Internet Design Preferences of Patients With Cancer

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Purpose/Objectives: To describe computer experience and preferences for multimedia design.

Design: Prospective, descriptive.

Setting: Physician office and outpatient cancer centers in an urban area in the southeastern United States.

Sample: Convenience sample of 22 volunteer patients with cancer from four racial groups.

Methods: A questionnaire on computer experiences was followed by a hands-on computer session with questions regarding preferences for seven interface items. Data termination occurred when sample size was obtained.

Main Research Variables: Design of Internet education site for patients. Variables include preferences, computer, cancer, multimedia, and education.

Findings: Eighty-two percent had personal computers, 41% used a computer daily, and 95% believed that computers would be a good avenue for learning about cancer care. Preferences included display colors in blue and green hues; colored buttons; easy-to-read text; graphics with a simple design and large, clear pictures; serif font in dark type; light-colored background; and larger photo size in a rectangle shape. Most popular graphic icons as metaphors were 911 for emergency, picture of skull and crossbones for danger, and a picture of a string on an index finger representing reminder. The simple layout most preferred for appearances was one that included text and pictures, read from left to right, and was symmetrical in its placement of pictures and text on the page.

Conclusions: Preferences are necessary to maintain interest and support navigation through computer designs to enhance the translation of knowledge to patients.

Implications for Nursing: Development of multimedia based on patient preferences will enhance education, learning, and, ultimately, quality patient care.

Key Points . . .

- A gap exists in the literature about patient preferences for multimedia design.
- Many patients believe that computers could be a good avenue for learning about their venous access devices.
- Patients prefer displays with dark blue or green bold letters in serif type with a light background.

A gap exists in what is known about patient preferences or choices associated with the effective multimedia design in healthcare education. Only a few studies have included multimedia design as a concept in all types of patient education (Boyington, Wildemuth, Dougherty, & Hall, 2004; Cousineau et al., 2004; Enzenhofer et al., 2004; Ruland, 2004; Sweeney & Chiriboga, 2003), and even fewer are specific to patients with cancer (Berry et al., 2004; Davison & Degner, 2002; Degner, Davison, Sloan, & Mueller, 1998; Hahn et al., 2003). Multimedia design encompasses many areas of concern, including content, text, layout, navigation, user friendliness, and font. However, no known studies have specifically assessed multimedia design preferences of patients with cancer that include several racial groups. The purpose of this study is to describe computer experiences and design preferences for interface development that would translate into a product of educational media for patients with cancer. The premise is that known preferences (Ruland) will enhance educational knowledge and increase user satisfaction. Ruland further elaborated that the result, because of preference, will be the achievement of desired patient outcomes.

Literature Review

The few studies that address the effectiveness and satisfaction related to the use of multimedia in patient education have focused on noncancer populations (Boyington et al., 2004; Cousineau et al., 2004; Sweeney & Chiriboga, 2003) or general cancer populations (Berry et al., 2004; Green et al., 2004). Studies in noncancer populations have found that visualization increases satisfaction in patient education about coronary catheter and endoscopy procedures (Enzenhofer et al., 2004); audio, video, and interactive tasks increase satisfaction for couples receiving infertility treatment (Cousineau et al.); multimedia improves senior citizen knowledge (Sweeney & Chiriboga); graphics enhance written messages (Boyington et al.); and computer-assisted instruction can increase knowledge in patients undergoing joint replacement surgery (Tibbles, Lewis, Reisine, Rippey, & Donald, 1992).

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Researchers have reported that 46% of patients worldwide have a personal computer (Jeannot et al., 2004), 53% of patients with cancer have personal computers (Macklin & Chernecky, 2001), and 40% of them use a computer daily (Berry et al., 2004).

Studies involving patients with cancer have found that patients undergoing radiation therapy can have their symptoms and quality-of-life experiences captured by computers (Berry et al., 2004), touch screens are effective in patients with limited literacy skills (Hahn et al., 2003), computer-based models can increase knowledge and are rated highly for patient satisfaction (Green et al., 2004), and computer interactive systems can help women cope with breast cancer (Gustafson, Basworth, Hawkings, Boberg, & Bricker, 1992).

