

Perceptions of satisfaction, usefulness, and ease-of-use in the use of health education website

Su Mei Teng, Shan Shan Cheng, Bo-I Chen, Eric Zhi Feng Liu

Abstract—Excessive computer use often leads to health-related problems, particularly among students. This study developed a health education website in accordance with the needs and preferences of university level students, by incorporating pertinent information within an interactive format using extensive animation. Participants then evaluated the website according to perceived usefulness, ease-of-use, and overall satisfaction. Most of the results were positive; however, a number of participants did not feel that the information was pertinent for people their age. These results indicate that, with regard to the acceptance of a tool or technology with the purpose of learning new information, the need for that information may outweigh the influence of usefulness and ease-of-use in its presentation.

Keywords—Computer users, health education website, users' satisfaction, users' perception

I. BACKGROUND

COMPUTER and the internet have made life more convenient; however, they have had negative effects as well. The Department of Labor in New Zealand has identified several potential health issues associated with computer use, such as visual discomfort, physical discomfort, stress, and fatigue [1]. Adolescents are currently the main users of computers and the internet [2]. In Taiwan, primary school students spend an average of 1.27 hours a day using computers during weekdays and 1.98 hours a day during the weekend; high school students spend an average of 3 hours a day during weekdays and 3.37 hours a day during the weekend [3]. Undergraduate students spend an average of 2.8 hours a day (weekdays and weekends) using the computer and surfing the internet [4]. These statistics have raised awareness regarding

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health-related issues associated with computer use. As part of the research for this paper, we identified health issues faced by undergraduate students and developed a website to inform young people about these issues and provide them with information about alleviating discomfort arising from computer use. We also investigated the perceptions held by users and their satisfaction with regard to the website.

II. RELATED STUDIES

This study reviewed previous work on health issues associated with computer use, health education, and the health promotion model. We also examined user perceptions of usefulness and ease-of-use as well as the principles of participatory design.

A. Health education and promotion

A range of physical conditions may develop or be exacerbated by working with computers [1]. Symptoms include visual fatigue, and pain or discomfort in the upper limbs, neck, and back, [1].

Hakala et al. discovered that the occurrence of pain in the neck, shoulders, and lower back of adolescents has been increasing since the 1990s [5], attributing this to the prevalence of computer and internet usage.

The aim of health education is to develop in individuals abilities and attitudes that help them to prevent illness and maintain their health [7~8]. In Taiwan, health education is provided mainly in elementary and secondary school. Related promotions also appear in posters and TV advertisements. Another important initiative is the health promotion model (HPM), designed to gauge the comprehension of health-related issues and participation in physical activities. The HPM was developed by Pender based on social cognition theory and expectancy value theory [9~11]. The model is based on the premise that cognition, action, and environment affect health promoting behaviors. The primary influencing factors include individual characteristics and experience (e.g., personal, biological, psychological, and social factors, and prior related behavior); behavior-specific cognitions and affect (e.g., perceived benefits of action; perceived barriers to action; perceived self-efficacy; activity-related affect; interpersonal influences; situational influences; commitment to a plan of action; immediate competing demands, and preferences), and

behavioral outcome (e.g., health-promoting behavior) [9~11]. Wu and Pender employed the HPM to investigate physical activities of Taiwanese adolescents and found that perceived benefits of action and perceived barriers to action were correlated with health promotion activities [10]. This means that if students perceive that actions or information are beneficial, they are more likely to accept them and adopt healthy behavior.

B. Perception of usefulness and ease-of-use

In a previous study on e-health education, it was shown that social and economic difficulties, operational difficulties, and the perceived usefulness of e-health education systems influence the usage and acceptance of e-health education systems [12]. In addition, previous studies on the HPM [9-11] have indicated that the perceived benefits of action, perceived barriers to action, and immediate competing demands and preferences influence health related behavior. These results echo the concepts of perceived usefulness and perceived ease-of-use, mentioned in the Technology Acceptance Model proposed by Davis [13].

According to Davis, behavior is influenced by perceptions. If users consider a product to be useful, they will tend to use it, and if they view it as easy to use, they are more likely to accept it [18]. This study used these concepts to evaluate the perceptions of undergraduate students' with regard to a website dedicated to health education. It was hoped that if participants viewed the website as useful and easy to use, they would be more likely to treat it as a source of health-related knowledge.

Previous studies have indicated that the internet is a common source of information [14] and researchers have reported that many people search for health information online [15]. In an investigation by Cohall et al., 74% of the participants sought information on medical problems, and the information they found influenced the way they subsequently ate and exercised [15]. Other research has demonstrated how educators could utilize the convenience of the internet to promote online health education, disseminate health-related knowledge, and investigate attitudes toward online health education [7~8, 16~18]. Cheng et al. claimed that the prevention and early detection of disease is becoming increasingly important and that individuals should assume a key role in keeping themselves healthy and informed [18].

