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Corinne M. Mar, Charles Chabal, Ruth A. Anderson and Amy E. Vore

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CORINNE M. MAR
Talaria, Incorporated, Seattle, Washington, USA

CHARLES CHABAL
Veterans Affairs Puget Sound Health Care System, Seattle Division & University of Washington School of Medicine, USA

RUTH A. ANDERSON & AMY E. VORE
Talaria, Incorporated, Seattle, Washington, USA

CORINNE M. MAR, PhD, is a clinical psychologist and computer programmer. She develops computer-assisted learning tools and interventions for healthcare.

CHARLES CHABAL, MD, Associate Professor, his research interests include improving healthcare through the use of innovative technology.

RUTH A. ANDERSON, PhD, is an education researcher who develops and evaluates the effectiveness of e-learning tools for healthcare.

AMY E. VORE, BA, assists in the development of educational content and runs usability and evaluation studies of e-learning tools.

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ADDRESS. Correspondence should be directed to:
CORINNE M. MAR, Talaria, Inc., 821 2nd Ave, Suite 1150, Seattle, WA 98104, USA. [email: cmar@talariainc.com]

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Abstract

Under-treated pain is a significant problem. Health care institutions are under increasing pressure from patients and accreditation bodies to improve staff training in pain management. Pain assessment, a necessary pre-cursor to good pain management, is a complex multi-step process requiring sophisticated understanding and superior communication skills. This article describes the development and usability testing of an interactive, Internet-deliverable, multimedia tutorial to teach best practice pain assessment. The software platform allowed non-programmers to create multimedia tutorials and included the capability to simulate role-plays. The tutorial was designed to actively engage and respond to the learner and to include skills practice. Twenty-five nurses took the tutorial and rated it positively on a usability questionnaire in terms of ease-of-use and learning method.

Keywords

communication skills, computer-assisted learning, nurse education, pain assessment, role-play

Introduction

PAIN ACCOUNTS for over 70 million outpatient visits in the United States (Carr, James, Bruera, Campbell, Hansson, Lema, Large, Mather, Miaskowski, Poulain, Shapiro, Stein, & Turk, 1993). Moderate to severe pain afflicts roughly half of all postoperative patients, three-quarters of patients with advanced cancer (Carr et al., 1993), and over half of residents in long-term care facilities (Fries, Simon, Morris, Flodstrom, & Bookstein, 2001). Insufficiently managed pain is still a major complaint of recipients of end-of-life care (Singer, Martin, & Kelner, 1999; Steinhauser, Christakis, Clipp, McNeilly, McIntyre, & Tulsky, 2000). The elderly, the young and minorities are at particular risk for under-treatment of pain (Bernabei, Gambassi, Lapane, Landi, Gatsonis, Dunlop, Lipsitz, Steel, & Mor, 1998; Cleeland, 1998). The Joint Commission on Accreditation of Healthcare Organizations (JCAHO, 2001) has called for an increased focus on pain management. Patients are also demanding better care. Nevertheless, good pain management continues to be a formidable challenge in most areas of healthcare.

Pain management is a complex task in large part because pain is a multi-faceted subjective response, with features that include intensity, quality and personal meaning (Agency for Health Care Policy and Research, 1992). Therapeutic decisions—and ultimately the patient's quality of life—are based on the validity of accurate pain assessments. Indeed, successful pain assessment and intervention in the context of patient expectations and education are shown to significantly impact reported pain (VanDalfsen & Syrjala, 1990), measures of physiological function (Lewis, Whipple, Michael, & Quebbeman, 1994) and even the length of hospital stays (Rauck, 1996; Tsui, Law, Fok, Lo, Ho, Yang, & Wong, 1997). However, pain assessment is a challenging skill to learn. It is a multi-step process that requires a thorough understanding of multiple assessment scales, the ability to use the scales with diverse types of patients in a variety of clinical scenarios and the ability to establish rapport among providers, patients, and often, family members. Ultimately, good provider–patient communication is the key to good pain assessment.

