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A Process for Developing an Instrument to Measure the Persuasion Perspectives of Parents Using PMCOM App

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Abstract. The current study focused on the instrument designing to measuring the persuasion perspectives of parents using persuasive mobile child's obesity monitor (PMCOM) app. So far, there is no single agreement on how to measure the level of persuasion of users especially for behaviour change systems. Therefore, the majority of researchers attempt to measure the level of users' acceptance or attitude. In this context, the present paper is aimed to provide a general process of an instrument design to be persuasive and generalizable for a similar behaviour change system, and appropriate for a similar context to target different groups of parents in other areas. A review of literature analysis led to five dimensions located under three variables that include trigger, ability and motivation. These variables are used to establish the required behaviour when combined with mobile applications. Finally, the process of developing this questionnaire provides guidance and information on the construction and validation of the questionnaires for any future studies.

INTRODUCTION

Many developers have designed persuasive systems for changing behaviour in healthcare domain. However, there is no agreement on how to measure the level of persuasion of users using these systems [1], [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], [9] have partly dependent on persuasive features by combining them with other theories during the validation process. In short, researchers should focus on validating perspective of persuasion if they have integrated 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], [13]). This paper presents key question why most of the applications may fail to persuade the end user, 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 main related variables and items based on a proven theoretical analysis [14]. 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 impacts of persuasive systems on users in a persuasive way [2].

The present paper is to develop a persuasive instrument based on identifying 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 persuasive instruments in mobile healthcare domain. However, the study 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.

PROCESS STEPS FOR DEVELOPING THE INSTRUMENT

The first step of the questionnaire design process is delivering an initial draft of data collection. The questionnaire was designed based on the guidelines provided by [16], [17] 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 Bahasa Melayu and then translated back again to English using back-to-back translation technique. Then it was given to an expert to check the translation from Bahasa Melayu to English. This process is to ensure the respondents' ability to comprehend and respond to the questions appropriately. Table 1 illustrates the variables and the sources of the instrument design.

The next step is to use the content validity where expert opinion is the public and most widely accepted method [18] cited in [19]. According to [20], content validity is determined by expert judgment. [18] suggested that expert review is sufficient to determine that it has content validity. Three to ten experts are the minimum required for content validity [21], [22], [23], but others suggested at least two experts [24], [16]. The final choice of the expert reviewers was essentially based on their experience in the field and scientific qualifications [25], [16]. Generally, the experienced professionals must have enough knowledge pertaining to the research concept, theory, or problem that address the subject content of the instrument; or knowledge with instrument formatting techniques which impact the structural construction of the instrument [25], [26]. Given the importance of the expert review process, seven experts were involved in the validation process. Six experts have experience in persuasive technology, human-computer interaction and mobile development; and one has experience in statistics research and instrument development.

In step three, the experts not only examined the appropriateness of the items and the wording, but they also judged the structure of the instrument and its potential of representation of principles. The researcher has presented a bibliography and summary of previous studies used as a definition of the universe of content as recommended by [25], [24], [16]. Consequently, individually or as a group, the experts reviewed all the related materials and commented on the area of study such as the operational definitions, comprehensiveness of theory and adequacy of sampling from the content universe.

In step four, the experts have to ensure the followings; (i) link each item with its respective aims, (ii) assess each item with its relevance in representing the topic, (iii) the items of the instrument must adequately describe the content or behaviour in the domain of interest and (iv) write remarks for each item of the instrument. In the following step which is the fifth in the design process, the statistics expert has to ensure that the formatting of the instrument has been organised well. In this step, the statistic expert has also suggested the use of the seven-point numerical scale to indicate the participant's level of agreement or disagreement with the presented statement.

Step six is to make sure that all the items in the instrument are clear to the respondents. Two parents having children of age between 5-14 years participated as experts in the research problem topic. They assessed each item of the instrument based on the clarity of statement. In the seventh step, the researcher has to make decision in combining the experts' final responses after making the necessary adjustments. In step eight, all experts' suggestions were considered to improve and arrange the content of the items and format of the questionnaire as needed.