Thus, this study developed a website to provide useful and practical health information for young computer users.

C. Participator Design

Muller and Kuhn described the principles of participatory design as the viewpoints of users when constructing a user-centered environment [19]. Participatory design principles are not a design style; rather, they are a design method and philosophy with the aim of developing a product capable of meeting the needs of end users. Participatory design principles have been widely adopted in a range of fields, such as software design, urban design, product design, and graphic design. [19].

Cheng et al. claimed that the prevention and early detection of disease require high-quality, reliable information [18]. The format of health-related information is also of the utmost importance, and should suit the preferences of end users. This

study adopted participatory design principles and collected the opinions of computer users before developing the website. In so doing, we sought to identify the interests of users with regard to healthcare, the kinds of information they are looking for, and the type of human-computer interaction they prefer (e.g., text, sounds, colors, animations and images).

III. METHODOLOGY

A. Participants and Their Opinions

Participatory design principles were adopted for the development of the website. We first developed a pool of information related to the opinions of end users by randomly surveying 338 undergraduate students who attend a university of science and technology located in northern Taiwan.

Among the participants, 59% were female, 33% were enrolled in the university's college of engineering, 25% in its college of management, 23% in its college of humanities and social sciences, and 19% in its college of service industries. Among those students, 3% claimed to use computers for less than one hour daily, 16% claimed to spend 1~2 hours daily, 42% claimed 3~4 hours per day, and 22% claimed 5~6 hours per day. Surprisingly, more than 20% of the participants claimed to use computers for more than 6 hours each day. When asked whether they experienced any discomfort while using the computer, 72% reported visual fatigue, 56% reported discomfort in the neck and shoulder, 25% complained of pain in the lower back, 13% reported headaches, 21% mentioned pain in their wrists, and 6% said they felt discomfort in their fingers. In addition, 82% of the participants said that they usually went to sleep after midnight, 52% said they eat out every meal, and 71% said they exercise less than one hour a day.

Regarding the preferred characteristics of human-computer interaction, 67% reported that they prefer websites using an animated format and 72% preferred the use of light colors for the background. When asked about the health information they require to alleviate discomfort caused by computer usage, 65% of the participants requested up-to-date information, 44% said they needed information related to exercise, 37% requested information about nutrition, and 60% wished to learn about the number of calories burned by various exercises. All of these opinions were integrated into the design of the website.

Following completion of the health education website, 120 students were randomly selected from the 338 students and invited to use the health education website. Two questionnaires were then administered to the students. The 120 participants returned 102 valid questionnaires.

B. Two 5-Point Likert's Scale Questionnaires on User Satisfaction, Perceptions of Usefulness and Ease-of-use

In this study, usefulness was defined as the extent to which users considered the information provided by the health education website to be useful. Ease-of-use refers to the ease with which users were able to use the health education.

The questionnaire on usefulness and ease-of-use was modified from the questionnaire proposed by Chang [20]. The questionnaire included 12 items with 5 points Likert's scale to

probe background variables and twelve items related to perceptions of usefulness and ease-of-use, as follows:

- Using this website helped me to obtain health knowledge quickly.
- Using this website helped me to improve my understanding of health-related issues.
- Using this website helped me to expand the range of my health knowledge.
- Using this website enhanced my interest in health-related issues.
- This website made learning about health issues easier.
- I found that this website was useful for learning about health.
- This health education system was easy to use.
- I found it easy to obtain health-related information in this system.
- I know why I want to use this health education system.
- I can use this system whenever I want.
- It was easy for me to master the use of this health education system.
- I think that the functions of this system are easy to use.

A pilot study was conducted before the main questionnaire was administered. The validity and reliability of the questionnaire was analyzed using IBM SPSS Statistics (SPSS). The Kaiser-Meyer-Olkin (KMO) measure was used to assess the adequacy of the samplings. Values of KMO of 0.5 and greater are adequate to proceed to factor analysis. In this study, the KMO measure was 0.798. Bartlett's test of sphericity was used to test the strength of the relationship among variables. In this study, the value for Bartlett's test of sphericity was significant ($p=0.000 < 0.01$), indicating that the correlation matrix was not an identity matrix, and the factor model was appropriate.

Cronbach's α was used to measure the coefficient of internal consistency, and the reliability of the questionnaire. In this study, the Cronbach α was 0.92, indicating that the questionnaire is highly consistent, indicating that the results are reliable.

