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Development and Validation of an Instrument to Measure the Persuasion Effects on Parents After Using the Persuasive Mobile Child Obesity Monitor App

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With the advent of technology, mobile healthcare (m-healthcare) applications have been developed to help people in managing their daily lives. In order to improve the use of m-healthcare applications, persuasive components in m-healthcare are vital for changing behaviour. However, there is no single agreement on how to measure the level of persuasion of users especially in m-healthcare for behaviour change. Therefore, majority of researchers attempt to measure the level of users' acceptance or attitude. So, this paper focuses on the development and validation of a generalized instrument to measure the persuasion effects which targets different group of users. Also, this work is aimed to design and evaluate an instrument to measure the persuasion perspectives of parents using the Persuasive Mobile Child Obesity Monitor (PMCOM) app. Based on the literature review analysis, there are three variables that depend on the persuasion theories which include trigger, ability and motivation that lead to behaviour change. These variables have five dimensions that include reminder, reduction, historical information, suggestion and praise. All dimensions are used to establish the required behaviour when integrated into the mobile application. The results of an evaluation among 58 parents show that the design of a persuasive instrument based on the generalizable process can provide guidance and information in the construction and validation of the questionnaires for any future studies.

Keywords: Instrument Development, Process Steps, Mobile Healthcare, Persuasive Elements, Child Obesity.

RESEARCH ARTICLE

1. INTRODUCTION

Many developers have designed persuasive systems for changing behaviour in the healthcare domain. However, there is no agreement on how to measure the level of persuasion of users using these systems [1] and [2]. Adding to that, there are no expert reviews (expert judgements) that verify the implementation of such persuasive instruments [2]. Therefore, majority of researchers attempt to measure the level of users' acceptance or attitude or satisfaction rather than persuasion perspective. Such as [3], [4], [5], [6], [7], [8] and [9] have partly dependent on persuasive features by combining them with other theories during the validation process. In short, researchers should focus on the validating perspective of persuasion if they have integrated the persuasive features into their system design.

Of course, some general valuation questionnaires already exist within the community, but overall, these instruments either focus on specific persuasive elements for reducing snacking (e.g., [10]).

Other studies only have validity for one specific system in one specific study context (e.g., [11], [12] and [13]). This paper presents the key question, why most of the applications may fail to persuade the end users, particularly in the healthcare domain. In addressing this problem, a researcher has to apply the general systematic process to be used independently of the problem domain in analysing the customers' significant requirements for persuasive applications [14]. Persuasion of the parents was one of the important issues that should be investigated in the previous study [15]. Therefore, this study constructed a persuasive instrument after determining the related variables and items based on a proven theoretical analysis [14], [16]. Thus, developing an instrument to measure the persuasion perspectives of users using the persuasive system is needed. The researchers identified a need for such persuasive instrument, particularly to be able to measure the impact of persuasive systems on users in a persuasive way [2].

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The present paper elaborates on the development of a persuasive instrument based on the identified related variables and items, especially those that can be used for persuading parents to monitor their children's obesity. Therefore, it proposed the process steps for developing the questionnaire to measure the persuasion perspectives of parents using the PMCOM App. The process steps are a roadmap for researchers to develop the persuasive instruments in mobile healthcare domain. However, the instrument can only be generalised to a similar behaviour change system, and for a similar context to target different groups of parents in other areas.

The remaining parts of this paper are organised as follows: instrument development is discussed in Section 2. In Section 3, the study describes the Research method. Then Section 4 presents the Data collection. Section 5 illustrates the Data analysis and Section 6 presents the finding and discussion. Finally, the paper provides the Conclusion and future research in Section 7.

2. RESEARCH METHOD

The study adopted a quantitative research method through face to face interview [18]. A set of questions were used in the research instrument for measuring the parents' perceptions on the use of the Persuasive Mobile Child Obesity Monitor (PMCOM) app.

This section deals with the sampling design of the current study which involves determining the target population, sampling technique, sampling location, and the sample size that is required for data collection. Questionnaire was used to get answers and feedbacks directly from the parents and the collected data is much easier to analyse. Besides that, the questionnaire provides standardized answers that make it easier to compile the data from the parents. Regarding the population of this study, according to [17], population is the entire group of people, events or topics of interest that the researchers wish to investigate. In a similar way, [18] also state that the research population is the total number of inhabitants, involving people, in a particular country, or geographical locations. Thus, defining the target population correctly is an essential step in the design of a research [19]. Therefore, population is the source of data; thus, the selection of the targeted population must be correct, and the sample must be carefully chosen.

