
Designing Usability Assessment to Improve User's Acceptability on Quality of Life Technology (QoLT) for Individuals with Disability

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Abstract Usability assessment has been installed into a wide range of software that focuses on assessing product usage from the user's perspective. Usability assessment of the quality of life technology for individuals with disability is being discussed and tentatively designed which is also expanded to the products for non-disabled people with minor adjustment of the usability assessment protocol. Designing an appropriate usability assessment protocol by referencing the currently available international standards on software usability tests with number of modifications to produce valuable feedbacks is under evaluation process regarding product usability enhancement. The feasibility study on usability assessment protocol into quality of life technologies is presented with discussions on further research.

Keywords: *Quality of Life Technology (QoLT), Usability Assessment, User Experience, Uer Interface*

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1. Introduction

The definition of usability is extent to which a product can be used by specified users to achieve modified goals with effectiveness, productivity, satisfaction, and safety in a specified context of use [1]. Here, the meaning of effectiveness stands for accuracy and completeness with which users achieve specified goals, and the meaning of productivity is resources expended in relation to the accuracy and completeness with which users achieve goals. The meaning of safety stands for safe and secure in use of the product and in terms of preventing secondary complication after use of the product. The meaning of 'context of use' is for users, tasks, equipment including hardware, software and materials, and physical and social environments in which a product is used. However, the meaning of satisfaction includes, but not limited, satisfaction scale, questionnaire, and discretionary usage.

At present, the usability assessment is adopted in the overall process of software development from its life cycle, development, product, and product being used in real world [2, 3, 4, 5, 6]. But most of the usability assessment is being implemented for the software products. When it comes to applying the usability assessment to the process of developing products for the individuals with disability, number of considerations and adjustments is required to fit into the environment for the prospective users. We collect related international standards on usability assessment to review the specifications of the usability assessment protocol and restructure its specifications to adopt the usability assessment process for the individuals with disability.

The considerations and adjustments as well as correlated design modification of the usability assessment protocol suitable for the products for the individuals with disability are discussed in this paper with further research discussions.

2. Issues on Usability Assessment

Growing interests and discussions on usability assessment of quality of life technology for individuals with disability lead research scientists to find scientific and objective methods of assessing usability of QoLT being developed in South Korea [7]. The ultimate goals of the usability assessment are to deliver assessment feedback to research teams regarding inconsistency in user needs from the prototype functions, and establish an evidence-based approach that will provide

research teams with a relevant threshold data of cost-benefit estimation as well as user's limitation and disability.

The research and development teams of the quality of life technology project in South Korea realize that there is a large and growing gap between the prototype features and user acceptance due to user's limitation and disability. Three influencing factors have been identified as the gap: 1) inconsistency in deploying concept of accessibility into development process for the prospective users, i.e., individuals with disability, 2) mismatches between user needs and prototype features, and 3) lack of evidence-based data as feedbacks for the prototype to reduce the gap. We regard usability assessment as one of available methods of resolving these three influencing factors.

3. ISO Referred Usability Assessment

3.1 Modified ISO Usability Framework

In order to specify or measure usability it is necessary to identify the goals and to decompose effectiveness, productivity, satisfaction, and safety as well as the components of the context of use into sub-components with measurable and verifiable attributes. The components and the relationships between them are illustrated in Figure 1 which is modified from the ISO usability assessment [8, 9, 10, 11, 12, 13].

When specifying or measuring usability, the following information is needed:

- a description of the intended goals;
- a description of the components of the context of use including users, tasks, equipment, and environments. This may be a description of an existing context, or a specification of intended contexts. The relevant aspects of the context and the level of detail required will depend on the scope of the issues being addressed. The description of the context needs to be sufficiently detailed so that those aspects of the context that may have a significant influence on usability could be reproduced; and
- target or actual values of effectiveness, productivity, satisfaction, and safety for the intended contexts.

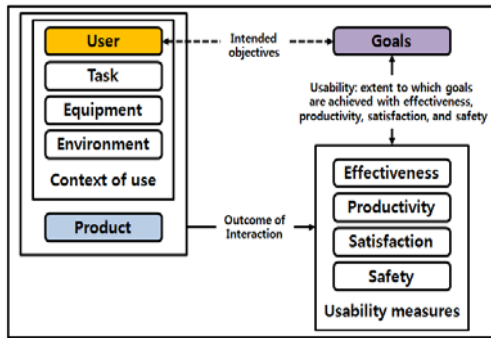


Figure 1. Usability Framework

3.2 Description of goals

The goals of use of a product should be described. Goals may be decomposed into sub-goals which specify components of an overall goal and the criteria which would satisfy that goal. For example, a telephone sales clerk might have the goal to “Maintain customer orders”. This overall goal might then be decomposed into sub-goals such as:

- “Make accurate record of all orders placed by customers”;
- “Provide information rapidly in response to customer inquiries about orders placed”.

The level at which the overall goal is set is a function of the boundary of the work system which is under consideration and which provides the context of use. In the example above, the work system under consideration consists of clerks taking telephone orders.

3.3 Context of use

Relevant characteristics of the users need to be described. These can include knowledge, skill, experience, education, training, physical attributes, and motor and sensory capabilities. It may be necessary to define the characteristics of different types of user, for example users having different levels of experience or performing different roles.

3.4 Choice of measures

It is generally necessary to provide at least one measure for each of effectiveness, efficiency and satisfaction.

Because the relative importance of components of usability depends on the context of use and the purposes for which usability is being described, there is no general rule for how

measures should be chosen or combined.