We also surveyed the level of satisfaction toward the health education website using a 5-point Likert's scale. The 14 items are listed as follows:

- I feel the health education website is interesting.
- I am satisfied with the interactive interface of the Discussion Forum provided by the health education website.
- The health education website helped me to learn about practical health information.
- Overall, I am satisfied with the content of the health education website.
- I am satisfied with the interactive interface of the Message Board provided by the health education website.
- I am satisfied with the process of using the health education website.
- Using the health education website improved my understanding of health-related concepts.
- The health education website was a waste of time. (Negative statement: the score was reversed)

- I am satisfied with the results of using the health education website.
- After using this health education website, I understand the importance of maintaining my health.
- I am satisfied with the color combination used on the health education website.
- I am satisfied with the sound effects used on the health education website.
- I am satisfied with the background music used on the health education website.
- I am satisfied with the organization format of the health education website.

C. Developing Health Education Website

This study started with the development of the interface of the website. In accordance with the preferences of participants, we used a light color for the background and included interactive animation to display key health information. Flash programming was used for the design of the website, running on Windows Server 2008 R2. To deal with incoming data and enable the addition and modification of information, we used an SQL server for the database. Because Flash cannot be connected to an SQL server directly, we developed a program using ASP.NET to act as a bridge for the retrieval of data from the SQL server, which allowed the data to be displayed on the website. The function of ASP.NET is presented in Fig. 1 and development tools are listed in Table 1.

Table 1. Development tools

FUNCTION	TOOLS
System platform	Windows Server 2008 r2
Website development	ASP.NET
Database	SQL Server 2008 R2
Website interface	Adobe FLASH
Sound effects	Gold Wave
Graphic design	Photoimpact, Photoshop

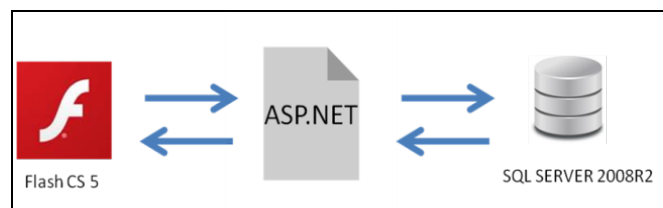


Fig. 1. Functions of ASP.NET

IV. RESULTS

The health education website developed for this study included the following eight sub-webpages: Food and Nutrition, Recipes to Improve Health, Exercises to Improve Health, Sleeping Soundly, Calories, Self-evaluation, Discussion, and Site Map. To promote further development, an evaluation block was included by which users could review the content and design of the website. The display of health information was handled mainly by animation and an interactive interface. Except for the listing of new health-related information,

text-based webpages were avoided. The structure of the website is presented in Fig. 2.