In summary, some scientific evidence exists about preferences for all types of patients regarding healthcare information and specific information needs of patients with cancer, but little information is available on patient preferences for multimedia design.

Conceptual Framework

Orem's (2001) theory of self-care was the framework that enveloped the practice of seeking information about venous access devices from the Internet. Researchers believe that if patient preferences are used, then patients are more likely to use the Internet to seek information related to health care. The present study also used translational research to support its findings as part of an integrated component in designing educational media for patients with cancer needing information about venous access devices. The conversion of the knowledge gained in this study to use in multimedia design would improve information seeking and usability and thereby enhance patients' education and overall well-being.

Purpose

The study had two purposes: to describe the computer experience of patients with cancer and to describe the preferences of patients with cancer regarding computer interface design.

Methods

Sample and Setting

A total of 22 patients with cancer who had venous access devices and resided in the United States were studied in relation to their preferences for multimedia design. The sample was chosen by placing a poster, with identical information on a take-home paper 8.5" x 11" in size, at each site. The poster included the study purposes, time commitment involved, what would be expected, where the study would be done and the date and time, the toll-free telephone number to call if interested, and the monetary payment for full participation. Potential subjects were accepted on a first-come, first-served basis based on filling the total sample size and with a minimum of four people of each race (African American, Asian, Caucasian, and Hispanic or Latino). Criteria also included a 1:4 ratio of men to women based on the knowledge that women are more likely to have venous access devices as a result of treatment of breast cancer (Biffi et al., 2004). Three sites were used for data collection: two outpatient, hospital-related cancer clinics and one private, multiphysician oncology office practice. All sites were located in the southeastern United States. As many as four private computer stations were set up at each site for the hands-on sessions, with two to three chairs at each computer.

Instruments

The research team developed the **Computer Experience Questionnaire.** The first items under "yes" were completed if a subject had used a computer before, and the "no" items were completed only by computer-naive subjects. Every participant completed the final item asking whether computers were helpful in learning about venous access devices. A **Computer Preference Form** was designed to capture the subjects' preferences regarding the aspects of the computer visual images.

Procedures

Computer experience: Patient knowledge of computers was assessed using a questionnaire. This was followed by a hands-on computer session, with one workstation for every two to three subjects. Each subject also completed a preference form. Computer experts, who were nurses or healthcare computer specialists, were available to teach participants how to use the equipment and answer questions that arose. Computer-naive people were paired with more experienced computer users. Pairing two computer-naive people together was avoided. Subjects were paired, however, for convenience. One computer expert was available for every two stations or maximum of six subjects. Subjects who were naive to the use of a computer mouse first were taught how to use the mouse and then how to use it in navigation. With each session, the groups of two or three participants chose a group leader to physically navigate through the computer preferences, with each participant making selections individually by marking them on the subject-coded Computer Preference Form. The form was an exact duplicate of what the subjects were seeing on the screen. Subjects were told to take as much time as they wanted to make a selection for every frame. Each frame included two or three preferences. After completion of each frame and reviewing each of the two items per frame, the group leader clicked on the next icon. Subjects could go back to any item at any time and change their answers regarding their preferences. The preference items included the areas of display color, menu buttons, text, text background, photo size, icon metaphors, and sample layouts about venous access devices. Snacks were provided between sessions for subjects. Sessions were limited to a maximum of 10 subjects to avoid problems with throughput in the research study and to allow enough time for questions and computer assistance if necessary. Subjects were rotated through session one (the Computer Experience Questionnaire), had a snack break, and were rotated through session two (the hands-on computer session and completing the Computer Preference Form). The Computer Experience Questionnaire session took an average of 20 minutes, and the Computer Preference Form session lasted as long as 60 minutes.

