educate them to be more responsible parents.



Figure 3: Food intake and exercise advices

Discussion and conclusion

This paper describes the development of the BMI Monitor App and parent’s evaluation of the app. It also discusses on educating the parents through the proposed approach. In the development process, this paper describes all the development stages of the app which include; i) requirements planning, ii) user design, iii) construction and iv) implementation. An activity diagram was created to illustrate the sequence of events by the user. The development process hopefully is able to provide some guidelines to mobile app developers in developing an effective and usable app especially related to the childhood obesity problems. The results of the evaluation revealed that parents appreciated the BMI Monitor App in monitoring their children’s BMI status and its various built-in features. The descriptive statistics indicated that the parents agreed in terms of Usefulness, Ease of Use, Hedonic

Motivation, Satisfaction and Outcome/Future Use of the app. The results also showed that there is no significant difference in means for all the dimensions between the male and female parents.

Due to time limitations and work constraints, most parents neglect in their responsibility of taking care and monitoring their children's condition especially the BMI status. Some do not even have the slightest idea to execute this responsibility. Parents require some form of tools that can help them with this matter. Since most parents are using Smartphone, the idea of developing the BMI Monitor App coincides with the needs of the parents. Parent needs something that is straightforward, easy to use, and easily available anywhere and anytime tool. Once the parents are able to determine the BMI status of their children, they can use the app to monitor the status by introducing programs such as weight control, systematic diet or even specialized exercise specific for their children. The app provides advices related to food intake as well as exercises to suit their children condition. Overall, this study highlights the importance of parents' involvements as the most influential remedy to child obesity problems. Thus, our effort in developing the BMI Monitor App coincides with the need to involve parents to ensure the success in reducing the childhood obesity problems. It is hoped that the findings of this research will encourage parents to use the BMI Monitor App not just for monitoring their children's BMI status but also to eventually be a more responsible parents. Further work to be considered can be a theoretical framework for investigating the important determinants in changing the parents' behavior towards the use of the app in monitoring their children's BMI status by incorporating persuasive technology into the app.

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