Applying usability testing techniques to improve a health promotion website

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Applying usability testing techniques to improve a health promotion website

Anetta Hinchliffe and W. Kerry Mummery

Introduction

The Internet is becoming a more popular way to deliver and obtain important health information. With more than 5.9 million Internet subscribers in Australia,[1] it is not surprising that more people are going online in search of health information.[2] There is, however, a lack of research detailing usability testing of health websites. One reason for this may be that organisations are conducting research, but not reporting it. Alternatively, and most likely, organisations are not conducting evaluations when planning and maintaining a website. White and Raman[3] report that the urgency to have a web presence is resulting in many websites being implemented with little or no formal research or evaluation.

According to Nielsen, usability "applies to all aspects of a system with which a human might interact".[4] An evaluation of the usability of a system involves the implementation of a variety of methods that examine how users interact with the system and assess whether the system's performance is acceptable.[5,6] It is imperative that health promotion websites conduct usability testing to examine whether their users can effectively and efficiently complete required tasks. This also reinforces the need to include users or potential users[7] in the development and maintenance of health promotion websites.

It has been reported that testing does not have to be elaborate and expensive to be successful.[8] Health organisations with limited funding can therefore conduct usability testing, not with the intent of finding all problems[9] but with the understanding that some testing is better than none.[4] There are many studies that highlight how testing can dramatically improve a website.[10,11] To date, the usability studies for health promotion websites have varied from focusing on specific testing for target populations[12] to testing for specific usability attributes such as aesthetics.[13]

Abstract

Issue addressed: Use of the Internet for health promotion is increasing; however, the lack of published research regarding website usability suggests that health promotion websites are being developed without consultation with their users or formal evaluation. This study conducted usability testing of an existing health promotion website to inform modifications and to identify common usability themes that should be addressed by organisations developing or maintaining a health promotion website.

Methods: A combination of qualitative and quantitative techniques were implemented during the usability testing sessions to gather data from users while completing tasks on the website. Techniques included performance measures (time taken), direct observation (participant observation) and subjective user preferences (questionnaire and interview).

Results: Improvements to the website were measured in terms of reduced problems reported, reduced time taken to complete tasks and increased subjective reports. Seven usability themes emerged from the data: design, feedback, format, instructions, navigation, terminology and learnability.

Conclusions: This study demonstrates the application of usability testing to the design and modification of a health promotion website and illustrates the areas or themes that can be used as a framework for testing and modification.

Key words: Internet; 10,000 steps; performance measures; subjective user preference.

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So what?

This study provides health promotion professionals with evidence that supports and directs usability testing of websites. Efforts in web-based design and dissemination should be guided by principles identified in this article.

The 10,000 Steps website

Originating from the 10,000 Steps Rockhampton project,[14,15] the 10,000 Steps program is a non-profit physical activity health promotion project consisting of research, development and distribution of new and existing program material at the local, State and national level, all with web-based support. The overall aim of the 10,000 Steps program is to increase participation in physical activity in a wide range of adult populations.

The 10,000 Steps website (www.10000steps.org.au) was developed in 2002 and is a key component of the dissemination of the 10,000 Steps project across Australia and internationally.[16] In June 2006, Mummery and colleagues reported that the website had 18,000 registered members;[16] in the following nine months this increased to more than 35,500 members. In comparison with another population-wide, web-based initiative, 'Canada-on-the-Move,' which recruited 3,173 members within a 10-month period,[17] the usage of the 10,000 Steps website is remarkable. Despite the importance of the 10,000 Steps website, no formal evaluation of the usability had been conducted. With growing numbers of members accessing the website and evolving interactive features, it became apparent that several issues needed to be rectified before further construction could take place. This resulted in the decision to implement a formal usability testing protocol as a key element of the redevelopment of the 10,000 Steps website.

Purpose

The purpose of this study was to employ usability testing of an existing health promotion website (www.10000steps.org.au) to inform modifications to the website and to identify common usability themes in the redevelopment of this site that may serve to guide future website development and maintenance in the field of health promotion.