For healthcare institutions, training staff about the sophisticated process of pain assessment is an ongoing, challenging requirement. As of 2001, healthcare facilities that seek JCAHO accreditation must ensure that their institution provides quality pain assessment and management services (JCAHO, 2001). While JCAHO requirements provide excellent guidance for standards of care, the responsibility of enacting the requirements falls to individual healthcare institutions. This is further complicated by the need to document an ongoing process that assures actual quality improvement and provides for continuing training. Again the responsibility for enacting these national standards falls directly to the local institution. Most institutions address these needs by ongoing inservice training, learning seminars and lectures and training of new employees. The quality and thoroughness of these training efforts varies greatly depending on a host of local factors. The factors may include the amount of time and resources available for training, the quality of the local instructors and ability of the organization to enact and monitor ongoing training efforts. Staff turnover and increasingly diverse workforce and patient populations further complicate training efforts. There is a clear need for tools that enhance the quality of training, provide for a standardized educational approach and allow for ongoing assessment of training effectiveness and learner needs.

The Veterans Affairs Medical Center in Seattle provides an example of how PARIS may be used to support institutional educational efforts. This institution is committed to improving pain assessment and management in both their outpatient and inpatient facilities. The current program of education and quality improvement relies primarily on lectures and inservices, a form of education that is relatively passive for the learner. The facility has received a grant to integrate PARIS into this training program. PARIS will reinforce the issues raised in lectures and inservices via a more interactive environment, allow learners to actually practice the recommended communication skills in simulated role-plays and receive feedback on how they handled case examples by listening to best practice techniques. We envision that other institutions will use PARIS in a similar manner.

The current pilot project consisted of three

components: (a) content development; (b) software development; and (c) usability study. It was designed to address some of the challenges associated with training a healthcare workforce about pain assessment. The project created an Internet-deliverable interactive multimedia computer tutorial to teach best practice pain assessment. The tutorial, named PARIS (Pain Assessment via Role-play Internet-delivered Simulation), was designed as a supplement, rather than a replacement, for current training practices. It is designed to provide cost-effective interactive skills training, allowing expensive inservice training to be used more efficiently.

PARIS was designed to create an engaging learning experience for the user reflective of the following principles of learning:

1. Multiplicity: knowledge is dynamic and complex; therefore, instruction should use multiple perspectives and representations.
2. Activeness: learning should be an active rather than a passive process.
3. Accommodation and adaptation: instruction should be responsive to ongoing appraisal of learner understanding.
4. Articulation: learning is enhanced by providing active feedback to the learner (Koschmann, Myers, Feltvoich, & Barrows, 1994).

These principles are reflected in facet-based instruction (FBI), an educational approach that was developed in cognitive science research by diSessa, Hunt, Minstrell, van Zee and others over the past decade (diSessa, 1993; diSessa & Minstrell, 1998; Hunt & Minstrell, 1994; van Zee & Minstrell, 1997). Consistent with other models of learning, such as those by Bruer (1993) and Glaser (1988), facet-based instructional theory states that training is more effective when it builds on a learner's pre-existing conception rather than simply providing the student with a set of facts. Using learner understandings as a point of departure, FBI lessons tailor information to individual learner needs, taking them through a series of problem-solving exercises that prompt them to question and ultimately modify (refine) their understanding. Ultimately, their understanding is aligned with the optimal conception. This happens, however, as a result of personal reasoning and interaction with underlying concepts, not just through the memorization of a 'right answer', as occurs in many traditional learning environments.

FBI has been used successfully to teach physics (Hunt & Minstrell, 1994) and statistics (Clarkson, Madigan, Donell, Hunt, Keim, & Minstrell, 1997) to high school and university students. It has also been used in a computer tutorial to teach healthcare providers pain management for elderly patients (Raffety, Allendoerfer, Minstrell, Chabal, Dunbar, & Nakamura, 2000). In that study, healthcare providers who completed the FBI-based tutorial learned significantly more than controls given written materials.

Both Koschman's principles and facet-based instruction inform the content of PARIS. Learner facets (understandings), gathered throughout the content development process, form the basis of the lessons focusing on the communicative interactions that are fundamental to pain assessment. Combining several interactive activities (e.g. problem solving, anticipation and prediction exercises, role-play, etc.), the tutorial actively engages learners, encouraging them to consider not only the reasons behind the steps in a given task, but also the perspective of the patients with whom they interact. Key among these techniques is the simulated role-play feature.

Role-play is a well-recognized and effective method of improving communication skills (Baile, Lenzi, Kudelka, Maguire, Novack, Goldstein, Myers, & Bast, 1997; Langewitz, Eich, Kiss, & Wossmer, 1998). However, live role-playing requires an intensive commitment of human resources and coordinated scheduling. Moreover, it can be difficult for some learners who are intimidated by improvisational performance in front of a group of peers. In an effort to increase training efficiencies, the project developed computer-based role-play simulations, which are self-paced and available on demand to learners. There is evidence that computer-based simulations are an effective means of training for conversation skills (Roston, 1994), certain nursing skills (Ribbons, 1998) and for advanced cardiac life support and anesthesiology (Schwid & O'Donnell, 1992; Schwid, Rooke, Ross, & Sivarajan, 1999). However, little has been written regarding the use of role-play simulation and other computer-delivered multimedia technologies in the teaching of pain management.

