Design and Evaluation of a Siebel Basic Navigation Course

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Abstract

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The results of a usability evaluation of an e-learning course are presented in this thesis equivalent. The main goal of the study was to evaluate the usability of the Siebel Basic Navigation e-learning course. A secondary goal was to explore the eventual impact of e-learning course usability on student performance.

The Siebel Basic Navigation course was designed for one of the major Canadian pharmaceutical companies. This course had five modules and a test at the end. The primary purpose of this course was to introduce a new Siebel application upgrade, since this company had just upgraded from a desktop-based Siebel application to a Web-based Siebel application. Major improvements and changes needed to be introduced to the users. The secondary purpose of this course was to introduce new hires, who would not have had prior experience with Siebel, to the Siebel application.

The participants, seven health care and banking professionals, completed the Siebel Basic Navigation e-learning course, and filled out the usability questionnaire.
The usability evaluation was based on the Generic User Interface Questionnaire developed by Chin, Diehl, & Norman, (1988). The distribution of the scores were calculated and high median (the middle value of a set of data), and high range were identified.

In addition to the descriptive statistics, correlations between the software usability and student test performance emerged, underlining the importance of usability evaluation of systems supporting on-line learning.

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Chapter 1

Introduction

The multimedia software and hardware industry is changing rapidly, presenting the learning technology industry with a growing variety of technological possibilities. The dynamic nature of the multimedia industry presents many problems for usability designers. It is understood that usability analysis techniques and development methods must maintain a high level of adaptability to ensure currency within the constantly evolving multimedia domain. Usability specialists must maintain an overall understanding of multimedia technology and its capabilities when attempting to identify weaknesses in the area of multimedia usability.

Means et al. (1993) indicates that designers need to "*think about how technology can support one's own instructional goals and learn how to orchestrate a class in which students are doing challenging projects, portions of which are technology based*" *(p. 15).* A researcher's efforts will be best deployed by first deciding on the types of learning that are most effective in an online format.

The ultimate objective for educational software is that it should be educationally beneficial, therefore it is important to understand how usability contributes (or not) to educational goals (Jones et al. 1999) when designing and creating e-learning environments.

Squires et al. (1996) advocate that "*there is a need to help evaluators consider the way in which usability and learning interact*" (p. 3). Given the importance of determining the effectiveness of the uses of information and communication technologies for learning, the need for evaluation of these technologies becomes crucial (Jones et al. 1999).

The learners' diversity and radical changes in learning tasks present significant challenges and pose the following questions: what is the role of usability in the context of modern educational software design? (Squires et al. 1999) Which usability attributes affect on-line learning? (Zaharias et al. 2000)

The aim of this study is twofold. First, it is to review the learning theories currently used to design e-learning applications, and to examine specific usability attributes that need to be considered when designing e-learning environments.

Second, it is to evaluate the usability of the environment of the Siebel Basic Navigation course; investigate if the design of an e-learning environment supports learning and knowledge transfer – or whether it has no effect on it – and report some preliminary findings derived from a usability questionnaire that was used to evaluate the interface of the Siebel Basic Navigation course.

Literature Review

Two topics provide the framework for this literature review: constructivism and computer-based learning. The first topic, a review of constructivist theory, analyzes the implications of constructivist theory for computer-based learning. The second is a review of usability techniques, as well as how these are used to improve the user interface of on-line learning applications (web-based, CD-based, courses hosted on LMS, *etc.*).

The rationale behind choosing these topics is to understand how constructivism is influencing the design and delivery of educational materials, as well as to understand how computer-based learning environments should be designed in order to facilitate advanced knowledge acquisition for expertise in complex domains.

Constructivist Theory

Constructivist theory rests on the assumption that learners construct knowledge as they make sense of their experiences. In contrast to behaviorist theories that have dominated instruction since the 1950s, a constructivist theory of learning considers the mental activities of learners, the nature of knowledge, and how this knowledge develops in the learner. Individualist Constructivist learning originates from a Piagetian perspective in which knowledge and meaning are constructed through experiences and interaction with physical phenomena and the environment. Learners "learn-by-doing" to accommodate new knowledge from experiences in their environment, and they assimilate this knowledge into their current conceptual framework through a process of equilibration (Piaget, 1929). Interaction and talk with others, which help induce cognitive dissonance, are essential to encouraging individuals to consider the ideas of others and change their own ideas.