The ninth step is to produce the final draft of the questionnaire in order to continue the validation process of the instrument. In this step, it is necessary to solicit advice or assistance from another expert who has expertise in graphic design, particularly for a questionnaire that is to be administered electronically. In this process, the second step to the ninth is to consider the content validity procedures. However, the content validity differs from other validity testing in one significant 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 [27], [28]. For this reason, some theorists consider this insufficient to provide evidence for validation of the

instrument, although content validation does influence the inferences that can be drawn from a score [29] cited in [22]. To tackle this issue, two of the leading theoreticians in measurement theory, Cronbach and Meehl [30] introduced what is known as construct validity. Regrettably, some researchers rush through the process of validation with little appreciation for its enormous importance, only to find that their instrument does not work for construct validity or internal consistency reliability when the response data is obtained [24]. Therefore, the new or adjusted instrument need to be re-evaluated based on the reliability test, with more evidence supported by performing construct validity [29].

TABLE 1. 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.	[31], [32], [33], [34]
		The reminder message of PMCOM app helped me in monitoring my child's obesity status.	[32], [33], [35], [36], [37]
		The reminder message of PMCOM app did not disturb me.	[38], [35], [37]
Ability	Reduction	The PMCOM app provided simple steps to monitor my child's obesity status.	[32], [34]
		The PMCOM app made the tasks of monitoring my child obesity status easier.	([32], [34]
		The PMCOM app's ability in monitoring my child's obesity status is worth more than overcoming the consequences of the obesity.	[39], [33]
		I took a shorter time to monitor my child's obesity status using the PMCOM app compared with the conventional approach.	[39], [33]
		The PMCOM app helped me to monitor my child's obesity status with less mental effort.	[40], [33]
		The PMCOM app did not interrupt my routine life, and I will continue to use it.	[33]
		The PMCOM app is suited to the norm of society, thus I felt comfortable in using it.	[33], [34]
	Historical Information	The PMCOM app enabled me to track my child's obesity status at any time.	[41], ([32], [33], [34]
		The PMCOM app allowed me to track my child's obesity status at any specific date.	[41], ([32], [33], [34]
Motivation	Suggestion	Suggested information motivated me to monitor my child's status for fear of the impact of obesity in the future.	[32], [33]
		Suggested information motivated me in keeping my child from being socially rejected by his/her peers.	[33]
		I accepted the PMCOM's suggestions on my child's obesity status; therefore I will encourage other parents to use it.	[33]
		I feel guilty whenever my child is obese or overweight; however, the suggestions helped me to handle the situation.	[33]
	Praise	Reading the PMCOM's praise messages encouraged me; therefore I was happy to use it.	[32], [33]
		I was pleased to see the PMCOM's praise messages because it did not disturb my parental feeling.	[32]
		The praise messages of the PMCOM app gave me hope to continuously monitor my child's status.	[33]

Construct validity is described as the "evidence to determine that the presumed construct is what is being measured" [20], [42], [16]. It verifies whether the instrument tapped the concept as theorised [43], and refers to the degree to which the construct measures what it is supposed to measure [44]. Investigators evaluate construct validity when specific criteria defines the concept; they verify whether key constructs were included using content validity assessments made by experts in the field or using statistical methods such as factor analysis [16].

In this regard, step ten of this process is to conduct a pilot study. It is carried out with a small sample of individuals who are similar to those for whom the instrument is designed. This trial version is tested by performing a construct validity and reliability test to discover any limitations on the fundamental study [45], [46], [47], [16]. In addition to that, to ensure that the words and phrases of the questionnaire are clear and straightforward to the parents, that had already been carried out in the sixth step.