The purpose of this article is to describe the development of the content of the PARIS tutorial, the design and results of the usability study and the implications of these results for further research and development.

Methods

In this section, we describe the software and content development of PARIS, as well as the usability study. The software, described in more detail below, was designed so that it could be reused to create other tutorials. The content was based on best practice pain assessment standards as taught at the Veterans Administration Puget Sound Health System—Seattle Division (Seattle VA) by co-author Dr Chabal, as part of the Veterans Healthcare Administration- Institute for Healthcare Improvement Pain Management Collaborative. The process of translating these inservice trainings into interactive multimedia is also described below. Finally, we describe the usability study in which a sample of nurses completed PARIS and provided feedback as to its usability and perceived utility. Usability testing is a standard part of creating a software product. It determines whether the software performs as designed and whether users find the software satisfactory, that is, easy to use, engaging and useful.

Software

Talaria uses modular, object-oriented software engineering, use-case driven requirements and specifications and an incremental development process. Software development followed a spiral model: an iterative cycle consisting of requirements, specifications, coding and testing (Boehm, 1988; McConnell, 1996).

The PARIS tutorial was created using the Talaria Tutorial Software Platform (TTSP). The Talaria Tutorial Software Platform uses the following technologies: Java 2, Java Server Pages (JSP), Microsoft SQL Server 7.0 and RealAudio from RealNetworks. This software enables rapid prototyping of interactive multimedia Internet-delivered tutorials. Multimedia features include text, pictures, graphics, audio, video and animation. Interactive features include multiple choice and essay questions, 'pop-up' windows, drop-down text and recording and audio playback. User responses are recorded in a database allowing branching and targeted feedback based on user actions and responses.

The TTSP includes a 'builder', which allows content authors, without computer programming experience, to input and edit content ('design mode') and then click a button to preview the formatted content as it will be seen by the user in a browser ('runtime mode'). Other features include: (a) the conceptual structure of a book; (b) templates for creating common page types; and (c) custom tags for controlling page layout including the placement of custom features on a page.

Another very useful feature of TTSP is the ability to simulate a role-play. This requires streaming audio to users, recording their responses, repeating this any number of times and then playing back the entire 'dialog'. Until recently, this has been difficult—if not impossible—to do on the Web. Content authors can use this learner-controlled digital recording system to teach communications skills by designing role-plays in which the computer plays one role and the user the other. Users provide real-time verbal responses to simulated persons and then listen to and evaluate their response in the context of the entire dialog.

Content development

The content development process involved translating the best practice pain assessment based on published standards (JCAHO, 2001) into a multimedia tutorial. This is a time-consuming process that requires: (1) establishing learning objectives and instructional strategies; (2) storyboarding and writing the content; (3) creating an appropriate user interface (UI); and (4) adding audio-visual enhancement. Finally, periodic reviews must be conducted with both area experts (MDs and RNs with recognized expertise in pain management) and end users (nurses and nurses in training) to ensure the authenticity and veracity of the content.

Learning objectives and instructional strategies Learning objectives were established from best practice guidelines. The instructional strategies to reach those objectives were based on the FBI pedagogical approach. A facet-based approach means that the content is built

upon the conceptions of a group of target learners (in this case nurses). Information and exercises are then developed to target specific learner conceptions (facets). In pure FBI tools, elaborate branching is involved as feedback and exercises are specifically tailored to guide learners from one conception to another. PARIS, however, is not a pure FBI tool. Learner facets guided the development of lessons and individual activities rather than serving as a point of departure for individual learning paths. Given the nature of the pain assessment content to be covered in this pilot project (communication and task oriented as opposed to complexly conceptual material) and our target audience (busy nurses in a variety of settings as opposed to students in a contained classroom), we found a more streamlined approach to be most effective.