The choice of measures and the level of detail of each measure are dependent on the objectives of the parties involved in the measurement. The relative importance of each measure to the goals should be considered. For example where usage is infrequent, high importance may be given to measures of learning and re-learning.

If it is not possible to obtain objective measures of effectiveness and efficiency, subjective measures based on the user’s perception can provide an indication of effectiveness and efficiency.

Satisfaction measures the extent to which users are free from discomfort, and their attitudes towards the use of the product. Satisfaction can be specified and measured by subjective rating on scales such as discomfort experienced, liking for the product, satisfaction with product use, or acceptability of the workload when carrying out different tasks, or the extent to which particular usability objectives (such as efficiency or learnability) have been met. Other measures of satisfaction might include the number of positive and negative comments recorded during use. Additional data can be obtained from longer-term measures such as rate of absenteeism, video observation of overloading or underloading of the user’s cognitive or physical workload, or from health problem reports, or the frequency with which users request transfer to another job.

4. Design of Usability Assessment for Quality of Life Technology

4.1 Considerations

With the ISO usability assessment protocol suites, we search the appropriate approach to adjust current usability assessment for the overall process, especially for the prototype phase of the project, of quality of life technology. Number of considerations to restructure the usability assessment protocol suites is discussed as follows:

- Current features of the ISO usability assessment protocols are required to adopt the prospective user’s capabilities due to their disability and residual functions.
- A certain specified process that should reflect the limitations of the prospective user’s capabilities in the development process along with the ISO usability assessment protocols.
- Additional process of collecting feedbacks and comments

on the prototype being assessed from the individuals with disability, *i.e.*, the prospective user is required.

- Additional process of verifying product's quality of usability, which includes matching the user needs with the outcomes of prototype assessment, is also required.
- Additional features of risk management including prevention of secondary complications and prevention of getting injured due to the use of product are required as a safety assessment of the prototype.
- As the usability assessment is new to the rehabilitation and quality of life technology communities, a reference model of the usability assessment will be helpful in designing the usability assessment protocol.
- As the ultimate goal of the usability assessment is to apply the protocol suites to each process of product life cycle as shown in Figure 2, the modified usability assessment protocol will be applied to the phase of effect of the product as a tentative approach of applying the protocol to the individuals with disability [1, 2].



Figure 2. ISO Software usability testing protocol suites

4.2 Design

At present, we tentatively design a reference model of usability assessment protocol consists of number of unit protocols. The protocol suite of the usability assessment for quality of life technology is for effect of product phase, not for overall status in Figure 2.

The framework of the newly designed usability assessment reference model is shown in Figure 3 which consists of three unit protocols: preliminary survey, assessment, and interpretation protocols.

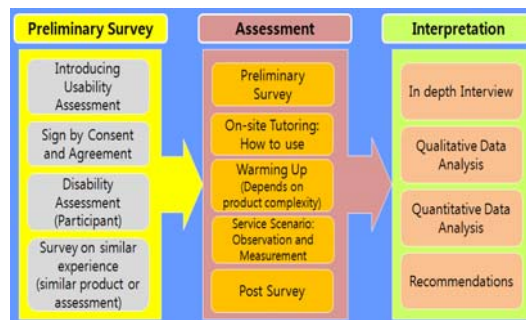


Figure 3. Reference Model of Usability Assessment for Quality of Life Technology

4.3 Preliminary Survey Sub-protocol

This sub-protocol is for preparing the usability assessment of a certain quality of life technology product, which consists of an IRB approval including interactions with participants, *i.e.*, subjects, regarding explanation of reason and method of the usability assessment followed by acquiring signature on the consent form. This step also includes disability assessment of the subject and survey on similar experience, which will affect the usability assessment. For instance, in case of usability assessment on mobile computing, we need to ask the subject if he or she has experience of using similar devices for a certain amount of time. We also need to ask the subject of joining similar usability assessment sessions prior to this participation.

4.4 Assessment Sub-protocol

This sub-protocol consists of number of surveys, on-site instruction of product usage, and product usage sessions. The preliminary survey consists of four usability measures to connect these outcomes to the outcomes of the post survey with the same four usability measures, *i.e.*, effectiveness, productivity, safety, and satisfaction, from the subject's perspective. We also recommend time and user behavior surveillance and measurements in the process of service scenario of using the product.

4.5 Interpretation Sub-protocol

This sub-protocol is to analyze collected data and find recommendations of a certain quality of life technology product, from outcomes of in depth interview, quantitative data analysis, and qualitative data analysis of video recording of a number of tasks by the subject. The in depth interview is collection of subject's comments and opinions those are in the

form of open questions. The observation and video recording data are for acquiring evidence-based data on product of quality in use from the subject perspective that consist of effectiveness, productivity, safety, and satisfaction of the product. Additional analysis might include assessing accessibility, portability, error frequency factors of the product. We recommend Common Industry Format (CIF) based usability assessment report which is the outcome of the sub-protocol [14, 15, 16, 17].

5. Conclusion

We introduce a novel method of the usability assessment protocol for the products of the quality of life technology by adopting and modifying the ISO International standard of software usability testing. A number of considerations and adjustments are also discussed to develop a usability assessment protocol in tentative status. The reference model of the usability assessment is presented to invite further discussion on its value and real world implementation.

6. Discussions

For the further study on the newly designed usability assessment, we need to review the reference model of the usability assessment and assess the model based on time and cost effectiveness in terms of improving quality of usability as well as quality of life for the individuals with disability. With number of trials of the newly designed usability assessment protocol, we expect second and third trials with the same usability assessment design settings to find out usability enhancement for the prospective user with disability.

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