Based on the statistics that have been published by the Ministry of Health Malaysia [20], the prevalence of obesity was higher among children in the urban areas than in the rural areas. By age group, the highest prevalence was noted among children aged 5-9 years and followed by children aged 10-14 years. Family involvement is the key to an effective treatment of childhood obesity [21] and obesity early in life has effects on health and economic outcomes [22]. Therefore, parents' recognition of excess weight and its associated health risks in their children are likely to be the important steps towards successful intervention. Consequently, this research relies on Malaysian parents who have children aged between 5-14 years old.

Adding to that, most of the respondents were from urban areas such as Kuala Lumpur and Putrajaya. For that purpose, the researchers have conducted a survey to gather information directly from the parents. The purposive sampling which is the non-probability technique was used for this study. The main constraint of this study is that the parents to be selected must have obese children. This is because so far there is no specific record pertaining to the parents having obese children in Malaysia. As such, the researchers have to approach the parents personally and make sure that they have obese children in order to be selected as respondents to this study. Consequently, the purposive sampling technique is appropriate since it is intended to be used when only limited number or category of persons can be approached [23].

The identification of sample size is quite fundamental to sketch the right conclusions in this research. On the other hand, if the sample size is too small, a well-managed study might fail in determining the impacts or may estimate the effects imprecisely. In the same manner, if the sample size is too big, the research would be more complicated and may even drive to invalid results [24]. Accordingly, [18] alleged that research sample size is a subsection of cases, chosen and calculated by the researcher for the basis of being capable to draw conclusion on the whole population cases under examination. Therefore, there are connections among sample size, target population and purpose of the study. Moreover, [25] and [26] argued that the minimum sample agreeable size for statistical analysis is 30. Regarding to the pilot study, the researchers such as [27] stated that the sample acceptable size for the pilot study is between 25 to 100, which constitutes the subjects from the target population. According to [28], the appropriate number of sample size for the pilot study must be at least 30. Hence, the sample size for this study is 58 parents for the pilot study.

3. INSTRUMENT DEVELOPMENT

The first step in the instrument development process is delivering an initial draft of the data collection. The questionnaire was designed based on the guidelines provided by [29] and [30] which include; the instrument should be attractive and concise; only consider items that are related to the objectives of the study, use simple and understandable language and avoid leading or loaded questions and ambiguity. Closed-ended questions are commonly required in the questionnaire design and any leading and loaded questions must be avoided, as well as being specific to avoid ambiguity. This questionnaire was written in English and then sent to experts at the Language Centre of Universiti Utara Malaysia for the translation process. The questionnaire was translated from English to Malay using back to back technique to check the translation from Malay to English. This process is to ensure the respondents' ability to comprehend and respond to the questions appropriately. Table I illustrates the variables and the sources of the instrument design.

Table I. Variables and sources of the instrument.

Variable	Element	Items	References From
Trigger	Reminder Message	The PMCOM app sent me a reminder message whenever I did not use it after a month.	[40], [41], [42], [43]
		The reminder message of PMCOM app helped me in monitoring my child's obesity status.	[41], [42], [44], [45], [46]
		The reminder message of PMCOM app did not disturb me.	[47], [44], [46]
Ability	Reduction	The PMCOM app provided simple steps to monitor my child's obesity status.	[41], [43]
		The PMCOM app made the tasks of monitoring my child obesity status easier.	([41], [43]
		The PMCOM app's ability in monitoring my child's obesity status is worth more than overcoming the consequences of the obesity.	[48], [42]
		I took a shorter time to monitor my child's obesity status using the PMCOM app compared with the conventional approach.	[48], [42]
		The PMCOM app helped me to monitor my child's obesity status with less mental effort.	[49], [42]
		The PMCOM app did not interrupt my routine life, and I will continue to use it.	[42]
		The PMCOM app is suited to the norm of society, thus I felt comfortable in using it.	[42], [43]
	Historical Information	The PMCOM app enabled me to track my child's obesity status at any time.	[50], ([41], [42], [43]
		The PMCOM app allowed me to track my child's obesity status at any specific date.	[50], ([41], [42], [43]
Motivation	Suggestion	Suggested information motivated me to monitor my child's status for fear of the impact of obesity in the future.	[41], [42]
		Suggested information motivated me in keeping my child from being socially rejected by his/her peers.	[42]
		I accepted the PMCOM's suggestions on my child's obesity status; therefore, I will encourage other parents to use it.	[42]
		I feel guilty whenever my child is obese or overweight; however, the suggestions helped me to handle the situation.	[42]
	Praise	Reading the PMCOM's praise messages encouraged me; therefore, I was happy to use it.	[41], [42]
		I was pleased to see the PMCOM's praise messages because it did not disturb my parental feeling.	[41]
		The praise messages of the PMCOM app gave me hope to continuously monitor my child's status.	[42]