To determine the PARIS learner facets, we used two approaches: (a) gathering input from subject-area experts; and (b) questioning target learners via a questionnaire. Experts helped to develop the facet questionnaire. A sample of about 30 nurses with a variety of levels of nursing experience completed the questionnaire. In addition, experts helped to elucidate learner facets based on their many years' teaching to learners' misconceptions about pain assessment. Nurse responses, in conjunction with expert knowledge, provided the facet base for the tutorial content. Ideally, a larger sample would be used to gather facets, however, due to the pilot nature of the study, this seemed like an adequate start especially since the PARIS tutorial automatically gathers learner answers and stores them in a database. These answers are available for review by instructors or by content developers who are updating the tutorial content. (We have already begun to incorporate new facets found during the usability study into the Phase II project currently under development.) Learner facets gathered before and during the development of the tutorial allowed us to better design interactive activities that address the problematic areas of understanding in our target audience.

Storyboard/content outline Storyboarding is a process by which a coherent narrative can be established. With regard to PARIS, storyboarding in the broadest sense involved the sequencing of all the lessons in the tutorial and the selection of specific patient cases to illustrate the learning objectives in a comprehensible order. Care was taken to depict a variety of patients (with regard to age, race and gender) and medical conditions.

User interface and multimedia content Guided by the content and learning objectives, the graphic designer developed the 'look and feel' of PARIS. This involved creating a recognizable and coherent design, which could be applied to various kinds of pages (text, recording, pop-ups, etc.). It also involved determining the tools to be included in the navigation bar and integrating them in a user-friendly way into the page design.

The final product The PARIS tutorial provides an introduction to the fundamentals of pain assessment. Geared toward students and practitioners in the nursing community, the focus of this tutorial is limited to the assessment of acute, postoperative pain in a typical patient population. The final version consists of four principal parts: (1) Understanding Pain; (2) Overview; (3) The Steps of Pain Assessment; and (4) The Practice Zone (see Table 1). In addition, PARIS also includes a detailed introduction to first-time users with varying levels of computer experience.

Understanding Pain presents pain as a biopsychosocial experience, describable in terms of intensity, quality and personal meaning. This section also introduces pain assessment as an important communicative interaction between healthcare providers and their patients. The *Overview* provides the learner with a full audio best practice example of a pain assessment. *The Steps of Pain Assessment* breaks down the pain assessment interaction into three principal parts: orientation, measurement and treatment. Each of these is broken down further into a series of brief didactics and interactive activities followed by a review. *The Practice Zone* combines content from all sections of the tutorial in a series of interactive review activities. Best practice examples are provided so that learners can self-assess their mastery of the material.

Each section of PARIS takes approximately 10 to 20 minutes to complete and may be viewed in a single session (approximately 1.5 hours) or in a series of sessions.

Table 1. Tutorial content

Understanding pain	*Overview*	*The steps of pain assessment*
1. Function	Full audio-visual example of pain assessment	1. Orientation Importance Patient role
2. Types		
3. Under-treatment		2. Measurement Taking a rating Abnormal ratings Setting pain level goal
4. History		
5. Dimensions		
6. Pain scales		3. Treatment plan Side effects Reassessment

How PARIS works In PARIS, brief lessons are enhanced and reinforced through a combination of audio, recorded and written activities designed to keep learners actively engaged. Audio pieces provide learners with 'testimonials' by pain sufferers and 'expert examples' of best practice with which to compare their own responses.

Short answer problem-solving exercises encourage learners to consider and articulate their thoughts regarding underlying concepts. In one example, the learner is given a scenario in which a patient reports an unexpectedly high level of pain. The learner is then asked to suggest reasons why the patient might give such an elevated pain score. The learner's written response (typed into a textbox) is saved to a database. The page that follows provides the learner with a list of possible responses to the question. These responses represent the facets that were determined through our questioning of experts and learners (nurses) described above. The learner can choose the facet that most closely matches their own response, and can explore others as well. Each response leads to a feedback page that addresses the learner's conception—if this conception is incomplete or incorrect, the feedback attempts to modify/correct the learner's conception. This series of pages is shown in Fig. 1.

Simulated role-plays (recording activities), like the problem-solving exercises, prompt learners to fully engage with the target material. As learners interact with simulated patients in these voice-recording exercises, they have the opportunity to practice, examine and improve the key communication skills that have been explored in preceding pages of the tutorial.

An example of a tutorial role-play page is shown in Fig. 2. After hearing a portion of a provider/patient dialog, the learner takes over the role of the provider and records their response to the patient. This can require one or more 'exchanges' with the patient. By following the cues given, the learner completes the conversation in an appropriate manner. The learner can then 'replay' the conversation to decide whether or not to repeat the exercise before moving on. Role-play exercises become more complex throughout the tutorial, commensurate to the learner's growing familiarity and comfort level with both the technology of the tutorial's role-play and the pain assessment process.