Central to constructivism is the idea that students bring their intuitions, experiences, and interpretations of scientific phenomena to learning situations. In the constructivist model, the prior knowledge that students bring to a learning situation plays an important role in how learners approach and solve problems, learn new concepts, and link new knowledge to their prior understanding. In a learner-centered learning environment, learners can regulate the pace of instruction, the choice of activity, and choice of path and process (Norman & Sphorer, 1996). The term "constructivism" was invented by Ernest Von Glasersfeld for his individualist idealist philosophy, and taken over by the Piagetians. As a result, constructivist learning often focuses on individual cognition and can be referred to as a "cognitive perspective" (Linn, 1986).

Researchers argue that learning needs to consider not just the individual learner, but learning as it happens in a group and the setting in which the learning occurs. Vygotsky and Leontiev emphasized that learning can occur through social activity, group interactions, and scaffolding by peers that are more able or even less able peers. (Leontiev, 1978; Vygotsky, 1978, Gergen, 1999).

As far as instruction is concerned, it is assumed that an instructor should try to encourage learners to discover principles by themselves. A task of the instructional designer, then, is to translate information to be learned into a format appropriate to the learner's current state of understanding. Information should be organized in a spiral manner so that the learners continually build upon what they have already learned.

Bruner (1966) states that a theory of instruction should address four major aspects: first, predisposition towards learning; second, the ways in which a body of knowledge can be structured so that it can be most readily grasped by the learner; third, the most effective sequences in which to present material; and fourth, the nature and pacing of rewards and punishments. Good methods for structuring knowledge should result in simplifying, generating new propositions, and increasing the manipulation of information.

Instruction should provide a context that will guide the individual in making sense of the environment as it is encountered. The information contained in the course must be combined with information outside of the course, taking into consideration the learners' prior knowledge, and environment, to enable them to construct the representation and understand the meaning of the course.

Duffy and Jonassen (1992) argue that instruction should not focus on transmitting plans to the learner but rather on developing the skills of the learner to construct (and reconstruct) plans in response to situational demands and opportunities.

Implications of Constructivist Theory to Computer-Based Learning

A vast majority of the literature about e-learning or virtual education seems to be dealing with how to transform learning material into an online format, arrange distance communication between the learners and the instructor, and use discussion platforms, which are supposed to enhance learner participation.

In most cases, the emphasis is on changing the original learning content to an alternative format. It is important to understand whether new technologies can offer completely new ways of presenting the content. Many skeptics believe that replacing classroom-based education with Internet-based education leads to a substandard education.

Neumann, (1998) states that online courses have to be designed differently, because online learning provides limited opportunities for interactions with other learners, and it is difficult to anticipate all possible options. Careful planning and well thought-out instructions and guidance are essential to making the experience more fulfilling for the learners.

Verma and Parikh (2001) point out several problems with current course websites. First, most Web sites are passive and lack interactivity, which is crucial in many learning activities. Second, the lack of team work such as group discussion, case study analysis, class discussion, asking questions and immediately receiving answers and instructor feedback is necessary. Third, the high cost of meetings in real classrooms (*e.g.*, video conferencing demands high bandwidth, which is not available everywhere).

Online technologies offer opportunities for creating collaborative, reflective learning experiences (Ruhleder & Twidale, 2000). Morgan (2001) describes online-based learning systems that are designed to incorporate different learning tools to present complex simulations, virtual classrooms, and other forms of on-line collaboration.

Jonassen et al. (1999) state that constructivist learning environments are technology-based environments in which learners are able to explore, experiment, construct, converse, and reflect on what they are doing, so that they learn from their experiences. In such environments, learners are presented with a complex and relevant problem, project, or experience in which the learning environment provides them with the tools and resources that they need to understand the problem and solve it.

It is important to note that, in a constructivist learning environment, technology plays an acknowledged and purposeful role in day-to-day activities, but does not become the object of instruction (McClintock, 1992). This environment can provide learners with a learning "space" in which the learner can observe, question, practice, and validate his knowledge.

Means and Olson (1997) found that technology could support instructors' efforts to engage learners in long-term, complex projects by dramatically enhancing learner motivation and self-esteem. Research shows increased motivation and engagement of learners when they use technology (Dimock, 1996; Sandholtz et al. 1997; Ferneding-Lenert & Harris, 1994; Lowry et al. 1994; Moore & Karabenick, 1992; Velayo, 1993; Williams, 1995).