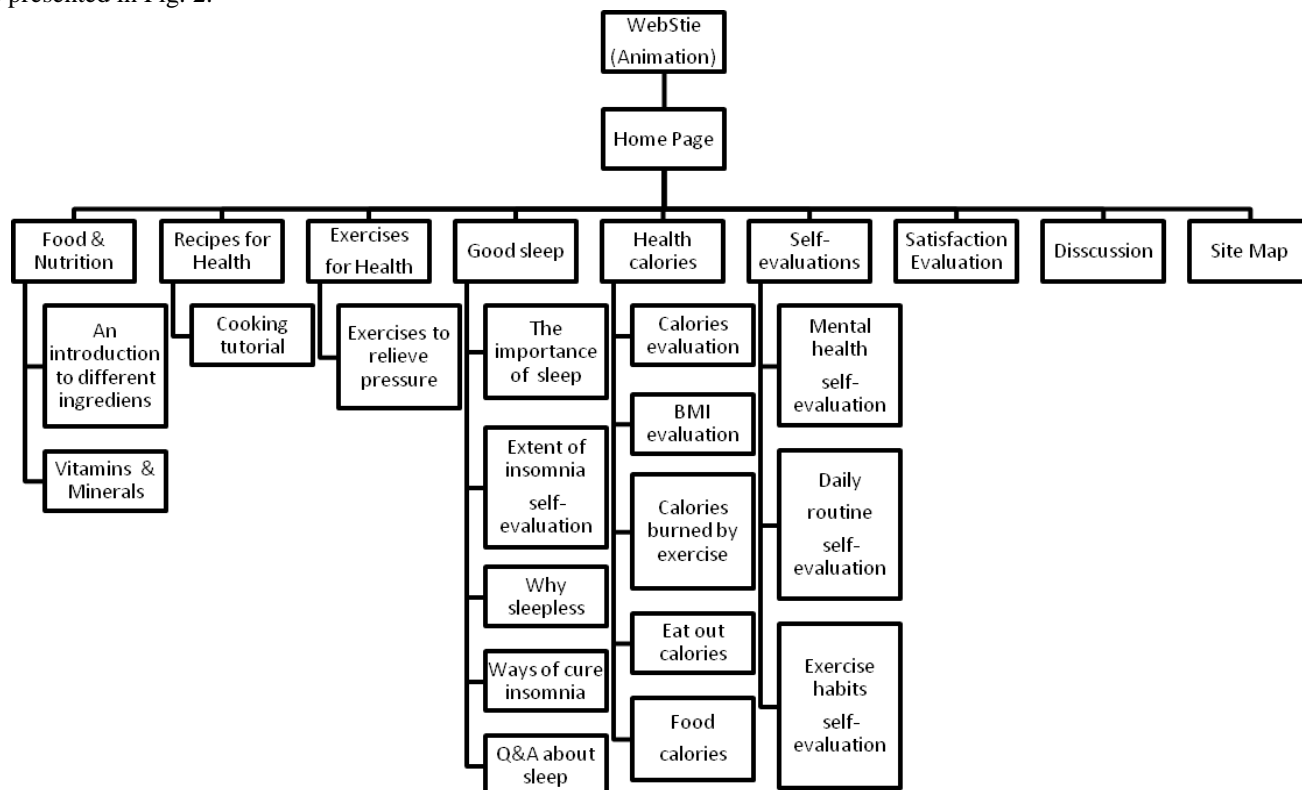


Fig 2. Structure of the health education website

According to the questionnaires, most of the participants used computers for more than 3 hours per day and experienced the unpleasant consequences of engaging in a sedentary activity for an extended period of time. To ensure that users did not spend excessive time using the website, a timer was included on the website to alert users of the need to take a break. A convergent table was also developed to share new health-related information. The timer and the convergent table are presented in Fig. 3.

The entire website was developed according to the needs of participants, with the inclusion of animations and video clips to teach students how to alleviate discomfort as well as calories burned by engaging in various exercises (Figs. 2 and 3). For example, students wishing to know the number of calories burned by playing basketball for one hour needed only to look up the activity and cross reference it with the time spent playing.



Fig. 3 Timer and convergent table for new health-related knowledge



Fig. 4 Video clip of exercise to promote health



Fig. 5 Calorie calculator for various exercises

The results of the questionnaire indicated that most participants stayed up late and ate food prepared outside the home. Thus, we sought to inform visitors to the website of the importance of sleep and eating healthily, as well as provide them with easy cooking tutorials and information about nutrition, how to improve sleep patterns, and how to evaluate of sleep habits. These interactive webpages are presented in Figs. 5 - 8.

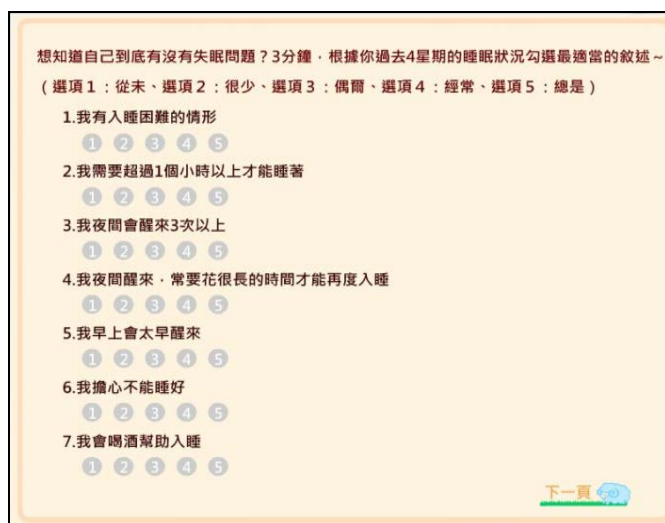


Fig. 6 Webpage of sleep evaluation



Fig. 7 Ways to improve insomnia



Fig. 8 Nutrition and calories

Participants were invited to evaluate the website according to their perceptions of its usefulness, ease-of-use, and their satisfaction using a 5-point Likert's scale. The results of the questionnaire are displayed in Tables 2 and 3.