Assessing computer preferences: During the practice session, subjects were asked to move the cursor, using the mouse, over a particular color square they liked from 216 colors displayed on the color picker screen of Netscape's® Web-safe color palette. The color they chose would display a six-digit number and letter combination code, in a centered box located below the colors, and they were to write that code on the form after the words text box #1. This was

Table 1. Sample Ethnicity

Race	Female	Male	Total
African American	6	2	8
Asian American	3	1	4
Caucasian	4	2	6
Hispanic or Latino	3	1	4

N = 22

repeated for a second choice (text box #2) and a third choice (text box #3). Each subject's three choices were reviewed by the computer experts on site, and, when 100% compliance was reached, the subjects continued by choosing someone to be the team leader based on consensus. The practice exercise session took no more than two attempts for all subjects to obtain 100% compliance. Following the practice session, seven computer-preference exercises began. Exercise one repeated the practice session but asked the subjects which three colors they would choose, in order of preference, for use as computer display colors and to write their preferences on their Computer Preference Form. The second computer screen offered a preference of seven different types of menu buttons for use in making selections on a Web page. Choices were listed as pairs: The choice was for button A or button B. The buttons included text alone, pictures alone, and text with pictures. The third exercise included text type, color, and size. Participants were guided through a series of screens showing serif and san serif text on different-colored backgrounds. They were asked to make a choice between A or B. Extensive research has been done on readability of type that indicates that serifs with round opening and closing on letters, such as seen in Times New Roman font, facilitate the horizontal flow necessary for comfortable reading (Mansfield, Legge, & Bane, 1996).

In the fourth exercise, the subjects changed backgrounds and text until they determined their preferences. This exercise brought together previous design concepts, namely background color with text color, style, and size. The subjects made their choices from selections shown on the left-hand side of the screen, and their choices were revealed on the right side of the computer screen. Current research shows that because people are accustomed to reading books with black type on a white background, preferences for reading multimedia will include a dark type on a light background (Nahm, Preece, Resnick, & Mills, 2004). The subjects then clicked the "next" button to continue. The fifth exercise dealt with options on graphic size and shape. The sizes ranged from 0.7" diameter (smallest round graphic) to 2.25" wide rectangle (largest size) graphic. Shapes included were round, square, and rectangle. The sixth exercise involved the choice of icons, out of a total of five dichotomous A or B choices that included various graphics as metaphors for everyday concepts such as danger, important, question, reminder, and call the doctor. The seventh and final exercise involved sample layouts. The researchers introduced the subjects to three different user interfaces for a sample Web site for venous access devices. Subjects were given a brief scripted introduction to the site and then were asked to navigate the site to determine which site was preferred in both appearance and ease of navigation. All three interfaces worked as functioning sites with active links and several choices to click on for patient information per page. The three layouts used different fonts, text type, color, background, and picture sizes; however, the content information remained constant throughout each interface.

Table 2. Computer Experience Questionnaire

Question	n[a]	%[a]	% Yes (N = 18)
Have you ever used a computer?			
Yes	18	82	–
No	4	18	–
If yes			
Do you have a computer at home?	18	82	100
Do you have a computer at work?	16	73	89
How often do you use a computer?			
Daily	9	41	50
Weekly	1	5	6
Monthly	1	5	6
Less than once a month	7	32	39
What do you use computers for?			
Playing games	5	23	28
E-mail	15	68	83
Writing checks	1	5	6
Information	10	45	56
Work	9	41	50
Other	6	27	33
Do you use the Internet?			
Yes	14	64	78
What sites do you access?			
Entertainment	4	18	22
Chat groups	1	5	6
Information	10	45	56
Other	8	36	44
Have you ever bought anything on the Internet?			
Yes	5	23	28
Have you ever used the Internet to learn more about your disease or treatment?			
Yes	7	32	39
Do you think using computers could be useful to your caring for your venus access device?			
Yes	16	73	89
Question	**n[a]**	**%[a]**	**% No (N = 4)**
If no			
Which statement more closely describes you?			
I am interested in using a computer.	2	9	50
I have some interest in using a computer.	1	5	25
I have no interest in using a computer.	1	5	25
Are you afraid to use computers?			
Yes	2	9	50
Do you think using computers could be helpful in learning about your venus access device and caring for it?			
Yes	4	18	100

[a] N = 22

Note. Because of rounding, not all percentages total 100.