In summary, this process provided adequate evidence of the instrument's validity. The process steps taken for developing the instrument are illustrated in Figure 1.
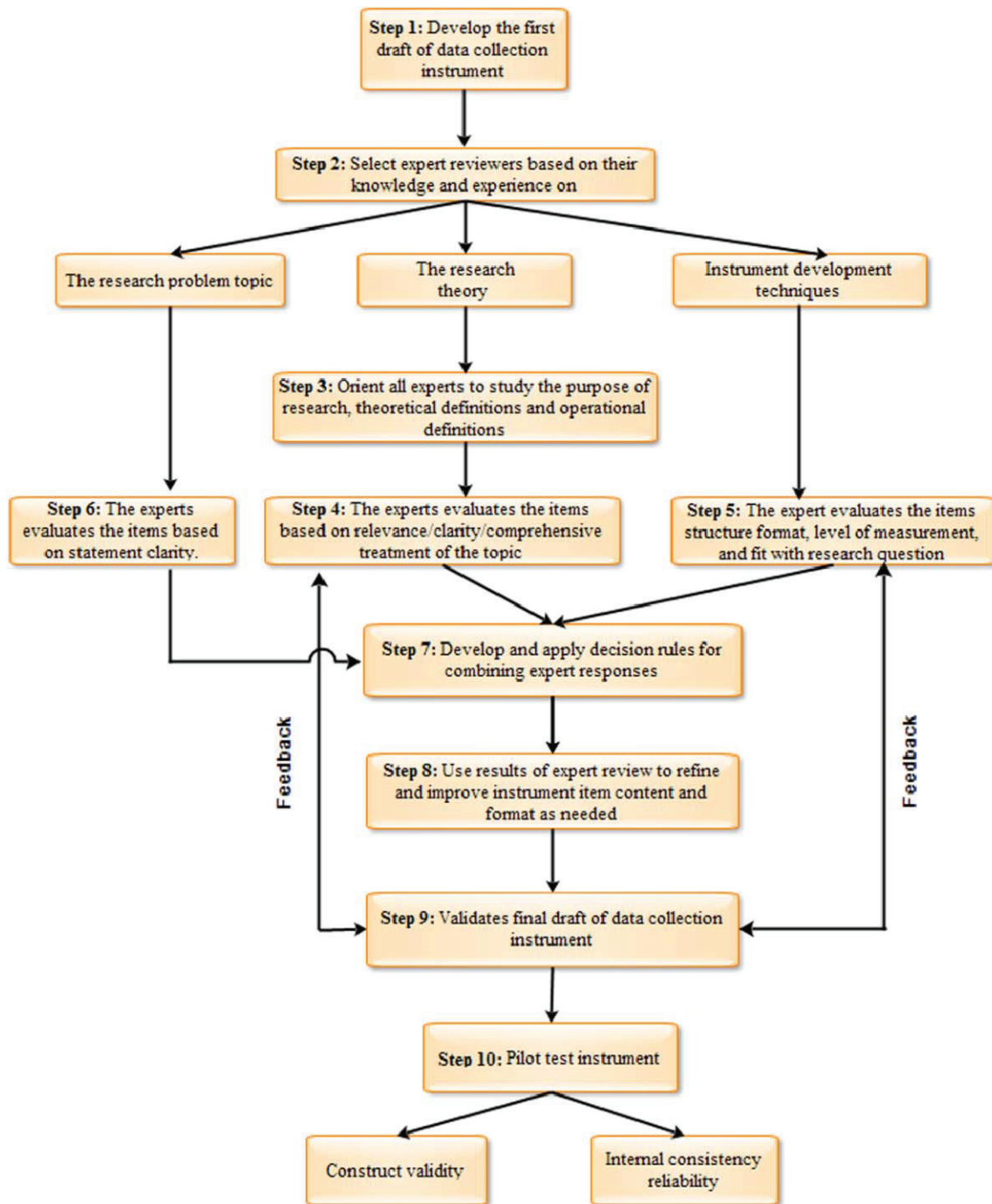

FIGURE 1. The process steps for developing the instrument

CONCLUSION AND FUTURE WORK

In conclusion, this paper explains the fundamental procedure to construct and validate a set of questionnaire through series of steps. This process starts with the construction of the first draft of the data collection instrument and ending with the trial testing of this instrument. This paper described the process steps in detail to develop the measurement elements that will be used to persuade parents to monitor their children's obesity. Hopefully, future studies will follow this work to investigate the level of persuasion for a similar behaviour change system and to a similar context to target different groups of parents in other areas. The ultimate aim of developing this instrument is to validate the PMCOM application by measuring the persuasion perspectives of parents on using this application. For future work, the principal component method will be used for factor analysis and Cronbach's coefficient alpha for the reliability analysis for validation of the developed measurement items among parents.

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