The second step is to ensure the content validity. Although different methods have been discussed in regard to the measurement of content validity, expert opinion appears to be the most widely accepted method [31] cited in [32]. According to [33], content validity is determined by expert judgment. [18] indicated that expert review is sufficient to determine that an instrument has content validity. Three to ten experts are the required minimum for content validity [34], [35] and [36], although some scholars suggested a minimum of two experts [37] and [29]. The selection of the expert reviewer was based on their experience in the field and scientific qualifications [38] and [29]. They were deemed to have sufficient knowledge in the research concepts, theory, or problems that address the subject content of the instrument; or knowledge with the instrument formatting techniques which impact the structural construction of the instrument [38] and [39].

Given the importance of the expert review process, seven experts were involved in the validation process. Six of the experts have experience in persuasive technology, human-computer interaction, and mobile development; and one has experience in statistics research and instrument development. The experts then reviewed, either individually or as a group all the related materials and commented on certain areas such as operational definitions, comprehensiveness of the theory and adequacy of the sample. The experts then reviewed, either individually or as a group all the related materials and commented on certain areas such as operational definitions, comprehensiveness of the theory and adequacy of the sample.

In step four, the six experts have to ensure the followings; (i) link each item with its respective aims, (ii) assess each item and its relevance in representing a topic, (iii) the items must adequately describe the content or behaviour in the domain of interest and (iv) write remarks for each item of the instrument.

In the fifth step, the statistic expert has to ensure that the formatting of the instrument was well organised. The expert has suggested the use of the seven-point numerical scale to indicate the participant's level of agreement or disagreement with the presented statement. The scale provides numbers rather than semantic space or verbal descriptions to identify the response options or categories [51] and [30]. Hence, the answer to each item in the questionnaire was measured on a seven-point numerical scale with the end points labelled 1 for "strongly disagree" and 7 for "strongly agree" to respectively indicate the participant's level of agreement or disagreement with the statement presented.

Numerical scales are frequently used to measure behavioural purposes [51]. In sum, a numerical scale works based on measuring the distance between numbers of positions. Several aspects were considered with regard to the seven-point numerical scale design. Firstly, the position to be measured has to be classified into two directional categories (positive and negative positions) without neutral position towards the issue under study [51] and [30]. Next, the number of classifications needed to be considered (i.e., "strongly disagree", "disagree", "agree" and "strongly agree").

This classification should depend on how finely a researcher wants to measure the perspective of participants in question [52]. Therefore, the statistic expert suggested in adapting Sugiyono equation [53], a mathematical equation which calculates the interval range of Likert scales by performing the mathematical equation as follows:

RS= (m−n) / b
Remark:
RS = Score range
m = highest score on scale
n = lowest score on scale
b = number of classifications
RS= (7−1) / 4=1.5

Table II illustrates the criteria of analysis for each category by the rating scales.

Table II. Criteria of Analysis for Each Category by Rating Scales

Category	Rating scale
Strongly Disagree	1 – 2.49
Disagree	2.5 – 3.99
Agree	4 – 5.49
Strongly Agree	5.5 – 7.00

Step six is to ensure the clarity of the instrument whereby two parents having children aged between 5 and 14 years participated. They have to assess each item of the instrument based on the clarity of statement. In step seven, the researcher has to decide on the combination of the parents' final responses after making the necessary adjustments.

In step eight, all the suggestions by the parents were taken into consideration to improve and rearrange the content of the items and format of the questionnaire. In step nine, the researcher produced the final draft of the questionnaire for the subsequent validation process. In this step, it might be necessary to solicit advice or assistance from somebody who has expertise in graphic design particularly for questionnaire to be administered electronically.