Unfortunately, the technology does not exist to accurately interpret the phonetic and semantic aspects of human conversation. Consequently, it is not possible to provide a computerized objective assessment of an individual's role-play performance. Instead, on the page following the role-play, learners must engage in a self-assessment of their performance. There, learners can hear an 'expert' interacting with the same simulated patient, compare their response and then try the role-play again if they choose. Since the expert example is placed after rather than before each role-play exercise, the learner must apply learning from previous lessons and examples to a new situation. This sequence discourages learners from simply mimicking the best case example the first time they attempt the exercise, while encouraging them to develop self-evaluation skills.

Usability study

The purpose of this study was to test the

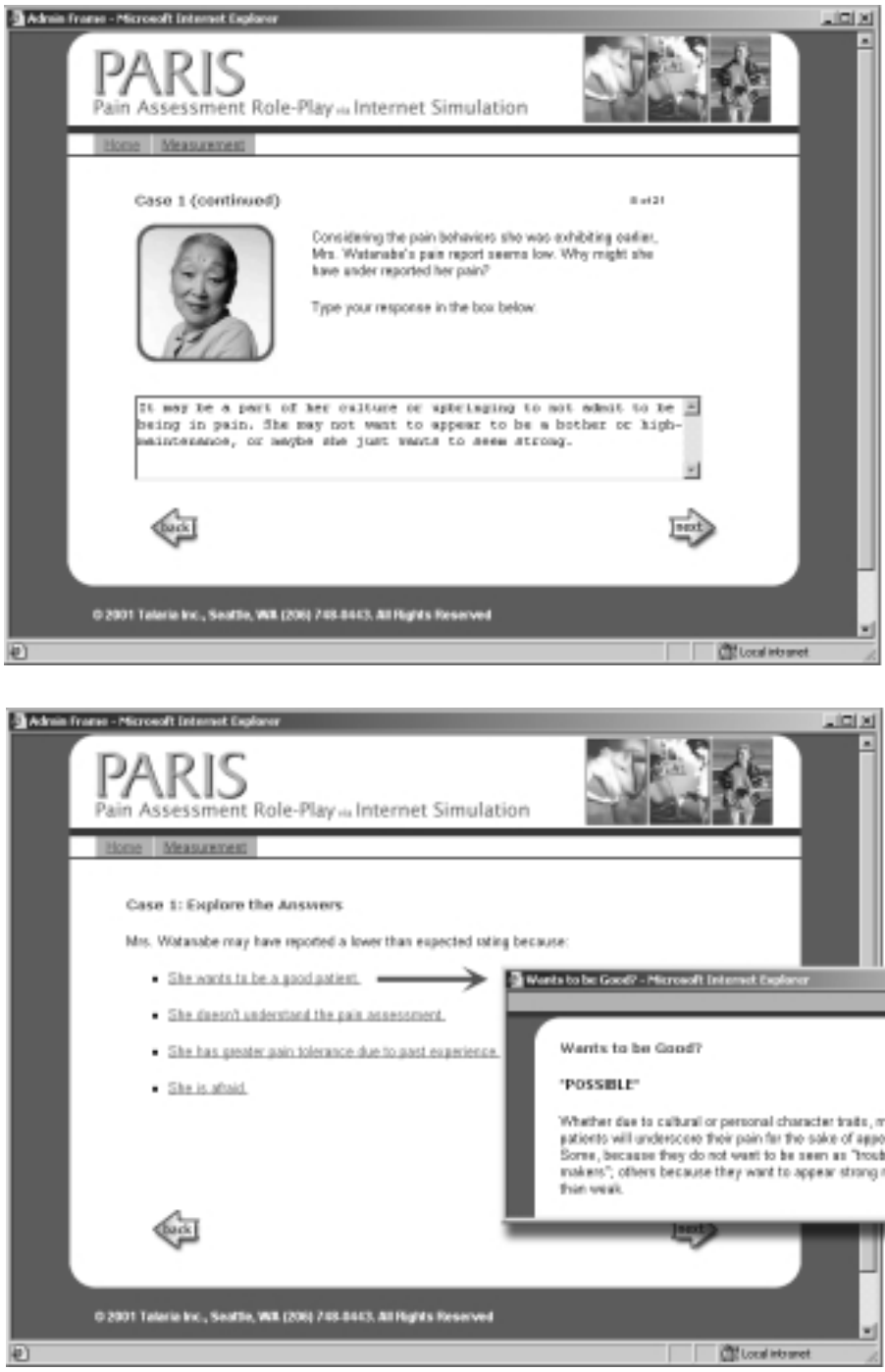

Figure 1. Problem-solving exercise.