Methods

Study design

This applied research study involved conducting usability testing pre- and post-modifications to identify problems that should be addressed and then to examine the effectiveness of the corresponding modifications and to identify themes relating to website usability. Figure 1 outlines the basic study design.
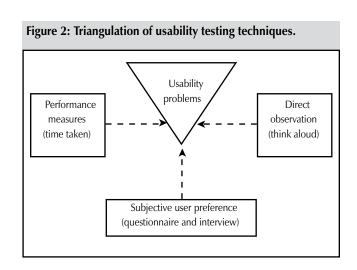
Participants

Users

A purposeful sample of 12 users was involved in the usability testing sessions. Six users were recruited at the time of each testing session. It has been reported that usability testing with five users will reveal 85% of usability problems.[4,18] The test users were chosen as they reflected the general demographic of the real users of the 10,000 Steps website.[16] The users covered a diverse age range and included six females (age 46 years±4.4) and six males (age 47 years±4.1). Seven of the 12 users reported accessing the Internet daily, four reported weekly and one monthly. All users were required to be first-time users of the 10,000 Steps website and have a minimum of three years of Internet experience (mean=6.3 years).

Experts

For this study, three expert participants were recruited to test usability pre-modification. The experts were asked to act in the role of less experienced users to provide an informed opinion on any potential problems they could see arising for users.[5] As their opinion was sought to inform modifications to the website, the experts were not involved in post-modification testing. The expert panel was selected to cover a range of

Figure 1: Study design.

Figure 2: Triangulation of usability testing techniques.

expertise, including health in older adults, computer-based problem-based learning, and computer informatics.

All participants volunteered and no incentive was provided for their participation. This study was approved by the Central Queensland University's Human Research Ethics Committee and all participants gave written informed consent.

Usability testing session

All usability testing was conducted in a research laboratory at the Central Queensland University to standardise Internet speed. Users were asked to complete a set of pre-specified tasks using the 10,000 Steps website. The 14 tasks were selected as being representative of common activities in the use of the 10,000 Steps website. Each user was studied in an individual session and all sessions were audio tape recorded. Users were informed of the nature of the research and that pre- and post- modification testing would be undertaken. Participants were blinded as to which group they were allocated until after completing the tasks. The testing session for the experts followed similar procedure to the users except time to complete tasks was not recorded. A combination of usability testing techniques was used to collect both qualitative and quantitative data during the testing sessions.[19-21] These were classified under the headings of: performance measures, direct observation, and subjective user preference.[22]

Performance measure

During the session the researcher recorded time to complete each task, taken by a stopwatch. Time was taken from the time the task was read aloud, until the specific task was completed. All timing was done by the principal researcher.

Direct observation

Users were required to think aloud while completing the tasks. This method provides rich qualitative data and is described by Nielsen as "the single most valuable usability engineering method".[4] It allows the user to effectively comment on how they are interacting with the website, what they are attempting to do, how they feel and when they encounter problems. This method is also beneficial as it occurs simultaneously while the user interacts with the website and does not rely on self-report measures, which can lead to incorrect or incomplete accounts of users' actions.

Subjective user preference

Immediately following the completion of the tasks on the website, each user recorded their perception of their experience with the website on a series of five-point Likert scale questions. Items were scored on the five-point scale where 1 equals strongly agree and 5 equals strongly disagree. The questions used to assess subjective usability included "I was able to easily find my way around the Step Log to complete the tasks" and "I think the information in the website is credible". A semi-structured interview was then conducted by the researcher. During the interview, the user was asked to provide additional feedback on their experience with the website, to elaborate on any problems and to provide any suggestions or recommendations.

Data analysis

Data analysis involved using a methods triangulation approach[23] to couple the data from a number of usability testing techniques (see Figure 2). Triangulation of data provides a comprehensive review of the usability of the website.[23]

For both the first usability testing session (UT1) and second usability testing session (UT2), the audio recording from each user's tasks and interview were transcribed and then systematically scanned for critical episodes identifying any positive comments, recommendations, as well as problems, confusion, misunderstandings or difficulties the user experienced. The critical episodes and researcher's notes were collated and distinctive usability themes were extracted. The evidence found in UT1 was used to guide the development of recommendations to improve the design of the website.