Computer-based learning environments represent complex phenomena with high potential for improving education and enhancing learning. It is likely that computers and their software will form only one component of this environment. Understanding of how such systems can best be designed and implemented requires further research (Jones et al. 1999).

Usability Evaluation

In current multimedia applications, the main assumption often seems to be that the more sophisticated the technology that is used, the better. Few considerations are given to, and little is known about, which technology provides the best support for a task in a specific context. (Petersen, 1998)

One of the often-claimed benefits of multimedia is increased human-computer interaction. New types of media and media combinations can improve interaction through various combinations of tools and tips that could be included into an interface. This allows the users to take advantage of the ability to attend to more than one stimulus at a time (Alty, 1991; Bearne et al. 1994).

Tselios et al. (2001) indicates that the learning process depends on the learner's motivation, previous experience, and the learning strategies that the individual has been supported to develop, and so forth. The effectiveness of any educational environment cannot be considered independently of these aspects. It is widely accepted that effective learning is also related to educational environments and tools that provide the learners with incentives for active participation in the learning process.

Good design of a course interface is critically important since the learner's interaction with a learning environment is often a one-time event. Jones (1994) and Zaharias et al. (2002) point out that, unlike software interfaces where users return repeatedly and gradually learn the interface, the on-line learning interface must make sense quickly, since the user is unlikely to use the environment for an extended period of time.

Laurel et al. (1992) state that different media can affect the subjective feeling experienced by the users; "media biases" have been used to describe how people experience distinct media types differently. Laurel, Oren and Don (1997) have shown that different media can affect the subjective feelings experienced by users. They found that where video was used to present information, users questioned the validity of the information in spite of finding it engaging. With the equivalent text presentation of the material, users felt the information was more reliable.

A lack of control of dynamic media features may be a further obstacle to successful use of multimedia applications. Dynamic media raise new demands in terms of controlling dynamic media (*e.g.*, play, stop, rewind, and adjust volume, indication of time-duration of the media piece) (Petersen, 1998). The dynamic multimedia application can also create additional requirements for standard control interfaces. For example, audio and video features will require a different set of commands than the usual application training. Lohr (2000) states that an instructional interface is especially effective when the learner is able to focus on learning content rather than focusing on how to access the learning content.

Efficiency and performance have traditionally been used to measure human-computer interaction with a new product or application, but these measures may be entirely inappropriate in a new media environment (Smith, Newman & Parks, 1997). Petersen (1998) argues that none of the existing multimedia evaluation methods consider how high level issues such as media biases, aesthetics, pleasure, and engagement can be assessed and that the vast majority of multimedia evaluation materials available consist of sets of guidelines that cannot be sufficient for evaluation of multimedia applications; firstly, because they assume that usability factors can be generalized; and, secondly, because they fail to predict user behavior.

Usability heuristics were summarized by Shneiderman (1987) and Nielsen (1993). They include the following: strive for consistency; minimize user memory load; provide informative feedback; provide clearly marked exits; provide shortcuts; prevent errors, provide help and documentation; provide ease of use and ease of learning the system; achieve aesthetic appeal of the interface; provide controls for parallel and serial group communication; effect transparency of the interface (Dringus, 1995).

Ravden & Johnson (1989) provide a checklist that places emphasis on visual clarity, consistency, compatibility, informative feedback, explicitness, appropriate functionality, flexibility and control, error prevention and correction, and user guidance and support. Schwier & Misanchuk (1993) present principles of simplicity, consistency, clarity, aesthetic considerations (*i.e.*, balance, harmony, unity), white space, time, and minimal memory load that should be used when designing and creating e-learning materials.

Further research may be useful to determine the upper limits for effective multimedia information presentation in specific scenarios (Bearne, Jones & Sapsford-Francis, 1994).

Many designers employ metaphors to equate the electronic environment to features of the physical environment that are well known. Where this is successful, it allows users to get an easy understanding of what was intended by the designer without the need for additional help or explanation. Such environments can also reassure novice users by providing familiar objects and functions in an unfamiliar environment. Metaphors are commonly employed by designers to indicate a particular meaning represented in a particular way, such as filing cabinets, folders, and documents or books with chapters.