Figure 2. Example of a role-play exercise.

feasibility and usability of PARIS. For feasibility, we hypothesized that the software would perform with no errors of branching or logic, few errors that required restarting the program and no errors that required rebooting the computer. For usability, we hypothesized a mean rating of 4 or above (on a 1 to 5, strongly disagree to strongly agree, Likert scale) in the desired direction for the usability questionnaire items.

Procedure Participants were scheduled in two-hour time blocks to view the PARIS tutorial at the study site. After consent, they filled out a demographic questionnaire that included questions about their experience with pain assessment. Participants took the tutorial on desktop computers in a private office, using a headset with microphone. After completing the main body of the tutorial, they filled out the Usability Questionnaire and were administered the Usability Interview by the research assistant (RA). If there was time, participants were asked to view and give their feedback about the 'Practice Zone' section. This section was evaluated separately because it was still being developed (had not undergone any testing and revisions). Also, we were concerned that it would make the study too long for some participants. Participants were paid $60 plus parking for their participation.

Participants Nurses and nursing students were recruited via flyers posted at hospitals and nursing schools in the Seattle area. Additionally, participants heard about the study by word-of-mouth. Our goal was to obtain a diverse sample

of nurses in terms of experience, education, age, gender and ethnicity. The diversity in the sample did not require any screening or oversampling. We scheduled the first 29 interested participants, 25 of whom showed up for their appointments and all of whom completed the study.

Participants ranged in age from 20 to 64 with a mean age of 34.5 and standard deviation of 10.8. The sample was 36 percent male, 36 percent ethnic minority (seven Asian/Pacific Islanders, two Africans) and 28 percent non-native English speakers. Fourteen (56%) were students in nursing school (four LPN, five BSN, five Masters/PhD). Twenty (80%) of the sample already had nursing degrees (three CNA, two LPN, six ADN, seven BSN, two Masters). Note that this means nine participants had a previous nursing degree *and* were pursuing additional nursing education. Seventeen participants reported having worked as nurses. Their years of nursing experience ranged from one to 30 years with a median of five years (M = 8.1, SD = 9.1). Twenty-two (88%) reported some experience doing pain assessment either at work or in school clinics, including 10 who performed daily pain assessments as part of their job. Two had only classroom exposure to pain assessment and only one participant had no experience with pain assessment. Twenty-two participants (88%) used a computer daily and 76 percent accessed the Internet daily.

Measures There were two measures of usability administered to participants after completing the PARIS tutorial. The Usability Questionnaire consisted of 16 statements (see Table 2), each with a five-point Likert response scale coded as follows: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree. The items were designed to cover ease of use, engagement/likability and utility. Three items were reverse-coded (items 2, 5 and 10). We included the reverse-coded items to guard against the possibility of the response styles of acquiescence or criticalness. However, this was not a large concern given the type of questionnaire and the transparency of the items (Murphy & Davidshofer, 1991).

The Usability Interview consisted of 10 open-ended questions asked by the research assistant. Questions asked about what they liked/disliked, what they learned, how the tutorial compared to other forms of learning and what they thought of specific aspects of the tutorial such as the role-plays.

Results

All 25 participants completed the PARIS tutorial usability evaluation. Most participants (68%) took between 60 and 90 minutes to complete the tutorial (not including the Usability Questionnaire and interview or Practice section). All participants completed the tutorial in less than two hours; four completed it in less than 60 minutes. Three of the four participants who took over 90 minutes were non-native English speakers. Fourteen participants also completed the informal evaluation of the Practice Zone section.

Except for two temporary minor technical difficulties, the software functioned without problems (no errors of branching or logic and no errors that required rebooting the computer). This result supported our hypothesis of technical feasibility.

Participants were quite positive about the tutorial. The mean score across all items for subjects ranged from 3.31 to 5.00 with a mean of 4.31 (median = 4.31 also) and a standard deviation of 0.427 (with items 2, 5 and 10 reverse-coded). This result is statistically significant, that is, we can reject the null hypothesis that participants' mean score was less than 4 at $p < .002$ (two-tailed, $t = 3.589$, d.f. = 24).

