

Usability Metric for Mobile Application: A Goal Question Metric (GQM) Approach

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ABSTRACT

Many usability guidelines have been created in numerous areas and mobile devices application is included as well. However, there is not much published works in relation to the usability guidelines that comes up together with metric. Although a number of measurement models (e.g. The Metric for Usability Standard in Computing [MUSiC]) have been produced for evaluating usability, they are not focusing on mobile application. This paper will make an attempt to review the existing measurement models and will further explain the development of usability metric using GQM approach. Further research will firstly develop a set of usability guidelines for mobile application which will be used to develop a metric for usability measurement.

Categories and Subject Descriptors

H5.2 [Information Interfaces and Presentation]: User Interface – Standardization; Benchmarking; Evaluation/Methodology.

General Terms

Measurement.

Keywords

Usability Guidelines, Mobile Application, Goal Question Metric (GQM).

1. INTRODUCTION

Usability is commonly comprehended as a qualitative attribute that assesses quality-in-use or how easy application are to use [9] and [8].

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Usability consultant, Nielsen [15] defined usability in terms of five quality components: learnability, efficiency, memorability, errors and satisfaction. All the quality components will be more practical if they are well-equipped with the metric to measure the usability. Usability guidelines require a measurement mechanism to be used to monitor, understand and improve software processes as well as mobile application [12].

In these days, mobile users are increasingly becoming reliant on their mobile phones as their primary communication medium, and will nearly always carry their handsets with them. This growing dependence on the mobile device is gradually positioning it as the key repository for other core services. These include the news, travel, weather, sports updates that are becoming essentials and 'must-have' for many users [14]. The increasing number of mobile users significantly implies the importance of assuring that the application is useable by means of usability evaluation method.

One of the popular measurement approaches is Goal Question Metric (GQM). The GQM approach that was developed by Basili and Weiss, becomes a de facto standard for the definition of measurement frameworks [19]. The approach is success for the reason that it is adaptable to many different organizations and environments, as confirmed by a large number of companies that have employed it (e.g. Philips, Siemens, NASA) [7]. The main interest for measurement activities in GQM is a software project other than that GQM also provides a practical approach for bounding any measurement problem [4] and [18]. Hence, GQM approach could also be extended as well to measure the usability guidelines by providing metric for guidelines.

A study on the challenges and issues of mobile application by Zhang & Adipat [21] lists nine usability attributes and measuring variables as a part of their studies. All the generic attributes were collected and compiled from existing usability studies but they were not validated. This has raised an interesting and even more challenging research question on how the usability of mobile applications can be effectively evaluated.

Moreover, there are a few studies on how to measure usability as well as constructing measurement metrics [10] and [6]. This supports by Kasper & Effie [12] suggesting that not many researches on usability measurement and means to select the measurement model. This creates an additional interesting research question that should be considered in this study: How to develop a metric for usability in mobile application?

This study aims to answer those questions and looking forward to develop usability guidelines for mobile application, thus producing a measurement metric based on GQM approach for each usability guidelines. The third objective of this study is to validate the metrics by means of several usability evaluation methods. The anticipated result will be the new validated model of usability guidelines for mobile application, a model which bundles together with measurement metric.

In the next section, a review of several usability guidelines will be presented prior to the description of the measurement model and highlight the limitation and complementarities of the various models. In session 3, we offer a description of some approaches exploited by previous research on developing usability guidelines before explaining the approach used in this study.

2. RELATED WORKS

ISO (International Standard Organization) standard is the most referral guideline as it is well packaged with measurement framework [10]. Nielsen and Shneiderman are among the committee members in the development of ISO guidelines; yet they produce their own guidelines as well.

However, only the guideline from ISO comes up with the measurement metric. The guidelines from Nielsen and Shneiderman can be divided into three guidelines according to ISO as summarized in Table 2.1. Since the metric is generic, it could be applied to mobile application with a few additional metrics to comply with the limitation of mobile devices.

Table 2.1 Usability Guidelines by ISO, Nielsen and Shneiderman

ISO 9241-11	Nielsen	Shneiderman
Effectiveness	<ul style="list-style-type: none"> Consistency and standards Error prevention 	<ul style="list-style-type: none"> Strive for consistency
Efficiency	<ul style="list-style-type: none"> Flexibility and efficiency of use Aesthetic and minimalist design Help users recognize, diagnose, and recover from errors 	<ul style="list-style-type: none"> Design dialog to yield closure Offer simple error handling Reduce short-term memory load
Satisfaction	<ul style="list-style-type: none"> User control and freedom Visibility of system status Match between system and the real world Recognition rather than recall Help and documentation 	<ul style="list-style-type: none"> Offer informative feedback Enable frequent users to use shortcuts Permit easy reversal of actions Support internal locus of control

Apart from the guidelines for software system by ISO, Nielsen and Shneiderman, there are several other guidelines developed for

mobile environment but unfortunately, all the proposed guidelines did not come up with the metric to measure usability. All these guidelines were developed for the application in numerous areas as described in Table 2.2 below:

Table 2.2: Guidelines for Mobile Environment

Areas	The guidelines
Mobile devices	<ul style="list-style-type: none"> By Jun et al., [11] By Alfredo et al., [2] By Nokia [16]
Mobile WEB/WAP application	<ul style="list-style-type: none"> By Webcredible [20] By Openwave [17]
m-Learning	<ul style="list-style-type: none"> By Daniel [6]
m-Commerce	<ul style="list-style-type: none"> By Susy et al., [5]