In this step also, it is necessary to consider the content validity procedures. However, the content validity differs from other validity testing in one aspect, it is not based on the scores from the scale, performance differences between persons, or changes based on some intervention; only on the expert's judgement about the content of the items [54] and [55]. For this reason, some theorists consider content validity as insufficient to provide evidence for validation of the instrument, although content validation does influence the inferences that can be drawn from a score [56] cited in [35].

To tackle this issue, Cronbach and Meehl [57] introduced the construct validity. Regrettably, some researchers have rushed through the process of validation with little appreciation for its enormous importance, only to find that their instrument did not work for construct validity or internal consistency reliability when the response data is obtained [37].

Therefore, the new or adjusted instrument need to be re-evaluated based on the reliability test, with more evidence supported by performing construct validity [56]. Construct validity is described as the evidence to determine that the presumed construct is what is being measured [33], [58] and [29]. It verifies whether the instrument tapped the concept as theorised [59] and refers to the degree to which the construct measures what it is supposed to measure [60]. Investigators evaluate construct validity when specific criteria define the concept; they verify whether key constructs are included using content validity assessments made by the experts in the field or using the statistical methods such as factor analysis [29].

In step ten, a pilot study was carried out with a small sample of individuals who were similar to those of whom the instrument is designed. The study was conducted by performing construct validity and reliability test to discover any limitations to the main study [51], [61], [62] and [29]. This process also ensured that the words and phrases of the questionnaire were clear and straightforward to the parents.

In summary, the process as shown in Figure 1 provides adequate evidence of the instrument's validity.

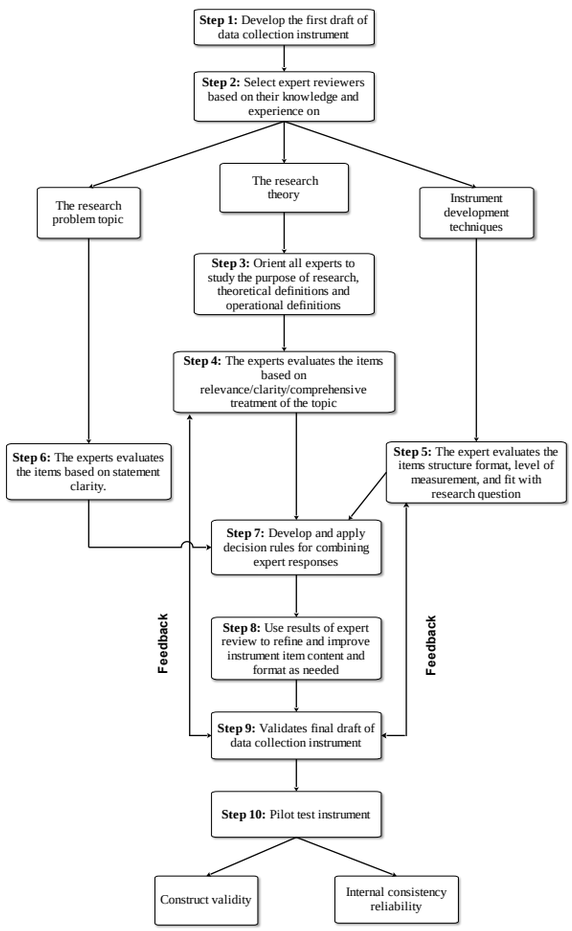

Fig. 1. The steps in developing the instrument.

4. Data Collection

The data for this study was collected through face to face interview using a questionnaire during November and December 2016. The criteria for the respondents include; (i) parents must have children aged 5 to 14, (ii) the parents must use the PMCOM application in order to answer the questions, and (iii) the parents were briefed on answering the questions, the purpose of the study and the terms used. It took approximately 40 minutes to complete the questionnaire. The respondents were selected from two different locations; Kuala Lumpur and Putrajaya. The researcher faced some difficulties during the data collection since some of the parents were busy at work or could not be reached easily. At the end, only 58 fully answered questionnaires were successfully collected. Demographic detail of the respondents is shown in Table III.

Table III. Demographic information of the respondents.