Table 3. Top Five Display Color Preferences for Each Choice

Color	Code	%
Choice 1		
Bright yellow	FFFFOO	100
Medium rose	FF3399	97
Light turquoise	99FFFF	90
Light blue	99CCFF	84
Sea-foam green	99CCC	81
Choice 2		
Light salmon	FFCCCC	100
Light orange	FF9966	97
Bright pink	FF66FF	91
Light purple	CCCFF	88
Medium purple	CC66FF	78
Choice 3		
Lime green	FFF33	100
Bright yellow	FFFFOO	97
Light pink	FFCCFF	91
Light peach	FFCC99	91
Soft, medium pink	FF6699	84

N = 22

Results

The sample consisted of eight African Americans (37%), six Caucasians (27%), four Asian Americans (18%), and four Hispanics or Latinos (18%). The total sample consisted of 16 women and 6 men (see Table 1).

Computer Experience Questionnaire

The questionnaire revealed that 82% of patients had previously used a computer. Of the users, 64% used the Internet and 100% had a home computer (see Table 2). Of the user group, 83% used a computer daily for e-mail, 56% for obtaining information, and 50% to do work related to their job. Thirty-nine percent used the Internet to learn more about their disease or treatment, and 89% believed that computers would be useful in helping them care for their venous access device. Of the computer-naive subjects (n = 4), 100% were able to learn how to use a mouse and how to navigate after a one-on-one session lasting up to 10 minutes. Three of the four computer-naive subjects stated they had an interest in computers after the entire hands-on session, but one subject stated that she still had no interest. That one subject stated that she was "still afraid" to use the computer on her own. In conclusion, the Computer Experience Questionnaire revealed that most patients used the Internet and about a third used it to gain information about health care. An overwhelming majority (95%) believed that computers would be a good avenue for learning about caring for their venous access device.

Computer Interface

The seven hands-on computer sessions produced the following results.

1. **Display color:** Subjects chose their top three preferences from the 216 display colors, and the top five ranked colors under each of the three preferences are seen in Table 3. Overall preferences included bright and light display colors.
2. **Menu buttons:** The results of preferences regarding navigation buttons on a menu (see Table 4) included the most popular choices to be 2A, which used a "▶" followed by text, and option 7A, which used large, square-shaped, 2.25" wide pictures.
3. **Text:** The three most frequent text choices were serif-type Times New Roman in 10-point font with blue lettering on a tan background (87%) or white background (86%) and sans serif–type Arial, nine-point font, with black lettering on a tan background (70%). The serif-type text, with round opening and closing on letters, is known to facilitate the horizontal flow necessary to make reading comfortable (Mansfield et al., 1996). It is used in books, newspapers, and magazines worldwide in the English language. The use of white color as lettering, Verdana font, and dark blue background were not preferred.
4. **Background:** A combination of style, color, and size of text on different backgrounds was tested. The exercise brought together two design concepts that had users interactively select, change, and choose their combination of text and background preferred. Top choices included bold text (97%), light background (81%), and larger-size text (91%).
5. **Photo size:** Five graphic sizes were shown, with 100% preferring a rectangle that was 1" long by 0.75" wide. This was followed by 97% who chose a 1" perfect square and 97% who chose a rectangle that was 0.75" long by 1" wide.
6. **Icons:** Graphics preferences as they relate to selected metaphors are listed in Table 5. Actual words, not pictures, were chosen overwhelmingly for the concepts of "tip" and "important," whereas the numbers "911" were preferred for "emergency." Metaphors best represented by pictures alone were danger (skull and crossbones), call the doctor (telephone), and reminder (string tied to index finger).
7. **Sample layouts:** Three different layouts as user interfaces were available for one Web site. Only one Web site was

Table 4. Menu Button Preferences

Descriptor	%
Button A	
1. Larger font but dead space to the right and left of a printed word	30
2. No heading, then a bolded arrow followed by a printed word in a larger font and no dead space	97
3. Small, round picture with a printed word underneath	68
4. Bordered frame with a picture, followed by the word descriptor	63
5. Circle with eight consecutive pictures and a ring of dead space in the middle	7
6. Rounded file-folder tab with two white-colored serif-font words printed on the tab with a medium-colored background	63
7. Four pictures placed in a square design with an open black space beneath each picture	80
Button B	
1. Smaller font but no dead space to the right or left of a printed word	70
2. Bolded heading, then a dash symbol followed by a printed word in a smaller font and right-side dead space	3
3. Left-justified margin with a printed word and right-side dead space	32
4. Key shape with a picture on the left side of the key and dead space on the right side with no word descriptor	37
5. Circle of arrows with the same word placed three times equidistant around arrows and a ring of dead space in the middle	29
6. Rectangular file-folder tab with two white-colored serif-font words printed on the tab with a dark-colored background	38
7. Three pictures placed in a longitudinal rectangle design with no open black space beneath any picture	20

