



# DIANA2: Computer-Based Teaching of Elder Care

Grant Number: R44CA74433-03

## Abbreviated Abstract

Talaria, Inc proposes to continue development of DIANA2, a computer-aided software tool for medical education, and apply it to teaching about pain and symptom management in the elderly. Using a technique called "facet based learning", DIANA2 engages learners in interactive vignettes that hone clinical skills more quickly and conveniently than traditional training methods. The training is to be delivered over the internet. In Phase I, Talaria developed DIANA2 modules that assess and ultimately modify learners' knowledge about pain management in the elderly. In pre to post test comparison against a control group using traditional techniques, the DIANA2 group improved "three times as much." In Phase II, a comprehensive program for teaching this topic will be developed, and its effects tested with a target audience of medical students.

## Primary Investigator

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Brian Raffety, Ph.D., was the PI of Talaria's geriatric care project FABLE for ElderCare. His research expertise includes modeling interpersonal transactions and assessing stress and coping, particularly through longitudinal electronic diary studies. He has extensive experience with Internet software design, including interactive educational simulations, documentation, and testing. The builder tools he has designed and implemented allow non-programmers to author interactive Web-based tutorials and assessment instruments. Dr. Raffety has united software, domain, and learning experts for collaborative design of projects. His doctorate was taken at the University of Washington in Personality and Clinical Psychology, and he has an M.S. from the University of Oregon in Gerontology, Community Health, and Public Policy.

## Research Team & Affiliations

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## Total Budget

\$ 748,696.00

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## Research Objectives

The evaluation study performed during Phase I provided the proof of concept for DIANA2 (Diagnostic Instructional Aid for Noetic Advancement) for elder care as a training tool for health care education. We proposed to further develop DIANA2 for elder care, an assessment and learning system that builds on relatively simple, cost-effective cognitive models. These models focus on characterizing users' understandings and diagnosing changes in these understandings during the course of learning. Following Hunt and Minstrell (1994), we have called these understandings "facets." Extensive catalogs of facets do not yet exist for pain and symptom management for the elderly, and during Phase II, we plan to refine and complete the development of a facet-based learning tool (DIANA2) accessible over the Internet.

## Theory/Hypothesis

Learners who use interactive facet-based learning (FBL) systems achieve greater content mastery than learners who use content-matched flat-format web pages such as those available through leading medical information and non-profit web sites.

## Experimental Design

Subjects were randomly assigned to two intervention groups: Group 1, the FBL intervention group, and Group 2, the standard web education intervention group. All subjects were administered a computer-based pre-test that assessed their baseline knowledge of the causes, symptoms, and care requirements for patients with emphysema. There were two versions of the assessment instrument and the instruments were counter-balanced as pre- and post-tests. Half of each intervention group received test version A as the pre-test and B as the post-test, and half received version B as the pre-test and A as the post-test.

## Final Sample Size & Study Demographics

Subjects included 40 second-year medical students at the University of Washington School of Medicine. None of the subjects had taken medical school coursework in respiratory illness prior to the study. The sample included 62% female participants, and participant ethnicity was 80% Caucasian, 15% Asian, and 5% other ethnic groups. The mean age of participant was 27.3 years and 82.5% of the sample was under 30.

## Data Collection Methods

Following the pre-test, the subjects logged on to the study web site. Group 1 (FBL) completed the interactive FBL training for emphysema. Group 2 was instructed to explore and "learn as much as you can" from three leading emphysema web sites, including WebMD, the Emphysema Foundation, and the American Lung Association sites. Each of these sites includes extensive information on Emphysema. Prior to the study, the content presented in these 3 sites had been analyzed and compared to the content in the FBL Emphysema course. The FBL course included content on all the major learning objectives covered by the 3 sites. The FBL course also addressed content areas not covered by the web sites. In particular, the FBL course had more extensive coverage of care requirements of persons with emphysema. The issues assessed by the Pre- and Post-tests were restricted to content covered by both the FBL and web information sources. Participants in Group 2 were given links to the



3 information sites. Each link opened a new window and the study web site stayed open in the background.