Item	Frequency	%
Gender		
Male	34	58.6%
Female	24	41.4%
Total	58	100.0%
Age		
26-30 years	10	17.2%
31-40 years	41	70.7%
>=41 years	7	12.1%
Total	58	100.0%
How long have you been using the smartphone?		
<5 years	18	31.0%
5-10 years	34	58.6%
>=11 years	6	10.3%
Total	58	100.0%
Education level		
Bachelor	21	36.2%
Master	9	15.5%
Ph.D.	6	10.3%
Others	22	37.9%
Total	58	100.0%
Have you ever used the PMCOM app before?		
Yes	58	100.0%
No	0	0.0%
Total	58	100.0%
Do you have any children between the ages of 5-14 years old?		
Yes	58	100.0%
No	0	0.0%
Total	58	100.0%
Are your children obese?		
Yes	58	100.0%
No	0	0.0%
Total	58	100.0%

5. DATA ANALYSIS

The data was analysed using two techniques; i) the principal component method for factor analysis, and ii) Cronbach's coefficient alpha for the reliability. For the purpose of data analysis, a Statistical Package for the Social Sciences (SPSS) software version 21 for Windows 7 was used. SPSS is the most widely used computer programme for statistical analysis, which comprises a comprehensive set of procedures for organising, transforming and analysing quantitative data [63] and [64]. It can utilise data from almost every type of data set format to generate tabulated reports, distribution charts and trends to descriptive statistics and complex statistical analyses.

6. FINDING AND DISCUSSION

Factor analysis was applied to determine the construct validity by verifying the dimensions of the measures that had been operationally defined and indicating the items that were most suitable for each dimension [61]. Therefore, a statistical procedure such as factor analysis is considered helpful in providing evidence of construct validity [30]. The test was run by Principal Components Analysis extraction with varimax rotation [58]. Exploratory factor analysis (EFA) was sufficient for this study as recommended by [58]. EFA was applied to define the underlying structure among the variables depending on the rotated component matrix. Three test indicators were used for accepting each item; the Kaiser-Meyer-Olkin measure of sampling adequacy (KMO test), the Bartlett test of sphericity and factor loading. The Bartlett's test of sphericity and KMO check whether the factorability of data achieves less or equal to 0.05 and 0.6 as minimum values respectively [58] and [65].

The KMO test measures the adequacy of a sample in terms of the distribution of values for the execution of factor analysis [66]. Bartlett's test of sphericity determines if the correlation matrix is an identity matrix [67]. Finally, factor loadings of ±.30 to ±.40 are minimally acceptable; values greater than ±.50 are generally considered essential for practical significance.

According to [58], these guidelines are applicable when the sample size is 100 or larger and where the emphasis is on practical, not statistical significance. In addition, factor loading represents the correlation between an original variable and its factor. In determining a significance level for the interpretation of loadings, an approach similar to determining the statistical significance of correlation coefficients could be used. However, Hair and his colleagues emphasised that research has demonstrated that factor loadings have substantially larger standard errors than typical correlations. Thus, factor loadings should be evaluated at considerably stricter levels. For this reason, the researcher can employ the concept of statistical power to specify factor loadings considered significant for differing sample sizes [58]. Table IV lists the guidelines for sample sizes necessary for each factor loading value to be considered significant, according to [58].

Factor Loading	Sample Size Needed for Significance
0.30	350
0.35	250
0.40	200
0.45	150
0.50	120
0.55	100
0.60	85
0.65	70
0.70	60
0.75	50

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The guidelines should be used as a starting point in factor loading interpretation. The data set was appropriate to carry out this test because all the criteria recommended by [65] and [58] were met. The results of the KMO index and Bartlett's sphericity test as data factorability measurements were 0.810, as shown in Table V. The KMO results confirmed the adequacy of the sample and continuation to factor analysis. The statistically significant Bartlett's test results indicated continuing with the factor analysis as there was a relationship to investigate.

Table V. KMO and Bartlett's Test of EFA.

Tests	Results
Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy	0.810
Bartlett's test of sphericity	
Approximate Chi-square	689.11
df	171
Sig.	0.000

The factor loadings represent the correlation between the measured item and its intended factor. Table VI presents the results of factor loadings for all items.

Table VI. Factor Loadings.

