MEASURING THE USABILITY OF SOFTWARE APPLICATIONS – METRICS FOR ACHIEVENESS

Amalina Farhi Ahmad Fadzlah, ¹Aziz Deraman
Department of Computer System and Computer Network, Faculty of Information Technology
Universiti Utara Malaysia, 06010 UUM Sintok, Malaysia
e-mail: syamirdza@yahoo.com

¹Department of Computer Science, Faculty of Technology and Information Science
Universiti Kebangsaan Malaysia, 46300 UKM Bangi, Malaysia
e-mail: ad@ftsm.ukm.my

ABSTRACT

In general, the concept of usability can not be measured but it is related to several usability metrics that can be measured. Focusing on the effectiveness factor, this present paper aims to formulate the achieveness metrics and furthermore giving an overview on how to measure the achieveness of the product. The model for measuring the usability has been developed in terms to determine the elements in measuring the achieveness of the software. As adopted from the model, three attributes in measuring the achieveness of the software: Individual Understanding, Recall Ability and Perceived Adequacy were claimed to be associated with measuring the Achieveness of the software applications. These attributes and the metrics used in measuring the achieveness as well as the formula for measuring the achieveness of the software applications are also discussed.

INTRODUCTION

Research on usability has sought to become a central concern to the design and selection of technology (Bevan et al. 1991; Nielsen 1993; Morris and Dillon 1996). It is claimed that usability is a key component of human and computer interaction as well as to the overall product quality (Porteous et al. 1993; Preece et al. 1994). The lack of attention to the aspect of usability could impact less system performance (Hornby et al. 1992). Usability is frequently described as a technology's capability to be used comfortably, easily, enjoyably, safety and quickly (Booth 1989; Lindgaard 1989; Ravden and Johnson 1989; Shackel 1991; Chapanis 1991; Sweeney et al. 1993; Preece 1993; Dumas and Redish 1993). More convincing, usability is defined as the “… extent to which a product can be used by specified users to achieve specified goals with effectiveness: the extent to which the intended goals of use are achieved, efficiency: the resources that have to be expended to achieve the intended goals and satisfaction: the extent to which the user finds the use of the product acceptable, in a specified context of use” (ISO 9241-11 1998).

Many of the literatures previously reviewed discussed on various definitions of usability. Some of the literatures decomposed it in terms of how to measure usability (Nielsen and Levy 1994; ISO 9241-11 1998; Frøkjær et al. 2000; Hornbæk 2006). And none stated the intention in developing a metric for measuring usability. On this background, this present paper aim to formulate the usability metrics and furthermore giving an overview on how to measure usability. As broadly accepted and previously mentioned, usability consisted of three distinct aspects. However, the discussion on how to measure usability in this paper only covered the aspect of effectiveness. One of the criteria of effectiveness is determine as the achieveness of the product with which users achieve specified goal. Thus, in order to measure the achieveness of the software product, indicators of error rates were included. The attributes of error rates as well as metrics used to formulate effectiveness is as presented in the next section, Section 2 Achieveness Model. The remainder of this paper is organized as follows. Section 3, Achieveness Metrics discussed the core unit of this paper aiming at on developing a formula for measuring the achieveness of the software product. Finally, the works in this paper will be summarized and concluded as drawn in Section 4, Conclusions.
ACHIEVENESS MODEL
A work on determining the elements for measuring the usability of the software product has been conducted (Fadzlah and Deraman 2006). By focusing on the effectiveness and achieveness as a factor and criterion respectively, three usability attributes and ten usability metrics were identified. These elements were further used to develop a model for measuring the achieveness of the software product (see Figure 1 below).