In some cases, metaphors can be misleading and may not always be the best way to represent information. Shneiderman (1997) believes that designers should exercise caution when using metaphors when presenting complex concepts.

Zaharias et al. (1999) argued that there is a need to focus on how to develop useful and usable tools and environments since, so far, we are focused more on the technology and not on the pedagogy, and there is very little thought at the decision-making level to usability issues.

> *If the strengths of new media are used appropriately, multimedia applications can be easier to use, more engaging and fun, easing navigation and support tasks that could not otherwise be supported by computer systems. However, if multimedia systems are created by people with no knowledge about the language of the new media, if human stimulus-response capabilities are not considered, or if no further work is put into answering some of the questions raised by researchers, multimedia systems may become sparkling, twinkling, colorful and expensive creatures of very limited use. One way to push multimedia*

systems in the right direction is through evaluations that consider the aspects outlined above." (Petersen, 1998, p. 3)

The need for usability has long been recognized in website design literature as a critical quality criterion when determining user satisfaction with a software system. Therefore, further investigations are needed to identify how the usability of a web-based learning application can significantly affect learning.

Chapter 2

Siebel Navigation Course Design Principles

Modern constructivist learning environments are technology-based where learners are engaged in meaningful interactions. The Constructivist approach emphasizes that the student is an "active learner," playing a central role in controlling the learning (Jonassen, 1999). Emphasis needs to be on student-centered learning that promotes ownership of the learning experience. Greening (1998) suggests, "where ownership occurs, active learning and regard for students' prior constructions follow quite naturally" (p. 25).

Jonassen (1994) proposed eight characteristics of Constructivist learning environments, which were followed to design the Siebel Basic Navigation Course:

1. Constructivist learning environments provide multiple representations of reality.

   Problem/project space — learners are presented with an interesting, relevant, and engaging problem to solve.

2. Multiple representations avoid oversimplification and represent the complexity of the real world.
   - Providing learners with the information they need helps them make meaning when it is provided in a timely manner.

3. Constructivist learning environments emphasize knowledge construction.
   - Cognitive (knowledge-construction) tools — complexity calls on skills that learners possibly do not posses. If this is the case, then cognitive tools that support the learners' abilities to perform those tasks are needed. These can provide help in constructing and representing what the learners know (*e.g.*, visualization tools).

4. Constructivist learning environments emphasize authentic tasks in a meaningful context rather than abstract instruction out of context.
    - Related cases — when expecting the learners to solve problems, it is important for the learning environment to provide access to a set of related experiences on which the learners can draw.
5. Constructivist learning environments provide learning environments such as real-world settings or case-based learning instead of predetermined sequences of instruction.
6. Constructivist learning environments encourage thoughtful reflection on experience.
7. Constructivist learning environments enable context and content-dependent knowledge construction.
8. Constructivist learning environments support "collaborative construction of knowledge through social negotiation, not competition among learners for recognition."
    - Conversation (knowledge-negotiation) tools must be provided to support collaboration.

The Siebel Basic Navigation Course used real-life examples where it was appropriate. Each scenario/problem was defined and explained in the introduction of the lesson. The scenario has specific examples and it used familiar terminology in order to achieve "buy-in" from the learners. Its purpose is to simulate the problem in the context in which it is normally and naturally encountered.

A narrative format was used to present information explaining the concepts and providing relevant examples. All the data that were required to solve the problem/complete scenario were embedded within the narrative.

Presentations and exercises built on each other to introduce more complex tasks, and learners had an opportunity to view and practice all of these tasks.
(Since the Siebel Basic Navigation Course was an introductory course, it was not required to include many complex problems and scenarios.)

The problem situation is displayed in the form of dynamic images. Actual software simulations are used to illustrate the task that the learner needs to perform so that the problems that are communicated to the learner are much more complex and interconnected. The presentations demonstrate all the steps necessary in detail. Each step has enough information to complete it; visual queues are provided, as well as positive or negative feedback for each step. After each presentation, learners are presented with an opportunity to practice the demonstrated task in a self-paced environment, using a similar scenario.

Screens from a Siebel database are used to create the simulations and practice exercises. The learner is able to review the real-life task carried out in the Siebel application. After the presentation, learners have an opportunity to practice. During exercises, the learner has to interact with the simulation, and appropriate feedback is provided after each step. This Siebel Basic Navigation Course provides learners with the ability to revise materials at their own pace, and in a non-threatening atmosphere.