No	Constructs and Items	Loadings
	Reminder	
R1	The PMCOM app sent me a reminder message whenever I did not use it after a month.	0.763
R2	The reminder message of PMCOM app helped me in monitoring my child's obesity status.	0.821
R3	The reminder message of PMCOM app did not disturb me.	0.812
	Reduction	
RE1	The PMCOM app provided simple steps to monitor my child's obesity status.	0.766
RE2	The PMCOM app made the tasks of monitoring my child obesity status easier.	0.764
RE3	The PMCOM app's ability in monitoring my child obesity status is worth more than overcoming the consequences of the obesity.	0.793
RE4	I took a shorter time to monitor my child's obesity status using the PMCOM app compare with the conventional approach.	0.771
RE5	The PMCOM app helped me to monitor my child's obesity status with less mental effort.	0.788
RE6	The PMCOM app did not interrupt my routine life, and I will continue to use it.	0.767
RE7	The PMCOM app is suited of the norm of society, thus I felt comfortable in using it.	0.767
	Historical information	
H1	The PMCOM app enabled me to track my child's obesity status anytime.	0.890
H2	The PMCOM app allowed me to track my child's obesity status at any specific date.	0.752
	Suggestion	
S1	Suggestion's information motivated me to monitor my child's status for fear of the impact of obesity in the future.	0.778
S2	Suggestions information motivated me in keeping my child from socially rejected by his/her peers.	0.783
S3	I accepted the PMCOM's suggestions on my child obesity status; therefore, I will encourage other parents to use it.	0.772
S4	I felt guilty whenever my child is obese or overweight; however, the suggestion's information helped me to handle the situation.	0.764
	Praise	
P1	Reading the PMCOM's praise messages encouraged me; therefore, I was happy to use it.	0.759
P2	I was pleased to see the PMCOM's praise messages because it did not disturb my parental feeling.	0.784
P3	The praise messages of the PMCOM app gave me hope to continuously monitor my child status.	0.865

The rule requires that the factor loading in this study must be greater than 0.70 [68] and [58], which has been accomplished for all items. Once the factor loading and eigenvalue were derived, the process was continued by rotating the data using the varimax method as shown in Table VII. Varimax rotation simplifies the factor structure and is used to ensure that all the correlations between variable items are presented in the same factor loadings [63] and [58]. The results as illustrated in Table VII show that all seven items in factor one was related to reduction, so it was labelled as the factor of reduction. Four items in factor two were related to suggestion, making this the factor of suggestion. Three items in factor three were related to praise, so it was labelled the factor of praise. Three items in factor four were related to the reminder, which was labelled the factor of reminder. Finally, three items in factor five were related to praise.

Table VII. Extraction rotated component matrix[a].

Items	Component				
	1	2	3	4	5
RE3	.793				
RE5	.788				
RE4	.771				
RE6	.767				
RE7	.767				
RE1	.766				
RE2	.764				
S2		.783			
S1		.778			
S3		.772			
S4		.764			
R2			.821		
R3			.812		
R1			.763		
P3				.865	
P2				.784	
P1				.759	
H1					.890
H2					.752

Reliability is an indicator of a measure's internal consistency measured in a number of ways. Internal consistency represents a measure's homogeneity or the extent to which each indicator of a concept converges on some common meaning [30]. More specifically, internal consistency is the degree to which the differences among the responses to one item are consistent with the differences among their responses to other items in the test [69]. One of the most popular approaches to assessing reliability is the internal consistency reliability coefficient using Cronbach's alpha [23]. Cronbach's alpha is also used to assess the internal consistency reliability of pilot test data [70]. The Cronbach's alpha value should be equal to or higher than 0.70, which indicates that internal consistency is acceptable [71] and [72]. Meanwhile, [17] accepted a value of Cronbach's Alpha to be equal to or higher than 0.60. [58] also suggested the minimum level of Cronbach's alpha as 0.6 to confirm that an instrument is valid and trustworthy.

A total of 19 items were used to measure all the five constructs of the questionnaire for this study. The distributions are shown in Table VIII.

Table VIII. Distribution of the Measurement Items with Their Construct.

Construct	Number of items
Reminder messages	3
Reduction	7
Historical information	2
Suggestion	4
Praise	3
Total	19

The results of the reliability test are shown in Table IX whereby all the constructs have high Cronbach's alpha values which indicates the internal consistency of the scale. All the constructs have Cronbach's alpha values of greater than 0.7 which means that all satisfy the recommended internal reliability criterion.

The analysis was continued to identify the items to be deleted and determine the Cronbach's Alpha value without the deleted items. In selecting the item, it was decided that the adjusted item-total correlation for each item of a scale should exceed 0.30, recommended as the standard for supporting item-internal consistency [72] and [73].

Table IX. Reliability Test.