As shown in Figure 1 above, usability attributes of Individual Understanding, Recall Ability and Knowledge Acquisition associated with measuring the Achieveness of the software applications. The usability metrics that contributed to measure the Individual Understanding of the software are Items Correctly Answered, Items Correctly Exampled and Items Correctly Questioned. Each items measured for this attribute interconnected with measuring the ability of users to give answer, example and question accurately. The usability metrics that contributed to measure the Recall Ability of the software are Items Correctly Memorized, Items Correctly Recalled and Items Correctly Recognized. Each items measured for this attribute interconnected with measuring the ability of users to memorize, recall and recognized items accurately. The usability metrics that contributed to measure the Knowledge Acquisition of the software are Items Correctly Explained, Items Correctly Integrated, Items Correctly Interpreted and Items Correctly Solved. Each items measured for this attribute interconnected with measuring the ability of users to explain, integrate, interpret and solve items accurately. The usability metrics that contributed to measure the achieveness of the software applications is as listed in Figure 2 below.
Each of the ten usability metrics \( (M_m) \) were coded based on its corresponded usability attributes \( (A_a) \), usability criteria \( (C_c) \) and usability factors \( (F_f) \). In order to simply develop a formula for measuring the level of usability of the software applications, these metrics were represented by \( F_f \cdot C_c \cdot A_a \cdot M_m \) as the \( m \)th metrics for \( a \)th attribute, \( c \)th criteria and \( f \)th factor. However, in this paper, the factor and criterion for the metrics were remained same as these metrics related to measure the accurateness and achieveness of the software.

### ACHIEVENESS METRICS

As previously discussed, the model for measuring the usability described that Individual Understanding, Recall Ability and Knowledge Acquisition associated with measuring the Achieveness of the software applications. Individual Understanding associated with items correctly answered, items correctly exampled and items correctly questioned. In the other hand, Recall Ability associated with items correctly memorized, items correctly recalled and items correctly recognized. Knowledge Acquisition, in turn associated with items correctly explained, items correctly integrated, items correctly interpreted and items correctly solved. The metrics used in measuring the elements of accurateness and the formula for measuring the accurateness of the software applications is as discussed below.

**Individual Understanding**

Individual Understanding associated with averaging the value of metrics Items Correctly Answered, Items Correctly Exampled and Items Correctly Questioned. Items Correctly Answered, coded as \( F_1 \cdot C_3 \cdot A_1 \cdot M_1 \) can be measured by dividing the number of items correctly answered with the total number of items answered or by subtracting the number of items answered with the number of items incorrectly answered and dividing it with the total number of items answered. Items Correctly Explained, coded as \( F_1 \cdot C_3 \cdot A_1 \cdot M_2 \) can be measured by dividing the number of items correctly explained with the total number of items explained or subtracting the number of items explained with the number of items incorrectly explained and dividing it with the total number of items explained. Items Correctly Questioned, coded as \( F_1 \cdot C_3 \cdot A_1 \cdot M_3 \) can be measured by dividing the number of items correctly questioned with the total number of items questioned or subtracting the number of items questioned with the number of items incorrectly questioned and dividing it with the total number of items questioned. Thus, Individual Understanding (IU) can be computed as:

\[
IU = \text{AVG} \left[ F_1 \cdot C_3 \cdot A_1 \cdot M_1 + F_1 \cdot C_3 \cdot A_1 \cdot M_2 + F_1 \cdot C_3 \cdot A_1 \cdot M_3 \right]
\]
and can be summarized as,
\[ \text{IU} = \text{AVG} \sum_{x=1}^{x=3} F_1 \cdot C_3 \cdot A_1 \cdot M_x \]  
(1)
in which high value of IU indicates high usability level of the software applications.