A glossary is used to provide business process context as well as definitions for the terms that are used through the course.

(The Siebel Navigation Course was hosted on a Learning Management System; additional resources were available for the users in their learning portal, such as manuals, reference cards, and additional courses. It was not required to provide external links to the course sources, and it was not necessary to duplicate them within the course.)

Siebel Basic Navigation Course Design

This course is designed for the sales representatives of the leading Pharmaceuticals company in Canada. The majority of the learners use technology every day and they have basic computer skills. The learners will access the course using the LMS, and will take the test at the end to validate their learning.

Their mandate is to learn Siebel application so they can record their interactions with their customers.

The objective of this course was to familiarize the learners with Siebel's basic interface, acquaint them with the navigation within this customized system, as well as allow them to understand its functionalities. This course helped to ensure that all learners have reached the same level at the start of their instructor-led course. By providing the learner with these skills, the instructor-led workshop will be able to focus on higher-level learning objectives related to the company's business processes.

Learners who are enriched by a course, and find it enjoyable, are more likely to complete the course and learn in an efficient manner. To keep learners engaged in the course, we will use interactive learning activities, relevant exercises, and real-life examples. A mountain scene with a trail that leads to the top of a mountain summit will be the basis of the principal scene.

Course Structure

The Siebel Basic Navigation Course will be divided into six modules, plus a final Assessment:

Module 1: Introduction to Siebel
Module 2: Siebel Screen Components
Module 3: Working with Lists
Module 4: Working with Forms
Module 5: Navigation
Module 6: Queries
Assessment

Module introductions explained the learning objectives for the module as well as the module's breakdown into lessons. Each module will be divided into an introduction and one or more lessons:

- Module X
  - Introduction
  - Lesson X.1
  - Lesson X.2
  - ...
  - Lesson X.n

Each lesson will consist of one or more simulated/animated presentations, and one or more interactive simulation exercises:

- Lesson X.1
  - Introduction
    - Presentation 1
    - Exercise 1
- Lesson Wrap up.

Once inside a given lesson, learners were presented with a menu of "activities" consisting of one or more presentations and exercises. Activities were ordered from the simplest case to the most complex. Each exercise was preceded by its corresponding presentation. Learners were able to review/redo an activity as often as they choose. The first screen upon entry into a new lesson state the detailed lesson objectives and introduce the activities contained in that lesson. The last screen in the lesson summarized what the learners should now know, and invited them to review/redo activities until they are entirely comfortable.

Presentations

Presentations will include simulations of Siebel to teach learners where something is located and/or how to do something in the software. All presentations were narrated, explaining each step as it is played out. Real-life job scenarios will be used whenever applicable to illustrate the usage of each new feature introduced. Learners will be able to replay the last "step" shown by clicking the Replay button underneath the sidebar. Learners will be able to advance to the next step or review the previous step by using the Forward and Back Buttons. Learners can also restart the entire presentation by reselecting its tab/title on the sidebar. Whenever a long procedure is being taught, the steps will be summarized on the sidebar as a memory aid.

Exercises

Exercises included simulations of Siebel closely resembling the ones used in corresponding presentations, but using new job scenarios instead. Exercises focused on helping learners remember key facts, concepts, and basic operating procedures. Instructions for exercises will appeared in a text window on the sidebar. The contents of this window changed each time the learner completes a step and advances to a new one. In the case of a text entry field, the simulation will do the typing for the learner.

The Forward and Back buttons are be available during the exercise. This will ensure that learners cannot circumvent the structure in place. (The only way to reach the end of an exercise – and be recognized as having completed it - is to actually do it.).

Exercise Feedback Strategy

If the learner performs the right action, the simulation will respond as the actual software would. If the learner does not perform the right action, the simulation will remain unchanged, the area that the learner has to click on (hot spot) will be highlighted, and feedback will be provided.

Additional feedback will be provided to the learner as he moves the cursor over the simulated work area. The mouse cursor will change colors in order to guide the user towards the correct action (see note below):

- Red: when the user is far from the hotspot (spot/button/tab upon which the learner has to click).
- Yellow: when the user is near the hotspot.
- Hand: when the cursor is on the hotspot.