Results by item of the usability questionnaire are shown in Table 2. The tutorial was rated positively by 84 percent or more of the sample on all but two of the items (7and 12). In spite of the level of diversity of the sample (0 to 30 years of nursing experience), 72 percent agreed with item 7: 'The level of the material was appropriate for my learning needs'. Some of our sample are likely to be the supervisory staff who give rather than take the inservice trainings therefore the material is not appropriate for their learning needs. This hypothesis is partially supported by indications of a trend for those with less experience to agree more strongly with this item. Presumably institutions that use PARIS will give it to those staff for whom it is most appropriate. Encouragingly, 92 percent of the sample agreed that the information in the tutorial was useful. Additionally, almost everyone agreed (95

percent of the 21 participants that answered these items) that they were 'interested in learning more about pain assessment in the future by using tutorials like this one' and would 'recommend this program to other nurses or nursing students'. Eighty-four percent of the participants thought that the recording role-play exercises 'enhanced my learning'.

The other item that received a less than 84 percent agreement in the desired direction was item 12: 'only' 72 percent of the participants agreed with the statement, 'The conversations between nurses and patients were realistic'. Consequently, we will focus on improving the realism of the dialogs in the next version of the tutorial.

Results of the post-tutorial interview indicate that participants liked the interactivity of the tutorial, finding the role-play exercises in particular to be 'engaging' and 'interesting'. One participant commented that, 'the interactive exercises helped me apply knowledge and retain what I learned'. Several reported that the essay questions 'helped me think'. Most participants said the tutorial either taught them something new about using the pain scale, or about communicating with patients with respect to pain assessment.

Many participants felt the role-play exercises provided an effective way to practice patient–provider interactions before dealing with patients in 'the real world'. During the usability interviews, non-native speakers of English emphasized that the role-play practice and expert examples were especially useful, as

Table 2. Usability questionnaire results

Item	*Median (range)*	*M (SD)*	*% Agreement (N)*
1. I enjoyed the tutorial	4 (3, 5)	4.32 (0.69)	88% (25)
2. The software program was hard to use	1 (1, 5)	1.56 (0.87)	4% (25)
3. The instructions were clear	4 (3, 5)	4.36 (0.57)	96% (25)
4. The information presented in the tutorial was useful	5 (3, 5)	4.56 (0.65)	92% (25)
5. I would have preferred to read the information in a book	2 (1, 3)	1.76 (0.66)	0% (25)
6. The tutorial held my attention	4 (3, 5)	4.32 (0.63)	92% (25)
7. The level of the material was appropriate for my learning needs	4 (2, 5)	4.08 (0.86)	76% (25)
8. The program was an effective way to learn	4 (3, 5)	4.32 (0.63)	92% (25)
9. The recorded role-play exercises enhanced my learning	4 (2,5)	4.24 (0.93)	84% (25)
10. The tutorial was boring	2 (1, 3)	1.76 (0.66)	0% (25)
11. The essay questions helped me to think for myself about the issues presented	4 (3, 5)	4.36 (0.57)	96% (25)
12. The conversations between nurses and patients were realistic	4 (2, 5)	3.88 (0.88)	72% (25)
13. Listening to the dialog examples helped me to learn	4 (3, 5)	4.28 (0.61)	92% (25)
14. This program was relevant to my nursing experiences	5 (3, 5)	4.44 (0.65)	92% (25)
15. I am interested in learning more about pain assessment in the future by using tutorials like this one	4 (3, 5)	4.38 (0.59)	95% (21)
16. I would recommend this program to other nurses or nursing students	5 (3, 5)	4.52 (0.60)	95% (21)

Note: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree

did those nursing students who had had few opportunities to observe real-life examples. Although some participants reported that they initially felt uncomfortable speaking into the microphone and hearing their own voice recorded, most of these added that they grew comfortable after they became familiar with the recording panel. A few thought that certain aspects of the recording exercises were repetitive.

One participant felt that some of the pre-recorded 'patients' were too 'ideal' (educated, articulate, cooperative) and that more diverse examples should be added. Another participant suggested that including challenging patients (e.g. drug addicted or children) would be helpful for nurses in training. Still others thought the various dimensions of pain assessment should be explored, including non-verbal behaviors and the use of alternative pain scales. In general, however, participants preferred the computer tutorial to both books and lectures. They found it interesting and useful because of its interactivity and opportunity for self-paced practice.

