Evaluating the Healthcare Management System by Usability Testing

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Abstract. To maintain and enhance good health status, many health management products have been developed. However, most of these products are lack of friendliness and usability. This study proposed a new process to evaluate the usability with an aim to improve the user experience. An experiment was conducted that participants played a Kinect sport game based healthcare management system. Results showed that the heart rates of participants were increased while using this product and led to effective exercise. According to the questionnaire results, this study also proposed some suggestions from the participants to improve the healthcare management system usability. The contributions of this study are both on the academic and practical aspects. In the academia, this study created a usability testing process to evaluate and verify a product/system. Practically, the result in this study could enhance the healthcare management system in a more friendly and useful manner.

Keywords: usability testing, user experience, healthcare management system, kinect.

1 Introduction

Healthy means well condition in both mental and physical status. Regular and suitable exercises are very important for people's health. According to the World Health Organization (WHO), “Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity [1]”. Hence, proper exercise could avoid or treat health troubles, promote the well mental, and keep healthy of human beings. However, in Taiwan, a lot of workers only had few time for the exercise. This results in worse health status. A healthcare management system is beneficial to keep healthy.

The purpose of a healthcare management system is to assist people to record the variety of physiological data and monitor their health status by themselves. There are already many products in healthcare applications on smart phones or television games. Many Taiwanese used them to maintain health or rehabilitation. However, some of the product interfaces were not designed and evaluated properly which lead

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to usability problems. Therefore, products of the healthcare management system are not useful and efficient.

The usability and user experience (UX) plays an important role in the product design and development process. International Organization for Standardization (ISO) defined that usability includes effectiveness, efficiency and satisfaction [2]. UX is the linkage between usability attributes and the corresponding user experience attributes [3]. Furthermore, usability metrics could serve as the instruments to evaluate the UX of product [4].

A new healthcare management system prototype combined with the Kinect motion games were developed by a research team in Taiwan. This study would evaluate that prototype interfaces applying the user experience and usability metrics so as to improve the friendliness and usability of this product.

2 Literature Review

This study evaluated a healthcare management system based on user experience and usability testing. The subsections are introduction of user experience and usability metrics.

2.1 User Experience

User experience (UX) is associated with a variety of meanings, ranging from usability, hedonic and experiential aspects of technology use [5]. UX were mainly programmatic [6], aimed at convincing the Human Computer Interaction (HCI) community to take issues beyond the task-related more seriously. The key is that measures of user experience should concern user performance based on actual usage [7]. Moreover, each of the product, usability and UX would represent a unique but interdependent aspect of usage. Usability metric for user experience is adopted for the subjective assessment of a product application's perceived usability [8].

2.2 Usability Metrics

According to the definition of the International Organization for Standardization (ISO) 9241-11, usability is associated with effectiveness, efficiency and satisfaction as achieved by users [9]. According to the previous research, it was found that usability could address eight main metrics: effectiveness, efficiency, satisfaction, errors, learnability and flexibility [10]. Nielson [11] defined the usability as learnability, efficiency, memorability, errors and satisfaction. Brink, Gergle, and Wood [12] share a similar viewpoint that usability is functionally correct, efficient to use, easy to learn and remember, error tolerant, and subjectively pleasing.

2.3 Summary

Based on the literature review, usability and user experience are two critical factors of a product, service or system, especially for a new health management system. Therefore, this study developed a simple but efficient process to measure the Kinect sport game based healthcare management system performance with usability metrics.

3 Methodology

This study conducted an experiment and designed the usability questionnaire to evaluate the healthcare management system. The research methodology was introduced as the following sections.

3.1 Questionnaire

According to the usability metrics, this study designed the questionnaire to collect and analyze the participant's feedback. The questionnaire was divided into the three parts: regular product usability metrics, create new user account at first time and product interaction customized for kinect product. The product usability metrics has 24 items, the establishment a new user account has 8 items and the product interaction has 15 items.

3.2 Participants

There were 45 participants to execute the tasks in the experimental process. They were including the 29 male and 16 female.

3.3 Design of Experiment

This study conducted an experiment to evaluate the Healthcare Management System. Firstly, the participants' heart rate (HR) would measure before the experiment by blood pressure meter (Fig. 2). Then, the subjects would initialize the healthcare management system by creating new user account. After setting up the new account, the subjects would play sport games in the healthcare management as exercise. Finally, the subjects would measure the HR again and fill in the usability questionnaire after the experiment. The Fig.1 shows the experimental process.

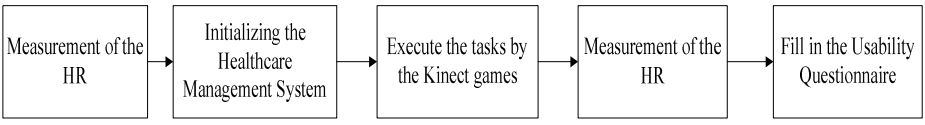

Fig. 1. Experimental Process

3.4 Experiment Equipment

The participants played and evaluated the Kinect sport game based healthcare management system in the experiment. The experimental equipment was blood pressure meter (Fig.2) and system devices (Fig.3 and Fig.4).