Constructs	No. of Original Items	Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items
Reminder messages	3	0. 783	0. 783
Reduction	7	0.911	0.911
Historical information	2	0.812	0.813
Suggestion	4	0.836	0.844
Praise	3	0.796	0.807

The removal of a low discriminating item would result in a significantly higher Cronbach alpha value. Table x shows that the corrected item-total correlation values for all the items are greater than 0.3, which indicate that the items are discriminating well between high and low scores on the whole questionnaire. Moreover, the removal of a few low discriminating items would not increase the reliability in this questionnaire. In general, item analysis showed very good internal consistency for all 19 items. In sum, these results indicate that the questionnaire has acceptable internal consistency reliability and the items overall are functioning well.

Table X. Result of Cronbach's Alpha If Item Deleted.

Constructs and Items	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if item deleted
Reminder			
1. The PMCOM app sent me a reminder message whenever I did not use it after a month.	0.422	0.682	0.889
2. The reminder message of PMCOM app helped me in monitoring my child's obesity status.	0.371	0.565	0.891
3. The reminder message of PMCOM app did not disturb me.	0.345	0.549	0.892
Reduction			
1. The PMCOM app provided simple steps to monitor my child's obesity status.	0.727	0.754	0.879
2. The PMCOM app made the tasks of monitoring my child obesity status easier.	0.505	0.645	0.887
3. The PMCOM app's ability in monitoring my child obesity status is worth more than overcoming the consequences of the obesity.	0.683	0.725	0.881
4. I took a shorter time to monitor my child's obesity status using the PMCOM app compare with the conventional approach.	0.621	0.751	0.883
5. The PMCOM app helped me to monitor my child's obesity status with less mental effort.	0.624	0.741	0.885
6. The PMCOM app did not interrupt my routine life, and I will continue to use it.	0.625	0.639	0.883
7. The PMCOM app is suited of the norm of society, thus I felt comfortable in using it.	0.786	0.814	0.878
Historical information			
1. The PMCOM app enabled me to track my child's obesity status anytime.	0.415	0.681	0.889
2. The PMCOM app allowed me to track my child's obesity status at any specific date.	0.465	0.656	0.888
Suggestion			
1. Suggestion's information motivated me to monitor my child's status for fear of the impact of obesity in the future.	0.636	0.772	0.884
2. Suggestions information motivated me in keeping my child from socially rejected by his/her peers.	0.403	0.643	0.890
3. I accepted the PMCOM's suggestions on my child obesity status; therefore, I will encourage other parents to use it.	0.656	0.778	0.882
4. I felt guilty whenever my child is obese or overweight; however, the suggestion's information helped me to handle the situation.	0.306	0.621	0.893
Praise			
1. Reading the PMCOM's praise messages encouraged me; therefore, I was happy to use it.	0.324	0.504	0.893
2. I was pleased to see the PMCOM's praise messages because it did not disturb my parental feeling.	0.605	0.693	0.883
3. The praise messages of the PMCOM app gave me hope to continuously monitor my child status.	0.461	0.674	0.888

7. CONCLUSION AND FUTURE RESEARCH

Attempts have been made to integrate different kinds of persuasive features in the design process of mobile applications. So far, few researchers have attempted to measure the level of persuasion rather than the users' acceptance or attitude or satisfaction. This paper developed a valid and reliable instrument for measuring the persuasion perspectives of parents using the PMCOM App. It is intended to help researchers to construct and validate the questionnaire by explaining the fundamental procedures in a series of steps. Each step describes in detail on how to develop the items of measurement used to persuade parents to monitor their children's obesity. However, this study has some limitations. First, the five dimensions that are allocated to the three variables that include trigger, ability and motivation might be sufficient to monitor the children's obesity by the parents. Therefore, this instrument can only be generalised when integrating the same dimensions to a similar behavioural change system, and in a similar context to targeting different groups of users in other areas. But on the contrary, future studies can take this process steps to develop any questionnaires in various fields and contexts. Second, some parents are unwilling or irresponsible to monitor their children's obesity status for time limitations, work constraints or insufficient motivation or ability. Therefore, the number of respondents from urban areas was only 58 parents who have children aged 5-14 years. Consequently, this problem needs more intervention by the Ministry of Health Malaysia to provide a free tool to persuade and educate parents about the risk of childhood obesity. Third, the statistics of child obesity in Malaysia is still confidential and unavailable to be utilised in any study. Thus, it is difficult to conduct any study related to childhood obesity due to lack of data or record pertaining to this topic.

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