**Recall Ability**

Recall Ability associated with averaging the value of metrics Items Correctly Memorized, Items Correctly Recalled and Items Correctly Recognized. Items Correctly Memorized, coded as \( F_1 \cdot C_3 \cdot A_2 \cdot M_1 \) can be measured by dividing the number of items correctly memorized with the total number of items memorized or subtracting the number of items memorized with the number of items incorrectly memorized and dividing it with the total number of items memorized. Items Correctly Recalled, coded as \( F_1 \cdot C_3 \cdot A_2 \cdot M_2 \) can be measured by dividing the number of items correctly recalled with the total number of items recalled or subtracting the number of items recalled with the number of items incorrectly recalled and dividing it with the total number of items recalled. Items Correctly Recognized, coded as \( F_1 \cdot C_3 \cdot A_2 \cdot M_3 \) can be measured by dividing the number of items correctly recognized with the total number of items recognized or subtracting the number of items recognized with the number of items incorrectly recognized and dividing it with the total number of items recognized. Thus, Recall Ability (RA) can be computed as:

\[ \text{RA} = \text{AVG} \sum_{x=1}^{x=3} F_1 \cdot C_3 \cdot A_2 \cdot M_x \]  
(2)
in which high value of RA indicates high usability level of the software applications.

**Knowledge Acquisition**

Knowledge Acquisition associated with averaging the value of metrics Items Correctly Explained, Items Correctly Integrated, Items Correctly Interpreted and Items Correctly Solved. Items Correctly Explained, coded as \( F_1 \cdot C_3 \cdot A_3 \cdot M_1 \) can be measured by dividing the number of items correctly explained with the total number of items explained or subtracting the number of items explained with the number of items incorrectly explained and dividing it with the total number of items explained. Items Correctly Integrated, coded as \( F_1 \cdot C_3 \cdot A_3 \cdot M_2 \) can be measured by dividing the number of items correctly integrated with the total number of items integrated or subtracting the number of items integrated with the number of items incorrectly integrated and dividing it with the total number of items integrated. Items Correctly Interpreted, coded as \( F_1 \cdot C_3 \cdot A_3 \cdot M_3 \) can be measured by dividing the number of items correctly interpreted with the total number of items interpreted or subtracting the number of items interpreted with the number of items incorrectly interpreted and dividing it with the total number of items interpreted. Items Correctly Solved, coded as \( F_1 \cdot C_3 \cdot A_3 \cdot M_4 \) can be measured by dividing the number of items correctly solved with the total number of items solved or subtracting the number of items solved with the number of items incorrectly solved and dividing it with the total number of items solved. Thus, Knowledge Acquisition (KA) can be computed as:

\[ \text{KA} = \text{AVG} \sum_{x=1}^{x=4} F_1 \cdot C_3 \cdot A_3 \cdot M_x \]  
(3)
in which high value of KA indicates high usability level of the software applications.
As mentioned before, Achieveness associated with averaging the value of metrics Individual Understanding (IU), Recall Ability (RA) and Knowledge Acquisition (KA). Thus, Achieveness (ACH) can be computed as:

\[
ACH = \left\{ \frac{\text{AVG} \sum_{x=1}^{3} F_1 \cdot C_3 \cdot A_x \cdot M_x}{x = 3} \right\} + \left\{ \frac{\text{AVG} \sum_{x=1}^{3} F_1 \cdot C_3 \cdot A_x \cdot M_x}{x = 1} \right\}
\]

\[
ACH = \left\{ \frac{\text{AVG} \sum_{x=1}^{4} F_1 \cdot C_3 \cdot A_x \cdot M_x}{x = 1} \right\}
\]

and can be summarized as,

\[
ACH = \text{AVG} \sum_{x=1}^{3} F_1 \cdot C_3 \cdot A_x \cdot M_x \ldots
\]

in which high value of ACH indicates high usability level of the software applications.

CONCLUSIONS

Elements for measuring the achieveness of the software applications have been identified and a model for measuring the achieveness of the software product has been developed. Based on the model, achieveness criterion is divided into three attributes in which each of these attributes was then measured by ten metrics that corresponded to it. Further, these elements were then used to develop a formula for measuring the level of achieveness of the software product. As for a conclusion, these formulas provide further direction towards measuring the overall effectiveness of the product specifically for software applications.

REFERENCES