A comparison was made between UT1 and UT2 of problem

Table 1: Problem counts.

| Themes | Pre-modifications (UT1) | | | | Themes | Post-modifications (UT2) | | |
	No. total problems	No. unique problems	$\overline{X}$ problems /Expert n=3	$\overline{X}$ problems /User n=6		No. total problems	No. unique problems	$\overline{X}$ problems /User n=6
Design	34	19	3.66	3.83	Design	8	5	1.33
Feedback	3	2	0.33	0.33	Feedback	2	1	0.33
Format	26	9	3.33	2.66	Format	9	4	1.5
Instructions	22	15	2.66	2.33	Instructions	7	2	0.33
Navigation	38	15	5.33	3.66	Navigation	4	1	0.66
Terminology	13	6	1.33	1.5	Terminology	0	0	0
Learnability	2	2	0	0.33	Learnability	0	0	0
Total	**138**	**68**	**16.64**	**14.64**	**Total**	**30**	**13**	**4.15**

counts, time taken to complete tasks and subjective user preference data to indicate if and how the modifications to the website had improved the usability. Descriptive statistics were used to analyse problem counts and time taken. Independent sample *t*-tests were conducted for the time taken.

Measured by Likert scale data, subjective user preference items were reverse scored so that higher values represented more favourable responses to the questions. Factor analysis using principal components analysis and varimax rotation was performed on the overall scale to identify groups of similar questions. Factor analysis provided two definable factors with eigenvalues over 1.0; the first factor contained five questions and the second factor contained two questions. Questions included in the first factor, defined as usability, were "I think the Step Log is user-friendly", "I like the overall presentation of the Step Log", "I like the overall layout of the Step Log", "I was able to easily find my way around the Step Log to complete the tasks" and "I am able to easily find my way around the website to get the information I am looking for". The second factor, defined as credibility and content, included questions "I think that the information in the website is credible" and "I think that the information provided in the website is useful". Two questions were removed from the analysis due to significant cross loading between factors, "I like the overall presentation of the website" and "I like the overall layout of the website". Independent *t*-tests using the mean of each factor examined differences in website usability pre- and post-modification.

Statistical data were analysed using Statistical Processing for the Social Sciences (SPSS) Version 13.0.

Results

Identification of problems and distillation of themes

The 14 tasks in UT1 revealed a total of 68 unique problems (see Table 1). From these, seven distinctive themes emerged and were subsequently used to categorise the episodes and problems identified in both UT1 and UT2. The themes identified were: design, feedback, format, instructions, navigation, terminology and learnability. The themes are presented in detail in Table 2 with a description and example quotes from users.

Informing the website modifications

A combination of individual unique problems and related emergent themes highlighted the areas of the website where users experienced difficulty. From these, recommendations on how the website needed to be modified were developed. It was identified that extensive problems were a result of poor design of the overall website, in particular the design and navigation (which accounted for half of the unique problems). As a result, a full redesign was carried out on the 10,000 Steps website. While not individually reported in this study, positive comments recorded during testing were also used to ensure that the recommendations for the modifications did

Table 2: Usability themes.