Fig. 2. Blood Pressure Meter

Fig. 3. Kinect Device

Fig. 4. Monitor Device

4 Results

After the experiment, this study recorded the participant's heart rate before and after the experiment. In addition, this study utilized the Statistical Product and Service Solutions (SPSS) 15.0® to analyze the questionnaire results. The Fig. 5 and Fig. 6 are male and female participants in the experiment.

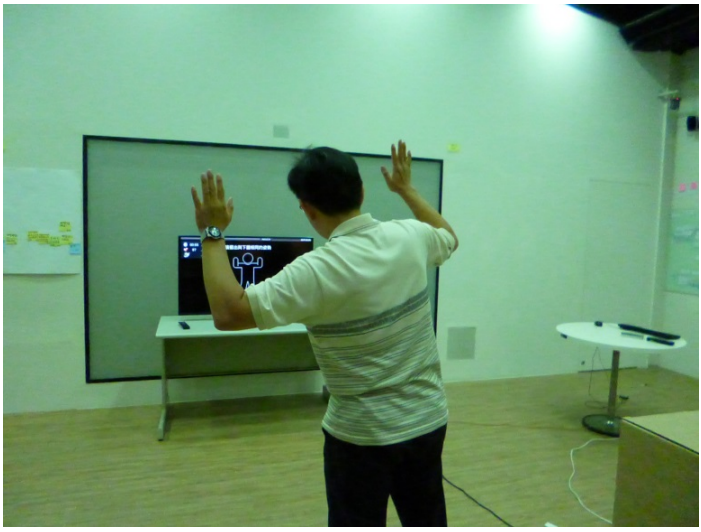

Fig. 5. Male Participant in the experiment

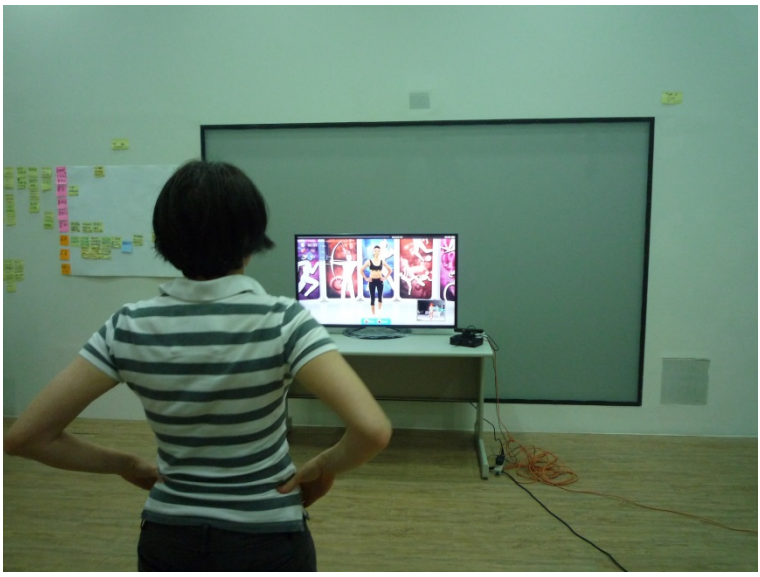

Fig. 6. Female Participant in the experiment

4.1 Heart Rate Variety

Before and after the experiment, this study measured the participant's heart rate (HR) by blood pressure meter. The average increased heart rate is shown in the table 1. There are eight participants had 55% HR variety increased, 11 participants increased 65% HR variety increased, 16 participants increased 75% HR variety increased and 10 participants increased 75% HR variety increased. The results indicated that the users would lead to effective exercise in the system.

Table 1. Average Increased Heart Rate

Increased Percentage	Participants
55 %	8
65%	11
75%	16
85%	10

4.2 Questionnaire Results

This study used statistical t-test to analysis the questionnaire results. According to the results and questionnaire design, the results cover three parts. Firstly, there are two items in the analysis results of the product usability are positive significantly ($p < 0.05$), and the other items scores are bigger than the average. The positive significantly items includes the "this product could maintain the health", and "this product

could report correct physiological and physical information". The results showed that this product could assist users in maintaining their health status.

Under created new user account category, one item in the analysis results is positively significant ($p < 0.05$). This item is "ask for unnecessary information in the system". Besides, there are also three items scores are below the average in metrics. They include the "receive operating information efficiently", "create new account in short time" and "not easy to make mistake". The result shows that there are many operating problems in the stage of creating new user account. This indicates that design team should improve the process of new account creation.

Finally, there are three items in the analysis results of the product interaction are positive significant ($p < 0.05$). They are includes the "pay attention in the use the product", "use the product would not tired" and "use the product was uncomfortable". Rest of the items scores in this category are above average. This result shows that the system should focus, stimulate and comfortable in the operating process.

5 Conclusion

By taking advantage of the physiological data and questionnaires of usability in this study, the results would investigate potential healthcare management system usability problems and improve the system regarding efficiency, effectiveness, satisfaction. errors, learnability and flexibility. Furthermore, this study developed a new process to evaluate the product of the healthcare management system. This study improved the healthcare management in terms of the usefulness and efficiency. As a result, this system could assist the people in managing their health and keeping themselves healthy.

This study contributed in both academic and practical perspectives. In academic aspect, this study developed a process to evaluate and verify the Kinect sport game based healthcare management system. Moreover, the subjective and objective data were collected and utilized in the experiment. Practically, this study verified the system that could enhance the system usability and performance which could enhance the healthcare management system in a more friendly and usefully manner.

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