## Outcome Measures

The A and B versions of the knowledge assessment test were not significantly different at pretest, with means of .50 and .47 percent correct, respectively ( $t(38) = 1.08$ ;  $p = .288$ ). There was also no significant difference between the A and B versions at post test, with mean scores of .80 and .81 percent correct, respectively ( $t(38) = -.32$ ;  $p = .750$ ). Looking at the pre and post-test scores for the 2 intervention groups, the 2 test versions were not significantly different for either group at pre and post tests ( $t(18) < .97$ ;  $p = ns$ ). Thus, we can reasonably conclude that the 2 versions of the knowledge assessment instrument were equally difficult. This allowed us to combine the scores from the two versions and to consider only pre- and post-test scores in our profile analysis.

## Evaluation Methods

The data was analyzed using a multivariate approach to repeated measures or profile analysis. Profile analysis includes 3 omnibus statistical tests: 1) Level, a between-subjects test where the overall test scores are compared between groups (analogous to an average pre- and post-test score); 2) Time, a within-subjects test of change over time ignoring group differences; and 3) Parallelism, the interaction of the between-subjects grouping variable (e.g. intervention group) and Time. The test of Parallelism is the main evidence we will collect to evaluate the research hypothesis. A significant effect for the Parallelism test would allow us to reject the null hypothesis that there was no difference between increases in learner knowledge across the 2 interventions. Furthermore, our hypothesis would only be supported if in addition to a statistically significant difference, the data indicated the interactive FBL intervention was more effective than the Standard Web intervention.

## Research Results

### Knowledge test results

Across test versions, the mean pre-test scores for the two intervention groups scores were similar (Group 1 = .49% and Group 2 = .48% correct); however, the post-test scores were not, with the FBL group showing significantly greater knowledge acquisition (Group 1 = .89% and Group 2 = .71% correct). There was a significant between subjects level effect ( $F(38,1)=19.27$ ;  $p = .000$ ) indicating that overall the FBL group had higher test scores. Also there was a significant within-subjects time effect, indicating that across groups, scores were higher at post-test than pre-test ( $F(38,1)=326.92$ ;  $p=.000$ ). Furthermore, the key test of parallelism was also significant, with the FBL group having greater knowledge acquisition ( $F(38,1)=22.85$ ;  $p=.000$ ). The squared effect size estimate for parallelism was .379.

### Free-format Test Results.

The free format responses for each question were randomly ordered hidden identifiers for the participant and the study group. These responses were then graded on a 0 to 2 scale, with 0 indicating clearly incorrect, 2 indicating clearly correct, and 1 being indeterminate.



The pattern of results mirrored the objective data analysis. The A and B versions of the knowledge assessment test were not significantly different at pretest, with means of .67 and .64 on the 0 to 2 scale, respectively ( $t(38) = .47$ ;  $p = .644$ ). This allowed us to combine the scores from the two versions and to consider only pre- and post-test scores in our profile analysis.

Across test versions, the mean pre-test scores for the two intervention groups scores were similar (Group 1 = .64 and Group 2 = .67 on the 0 to 3 scale); however, the post-test scores were not, with the FBL group showing significantly greater knowledge acquisition (Group 1 = 1.57 and Group 2 = 1.05 on the 0 to 3 scale). There was a significant between subjects level effect ( $F(38,1)=12.2$ ;  $p = .001$ ) indicating that overall the FBL group had higher test scores. Also there was a significant within-subjects time effect, indicating that across groups, scores were higher at post-test than pre-test ( $F(38,1)=330.48$ ;  $p=.000$ ). Furthermore, the key test of parallelism was also significant, with the FBL group having greater knowledge acquisition ( $F(38,1)=55.40$ ;  $p=.000$ ). The theta squared effect size estimate for parallelism was .593.

#### Follow-up Data

The voluntary follow-up rate for the FBL tutorial group was significantly higher than that for the standard web group, with 60% and 15% of the participants completing the follow-up quiz, respectively ( $U = 123$ ;  $p = .042$ ). The reminder emails were sent with return receipt requested, and we were able to verify that all subjects received at least one of the 3 reminder emails that invited them to complete the brief follow-up test.

Because so few of the standard web group completed the follow-up, only the FBL tutorial group data were analyzed. To determine if there was a bias in the participants who responded, we compared the post-test scores for follow-up responders and non-responders. There was no significant difference in their post-test scores, which averaged .90 and .87% correct, respectively ( $t(18) = -1.12$ ;  $p = .27$ ). This suggested that the follow-up respondents were representative of the sample. The FBL tutorial group scored 80.2% correct at follow-up. This showed good retention of the content and was well above the mean test score of 71% achieved by the standard web group immediately after completing the intervention.

## Barriers & Solutions

### Product(s) Developed from This Research

ElderCare Tutorials