Table 2. Evaluation of health education website: usefulness and ease-of-use

Content	Mean	SD
1. Using this website helped me to obtain health knowledge quickly.	3.92	0.62
2. Using this website helped me to improve my understanding of health-related issues.	3.94	0.64
3. Using this website helped me to expand the range of my health	4.03	0.70

knowledge.		
4. Using this website enhanced my interest in health-related issues.	3.80	0.73
5. This website made learning about health issues easier.	3.98	0.66
6. I found that this website was useful for learning about health.	4.05	0.60
7. This health education system was easy to use.	4.05	0.71
8. I found it easy to obtain health-related information on this system.	4.02	0.67
9. I know why I want to use this health education system.	3.92	0.71
10. I can use this system whenever I want.	3.95	0.64
11. It was easy for me to master the use of this health education system.	3.96	0.69
12. I think that the functions on this system are easy to use.	4.13	0.70

The item “I think that the functions on this system are easy to use” received the highest score, and the item “Using this website enhanced my interest in health-related issues” received the lowest mark. Nonetheless, all items scored higher than 3, indicating a positive evaluation of the site.

Table 3. Participant satisfaction with health education website

Content	Mean	SD
1. I feel the health education website is interesting.	3.91	0.59
2. I am satisfied with the interactive interface of the Discussion Forum provided by the health education website.	3.91	0.67
3. The health education website helped me to learn about practical health information.	4.05	0.65
4. Overall, I am satisfied with the content of the health education website.	3.78	0.75
5. I am satisfied with the	3.75	0.75

interactive interface of the Message Board provided by the health education website.		
6. I am satisfied with the process of using the health education website.	3.90	0.68
7. Using the health education website improved my understanding of health-related concepts.	3.93	0.66
8. The health education website was a waste of time (-).	2.96	1.10
9. I am satisfied with the results of using the health education website.	3.82	0.62
10. After using this health education website, I understand the importance of maintaining my health.	3.95	0.65
11. I am satisfied with the color combination used on the health education website.	3.93	0.70
12. I am satisfied with the sound effects used on the health education website.	3.74	0.82
13. I am satisfied with the background music used in the health education website.	3.76	0.78
14. I am satisfied with the organization of the health education website.	3.98	0.68

The participants expressed satisfaction with the function and organization of the health education website. On the satisfaction questionnaire, item 7, “Using the health education website improved my understanding of health-related concepts,” received the highest score, and item 8, “The health education website was a waste of time,” received the lowest score.

V. DISCUSSION

This study developed a health education website to help undergraduate students acquire the health-related information they need to ease the discomfort they feel as a result of using computers.

The results of descriptive statistical analysis indicate that participants considered the health education website easy to use and the information useful. Values of standard deviation indicated that the participants’ responses were highly consistent. When participants were asked to evaluate the usefulness and

ease-of-use of the website (Table 2), the item that received the lowest score was "Using this website enhanced my interest in health-related issues." Raw data revealed that 33 of the students did not comment on this item and 2 participants replied that their interest was not sparked, claiming that they were too young to consider healthcare issues. They also described how they were unable to reduce the time they spent using computers due to the rigors of their daily life.

The results of descriptive statistic analysis of participants' satisfaction with the website (Table 3) indicate that the participants agreed with most of the statements, except for the item, "Using the health education website is a waste of time." The low standard deviation of responses to this questionnaire indicated that the participants replied in chorus with one another in regard to the items. Raw data indicated that 35 students considered the website a waste of time. Cross referencing this item to the item with the lowest score in Table 2, which displays results for questions relating to satisfaction with the website, indicated the same 35 persons. The researchers assume that the participants who do not feel a need for health-related information were unlikely to have their interest piqued by this subject, and therefore were likely to consider using the website a waste of time.

Davis claimed that users will use things that they perceive to be useful and easy to use [13]. However, we discovered that users do not necessarily want to spend time using the health education website, despite the fact that they found the website useful and easy to use. Clearly, a sense of the need for health-related information is a key factor influencing the use and acceptance of the health education website. The HPM mentions that the immediate demands and preferences of individuals influences their health related behavior [9-11]. In this study, the participants' feedback revealed that the need for this information clearly outweighed the influence of usefulness and ease-of-use.

VI. CONCLUSION

Previous studies have found that discomfort and pain in the neck, shoulder, and back can be attributed to the heavy use of computers [5-6]. Nonetheless, very few resources are available specifically addressing this issue and many of the available resources are not presented in a way that users find appealing. This study developed a new website in accordance with needs and preferences of young computer users. The website was then evaluated by users according to usefulness, ease-of-use, and user satisfaction. Most of the results were positive; however, a number of participants in the study did not feel that the information was pertinent at their age. Future studies could investigate actual changes in the lifestyle of participants with regard to health promoting activities, such as spending less time using the computer and exercising more frequently. In addition, researchers could compare the degree to which perceived need, and perceived usefulness and ease-of-use, influence potential users to accept and use a technology. The findings in this study could help educators and parents to promote a healthier approach to computer use.

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