Discussion

There were several limitations to this study. As in most studies, participation was voluntary, resulting in a self-selected sample. This may have made the participants more likely to be interested in and positive about the tutorial. Furthermore, the demand characteristics of the study may have encouraged positive feedback and comments. However, we did emphasize in the instructions to the participants that the tutorial was a work-in-progress and that the purpose of the study was to get their honest feedback, including criticism, and that this feedback would be used to improve and expand the tutorial.

Perhaps the greatest limitation of this study was its pilot nature and focus on usability and feasibility. Because of this, the small sample size did not allow for more analysis of variables that may have influenced usability results and there was no comparison method of learning. In addition, educational effectiveness was not tested. These important issues will be addressed in the larger Phase II project, which will include a larger scale randomized trial with a control group and a behavioral measure of educational effectiveness.

An important step in determining the viability of any e-health product is to establish its acceptability among members of the target audience. Results of the usability study demonstrate that participants found the program appealing and easy to use. Over 90 percent of the participants agreed that PARIS is an 'effective way to learn'. One person said, 'The tutorial mimics life experience. It stays with you longer than a book.' Ninety-five percent of the participants agreed that they were 'interested in learning more about pain assessment in the future by using tutorials like this one'. These responses lead us to believe that interactive communication-based programs will have an ongoing place in the training of healthcare professionals. In the post-study interview, several participants suggested that PARIS be included in the educational curriculum of all healthcare professionals interacting with people experiencing physical pain.

With an emphasis on communication and active learning, PARIS is a useful training tool for individual learners, educators and institutions interested in improving pain assessment skills. For the individual learner, PARIS is easy to use and available on demand. Multiple methods of presentation, including audio, text and graphics, help to accommodate both visual and auditory learners, while simulated role-plays require learners to actively apply what they are learning in patient–provider interactions. They can then self-check the quality of their interactions and responses by comparing them to best practice examples.

Educators who supplement their trainings with PARIS can use the data-gathering feature of the software to access learner responses given throughout the tutorial. These data could then be used as a basis for program revision and to better tailor inservice trainings to specific group needs.

At the institutional level, the software's data-gathering capability could be used to assess staff's knowledge of pain assessment relative to hospital or other standards. Furthermore, the software's builder feature, which allows for customization of content, would allow for any content to be quickly and easily altered to reflect new requirements and protocols in pain management as they occur.

Finally, PARIS can be used to promote a standardized language and approach with regard to

pain assessment. Three nurse educators and several participants in the post-usability interviews indicated that problems in pain assessment accuracy often result from a lack of uniformity of approach by all members of the healthcare team. Physicians, for example, do not always use the same language as nurses to elicit pain ratings from patients. This can result in discrepancies in pain reports that can negatively impact the patient's pain management program. Most participants in the study suggested that the entire healthcare team could benefit from PARIS, in part, because it offers a common language and an approach that is easy to employ.

To our knowledge there are no other computer-based interactive pain assessment training programs with the capabilities currently available in PARIS. A survey of healthcare education distributors, Internet sites and traditional publishers supports this assertion. However, simulation-based training is offered by several companies in other areas of healthcare. Companies such as Mad Scientist (Alpine, UT) and Anesoft (Bellevue, WA) sell software designed to assist with training in many areas of healthcare such as Advanced Cardiac Life Support, management in the intensive care unit and trauma management. Like PARIS, these products do not aim to supplant traditional training but to provide learners with opportunities to practice skills thereby reinforcing and complementing more traditional approaches.

We are planning further research and development of PARIS to address some of the limitations of this pilot study. In particular, we will do a controlled, randomized trial comparing the tutorial's usability and teaching efficacy to a 'usual training' control condition, e.g. videotaped lecture. We will measure efficacy not only through a written test of knowledge, but also by coding behavior with standardized test patients. In terms of content revision, there were several issues raised by our sample of nurses that will be addressed. These include expanding the content of PARIS to include many types of pain (e.g. cancer pain, chronic pain, etc.) and kinds of patients (e.g. less educated, children, etc.). We will also subject the dialogs to more review in order to render them as realistic as possible.

Future research with PARIS must address the issues of research in e-health in general: What is the appropriate control condition? If we want to test the delivery method, then holding the content constant across delivery method is a required, non-trivial task. What are the appropriate outcome measures? When teaching skills in addition to knowledge, the true target of the intervention is behavior, yet behavior is relatively difficult to measure. What is required to ensure that empirically supported e-health interventions are actually used in healthcare settings? The potential of computers to deliver cost-effective education and training, whether via the Internet or via desktop programs, will go unrealized unless such interventions are designed to accommodate the existing healthcare infrastructure.

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