Themes	Definitions	Examples from UT1 and UT2
Design	General page design and layout, including consistency, what is located on the page and how it is located. Includes content, font, colour, density, placement, images.	"I would make the top banner smaller, thinner, so it doesn't push so much of the information below the fold" "Font size could be a bit bigger … or when you click on something it makes it bigger".
Feedback	System providing feedback to assist users in recovering from errors or guide them in completion of tasks.	"Well it doesn't tell me that I need to re-enter my password – I could have been here for hours".
Format	Effective use of general features throughout site such as entering online forms, the date format shown, logical order and use of drop down menus.	"I just submitted my birth date before where I had to put in as a different format" "You shouldn't have to think, you should just be able to punch it in". "What it should do is put the cursor in the right place when you start off". "Why don't you have Australia first?"
Instructions	Providing users with brief, clear, helpful information to guide them as they complete the task and to assist in error prevention. i.e. password 4-7 characters (case sensitive).	"If you could just clarify that your password doesn't have to be anything specific … it comes straight after your email address and most people have an address and their password associated with that".
Navigation	The way a user navigates throughout the website to complete tasks. Includes clear menus, link recognition, user to know where they are within the site at all times and how to get back to where they came from.	"It doesn't have obvious menus" "things happening everywhere – menus and menus everywhere" "alright well that was nicely hidden wasn't it [didn't identify a link]"
Terminology	Reflect the users' language, tasks and intentions on the website. User should not have to think about what might be within a link – but be able to easily identify their desired link. Including link names.	"It says submit steps, previous steps, if you're going to change something you're immediately looking for the word edit" "I had a look at the edit thing but I didn't know if that meant my own personal details or whether it was a steps thing" "I'm going back to the beginning because I am very confused, now I am just randomly clicking … media is a funny name though" "media not a word used by older adults. If they are looking for 'newsletter' that's what they will look for".
Learnability	The ability to easily learn a website.	"For a beginner the website could be quite frustrating to use".

not eliminate the areas that the users positively commented on. Figures 3 and 4 provide examples of the 10,000 Steps website pre- and post-modifications.

Comparing the pre- and post-modification results

Problem counts

Comparing the problem counts of UT1 and UT2 showed a significant decrease in the number of unique problems (t_{12}=2.95, p=0.004) and the problems-per-user (t_{12}=2.54, p=0.03). Table 1 provides an overview of the problems found in both usability testing sessions.

Time taken to complete tasks

The mean time taken to complete the 14 tasks in UT1 was 21.59 minutes (SD±4.8) and in UT2 was 10.18 minutes (SD±6.2). Overall, the modifications to the website resulted in the mean time to complete the tasks decreasing by 52% (9.05 minutes). An independent sample *t*-test revealed this as a significant decrease in time (t_{10}=3.56, p=0.005).

Subjective user preference

Internal consistency (Cronbach's alpha) for the usability factor (α=0.88) and credibility and content factor (α=1.00) were high, indicting acceptable reliability of the measure. Analysis showed a significant improvement in the usability score (t_{10}=-2.636, p=0.025) with the means improving from 3.13 (SD±0.59) on the pre-test to 4.10 (SD±0.68) subsequent to the modifications. No significant change was observed in terms of credibility and content (t_{10}=-0.542, p=0.599), with the pre-modification mean being 4.33 (SD±0.51) compared with a post-modification mean of 4.50 (SD±0.55).

Discussion

The purpose of this study was to formally evaluate an existing health promotion website with the intent of applying usability testing to systematically improve the website and to categorise the problems identified into usability themes. A number of usability testing techniques were used to gather data prior to the modifications and then again using the modified website. Pre- and post-modification comparisons highlighted the improvements made to the website including problem counts, performance and user preference.

With more organisations delivering health information and programs online, it is imperative that potential users are included in the development and maintenance of the websites.[7] While an organisation may not recognise any major areas of concern, implementing formal usability testing can identify how users interact with the site. This study demonstrates that not only is it important that users can complete tasks, but that they do so with ease and without encountering problems. It is important to test existing health promotion websites with end users to make improvements.

Little research has been conducted in usability testing of interactive health websites, which makes it difficult for health promoters to identify where problems with their websites will come from. The 10,000 Steps website is an example of this; a website that was originally developed with no formal usability testing or involvement from users. It was decided, unlike other usability studies,[12,13] not to approach the testing with pre-identified usability attributes, but instead to distill attributes from the testing results. As such, this is the first known study that has tested a range of tasks across a health promotion website to identify problems under thematic headings.

Figure 3: 10,000 Steps website home page, before modifications.