2.1 Usability Guidelines Development

In these days, several methods are employed to develop usability guidelines for mobile application. Most of the guidelines were created by conducting usability testing and evaluating feedbacks from user [2], [20], [16] and [17]. Other researchers have produced guidelines based on the literatures on usability theoretical framework, constraint and unique properties that are intrinsic to mobile computing [11], [21] and [6]. On the other hand, Susy et al., [5] create usability guideline for m-commerce using cognitive walkthrough and heuristic evaluation methods to evaluate the usability of ten wireless sites in three platforms. The use of both methods by them has made possible the identification of usability issues encountered by novice and experienced users while focusing on specific user tasks and design guidelines as well.

2.2 Measurement model

There are a number of models for usability measurement; for instance, Quality in Use Integrated Measurement (QUIM) developed by Ahmed et al. [1]. QUIM is a consolidated model for usability measurement and metric; and also appropriate for user who have no or little knowledge of usability. The model consists of 10 factors which are subdivided into 26 criteria. For the measurement of the criteria, the model provides 127 metrics. The model is basically used to measure the actual use of working software and identifying the problem. The model is not optimal yet and needs to be validated.

Among other models and methods that are previously developed includes the Metrics for Usability Standards in Computing (MUSiC), the Software Usability Measurement Inventory (SUMI), the Skill Acquisition Network (SANE), the semi-Automated Interface Designer and Evaluator (AIDE), and the Diagnostic Recorder for Usability Measurement (DRUM). All the models and methods which aim to evaluate usability still have some limitations. For instance, they are not intended for developers who are not familiar with the field of HCI and they are difficult to apply [1].

2.3 Review of GQM Approach

To the best of our knowledge, there is no published work on using GQM approach to develop metric for usability. Therefore, it is crucially essential to explore and apply GQM approach to create metric for usability particularly for mobile application. The GQM paradigm is evidenced to be practical in deciding what to

measure, and choosing the most important goals or the most usability guidelines to measure. Basically, the approach defines the goal first, then refines the goal into questions, and finally defines the metric that should provide information to answer the questions [19]. GQM that is a generic model could be used in many areas of measurement such as purpose, object, issues, viewpoint and others [3].

3. SELECTION ON METHOD

3.1 Usability Guidelines Development

In this study, we will initially produce the usability guidelines based on the collected works from literature. The four steps involved in this stage are described in Figure 3.1. and are adopted from Leavitt & Shneiderman [13]. The initial set of guidelines will be drawn from existing usability guidelines, published research articles and research summaries. Three generic usability guidelines will be selected (ISO, Nielson and Shneiderman) and the rest will be the guidelines from mobile usability. During the second step, a review process will be conducted to:

- Identify and combine duplicate guidelines.
- Identify and resolve guidelines that conflicted with each other.
- Reword unclear guidelines.
- Select the guidelines that comply with mobile devices only.

In determining the “importance and appropriateness”, each guideline will be marked whether as “good”, “appropriate” or “not appropriate”. The marking process is based on the question: ‘How important is this guideline to the success of a mobile application?’ Those guidelines that are rated as having little importance to the success of a mobile application will be eliminated. Finally, a group of usability researchers, practitioners and authors will be recruited to generate a ‘Strength of Evidence’ rating for each guideline. The expected result will not be more than ten usability guidelines for mobile application.

3.2 Metric Development

In this section, the creation of the metric for mobile usability guidelines using GQM approach will be discussed. According to Basili et al. [3], GQM model is a hierarchy structure starting with a goal as described in Figure 3.2. The goal will be refined into numerous questions before creating metrics for each question. Our aim is to generate a complete set of metrics that assist in improving usability guidelines. In this paper, we also demonstrate an example of usability metric using GQM approach as shown below:

G1: Efficiency

Q1: Once users have learned the design, how quickly can they perform tasks?

M1: Task completion time

M2: Duration used to finish given exercises

M3: The duration spent on each screen



Figure 3.1: Four Steps to Create Usability Guidelines

The first draft of the model will be validated with two test cases by implementing usability test on mobile application. The validation process will be iterated until satisfaction is achieved towards the model. We have decided to select Geography Positioning System (GPS) and Games as test cases since they are currently very popular applications.

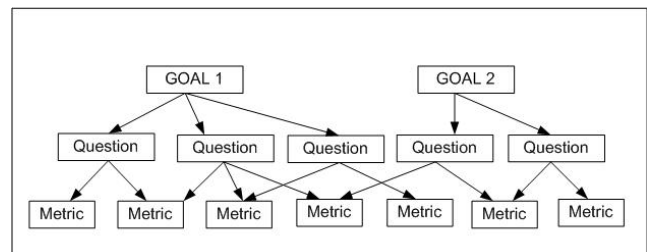


Figure 3.2: A GQM Model (adopted from [3])

4. CONCLUSION

In this study, we attempt to propose the development of a set of metrics using GQM approach to measure the usability of mobile application. Four-step method that is proposed by Leavitt & Shneiderman [13] will be employed to shortlist the usability guidelines followed by generating the metrics for each guideline using GQM approach. The anticipated result is hopefully to be a set of usability guidelines bundled with the metric to assist developer in designing the mobile application.

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