N = 22

Table 5. Icon Metaphors

Icon	Depiction	%
Emergency	Numbers "911"	91
Emergency	Picture of an ambulance	9
Call the doctor.	Picture of a telephone	78
Call the doctor.	Picture of a male physician wearing a stethoscope standing in the vertical crossbar of a red cross	71
Call the doctor.	Picture of a stethoscope	29
Call the doctor.	Picture of a male physician standing in the vertical crossbar of a red cross	19
Call the doctor.	Picture of a woman with a phone to her ear	3
Danger	Picture of a skull and crossbones	90
Danger	Picture of a large "X" in a square	10
Important	Word "important" attached to a picture of a five-pointed star	83
Important	Picture of an exclamation point in a triangle	17
Question	Picture of six question marks in a nonlinear row with varied height placement	75
Question	Picture of a question mark behind a magnifying glass	25
Reminder	Picture of a bow-tied string on a pointed index finger	97
Reminder	Picture of an elephant	3
Tip	Word "tip"	75
Tip	Picture of a light bulb	25

N = 22

chosen so that content would not be a confounding variable. Appearance was preferred for layout 1 (72%), and navigation was preferred for layout 3 followed by layout 2. Layout 1 displayed a simple and symmetrical design, with a light background and bold text, using a left-sided tool bar and a long picture following the text in the header area. Layout 3 had all navigation choices on the left toolbar in large white text, with each individual line of text centered within a block, on a dark background, and used only words on the tool bar with no pictures. Layout 2 was similar to 3 in text, background, and tool bar, except that the tool bar displayed a box to click on after the text and the individual lines of text were not centered within a block.

Discussion

Display colors preferences were blue and green hues that were bright or light. Mean button preferences included color, clear text, and graphics that involved a simple design with larger clear pictures. The preferred text type was serif, such as Times New Roman font, in black type. The preferred background was a light color. Patients also preferred large, dark, bolded text on a light background. Larger photo size was preferred with the most popular being a 1" x 0.75" rectangle shape. The most popular graphic icons as metaphors were "911" for emergency, picture of skull and crossbones for danger, and a picture of a string tied in a bow on the index finger representing reminder. The simple layout most preferred for appearances was one that included text and pictures, read from left to right, and was symmetrical in its placement of pictures and text on the page. The layout preferred for navigation used larger buttons and the list of choices was on the left-hand side of the screen with little dead space remaining. With the implementation of these results in educational multimedia design, patients with cancer can be expected to increasingly seek information online regarding venous access devices, which will lead, ultimately, to better patient outcomes.

Limitations

Because of the small sample size and subject bias in the study, the generalizability of findings is limited. Future research should focus on replicating the study in a larger and more geographically representative sample while maintaining the minority representation from diverse ethnic backgrounds, including African Americans, Asian Americans, Caucasians, and Hispanics or Latinos, as well as patients from different clinical sites. The study also was limited because it included only English-speaking Americans, those who had a diagnosis of cancer, those who had a venous access device, and those who lived in the southern United States, and because only two or three choices were offered for the multimedia preferences. Although pairing occurred, researchers saw no evidence of influence because no discussion occurred between subjects. The leader's role was implemented as that of doer, the one who clicked on the next choice once both subjects had completed their individual choices.

Implications for Nursing

When creating an Internet design for educating patients with cancer, nurses need to consider layouts that will ease navigation for obtaining information and adhere to preferences to ease usage and thereby enhance learning through more effective translation. The design also should be as culturally and ethnically specific as possible. The main findings include the use of bold dark text with a light background, a left-sided tool bar, and larger, square photos in a symmetrical display. Additional research needs to be conducted regarding the preferences of other national and cultural groups and with comparison of metaphors for possible universal communication.

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