To test the overall website, participants were asked to complete 14 specific tasks designed to emulate typical usage patterns. From the processes, seven usability themes emerged and were used to categorise the identified problems. By identifying issues with the whole website and identified themes, modifications were able to improve the usability across the overall website. As each website's features and goals differ, it is recommended that organisations developing or maintaining a health promotion website consider the seven themes identified in this study to guide, but not limit, their testing.
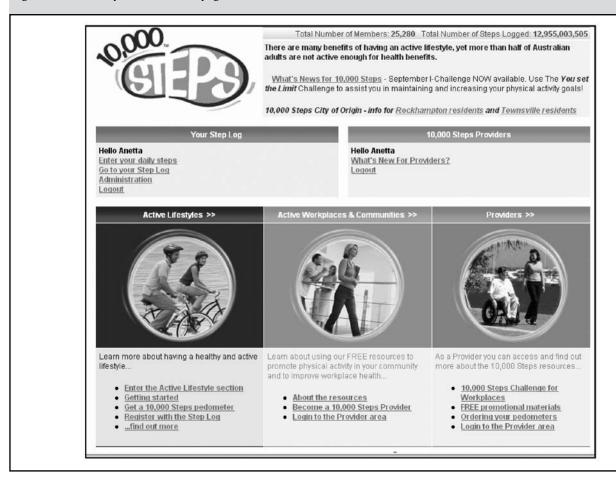
While time taken can be influenced by variables such as Internet speed and individual user approach, when considered with other techniques and used under the same methods in pre- and post-testing it is beneficial data to collect.[4] Nielsen explains that "efficiency of use" can be quantified as the average time it takes users to perform a certain number of specified tasks.[4] Thus, in this study, the decrease in average time to complete all 14 tasks by 52%, while controlling for Internet speed, suggests that the modifications to the website improved the efficiency of conducting these typical tasks on the website.

Although not conclusive, research studies have found a direct correlation between perceived usability and credibility of a website.[24] The questions pertaining to subjective user preference in this study were separated into two definable factors, 'usability' and 'credibility and content'. User feedback found an increase in terms of usability following the modifications to the 10,000 Steps website. However, user feedback for the 'credibility and content' of the site was unchanged. This demonstrates that, with proper modifications, usability can be improved without endangering perceived credibility. These findings suggest that to ensure overall subjective user preference a website needs to be perceived by users as both usable and credible. The results also support the notion that making modifications as a result of usability testing can improve a user's subjective opinion of a health promotion website.

This study shows that usability testing does not require sophisticated and expensive methods to be successful.[8] The current study was not conducted to identify every usability problem with a website, but instead to show how implementing usability testing with a small number of users can identify a large portion of usability problems[4,18] and assist in making significant improvements to an interactive health promotion website. While more quantifiable tests with a larger sample size could have been conducted, it is questionable whether the added expense would have provided any more

Figure 4: 10,000 Steps website home page, after modifications.

valuable data. Further research is recommended to identify the association between sample size and quality and quantity of data for health promotion websites.[25] For health organisations developing and maintaining websites, budget and schedule constraints are acknowledged as a problem in using this medium.[26] It has previously been recommended to place less focus on finding all problems;[9] this study supports this notion and reiterates that conducting some usability testing is better than none.

Limitations

It is acknowledged that this study is not without its limitations. The researcher was the only observer during the testing sessions. It is recommended that where possible a minimum of two observers should be used to decrease the risk of observer bias and increase the rigour of the findings.

Conclusion and recommendations

Simple usability testing in conjunction with website redesign identified problems and pointed to improvements on a health promotion website from an end-user's perspective. The usability testing was invaluable in identifying not only major areas and themes that needed modifying, but also smaller, easily fixed problems that users encountered. The identification of the seven usability themes can also be used to guide future research and development of the 10,000 Steps and other health websites.

This study reiterates the importance of involving end users and conducting usability testing to the success of a health website – and the notion that it is never too late. As a result, it is recommended that other health professionals incorporate evaluation into the planning of their website's development and maintenance. Subsequently, future research needs to identify whether the seven usability themes identified in this study cover usability problems of other health websites delivering information and programs.

Acknowledgement

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