Course Completion and Assessment included multiple choice, true/false, listing, short answer, matching, and simulation questions. The assessment button was only available when the learner completed all the modules. During the course, the Assessment button was "grayed out", and automatically became active once all modules are completed. An Assessment could be retaken at any time and as often as the learner wants. After answering a question, the learner will be prompted to the next question and will not see the resulting screen or feedback.

Questions were weighted according to the number of actions/choices required from the learner in order to respond. E.g., a True/False question was worth one point, a three-step simulation question was worth three points, and a pick list from which a learner must select five things was worth five points. A learner lost one point for each incorrect action/choice.

A learner's score was calculated as a percentage of the total number of correct actions/choices in the test.

Progress Tracking and Reporting Strategy

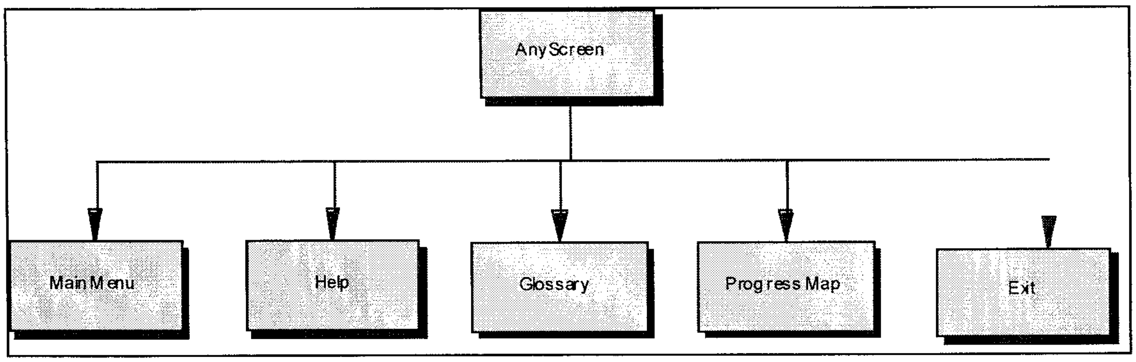
The courseware tracked where learners currently are/were located in the course, which presentations they have seen, and which exercises they have completed. These were recorded and reported in the course progress map.

The course progress map reported the last test scores.

The course progress map is accessible at any point during the course by clicking the Progress Map icon on the main interface.

Available from any Screen:

Figure 1: *Available from any screen*



Course Browser

The courseware ran inside an Internet Explorer Browser. The browser toolbar and the Flash right-click menu were disabled.

Navigation and Orientation Strategy

The learner were able to progress through the course linearly.

The learner had three options for navigating to another part of the course:

Menus

The learner were able to navigate directly to any module, or lesson, at any point during the course. Once inside a given lesson, the learner were able to navigate to a presentation or exercise using the tabs in the side bar.

Forward/Back Buttons

The learner were able to go to the next or previous screen/step in a presentation using these buttons located below the sidebar. These buttons were not available during exercises (see the Learning Activities section for details).

The course had three orientation indicators:

Location Trail

The location trail on the main interface indicated the module and lesson in which the learner is currently located.

Side Bar Tabs

Once inside a given lesson, the highlighted tab in the side bar indicated the current presentation or exercise in which the learner is located.

Progress Map

The progress map showed the learner where he currently is located within the whole course.

Learning Tools and Features

Learners had the following learning tools and features available to them:

Help

A Help button was available to the learner at all times. When the learner clicks the help icon from the main interface, he will be brought to the animated help, which contains:

- Who to contact (a phone number and/or Email address) if the learner has a question about Siebel or is experiencing technical difficulties.
- An explanation of the purpose of the course and the course completion requirements.
- A map of the learning workspace (i.e. the main courseware interface).
- An explanation of the different navigation options.
- An explanation of the progress tracking features available in the progress map.

- An explanation/summary of the learning support features and options available.

Tool Tips

All main user interface buttons that are represented with an icon will have a text Tool Tip label (i.e. a descriptive name for the button) that was displayed on a rollover.

Exit

The Exit button on the main interface allowed the learner to leave at any time and from anywhere in the course.

Glossary

A glossary of terms were available to the learner at all times. When the learner clicked the glossary icon from the main interface, a pop-up window containing a list of definitions for key Siebel terms appeared.

The glossary was not available during the test.

Progress Map

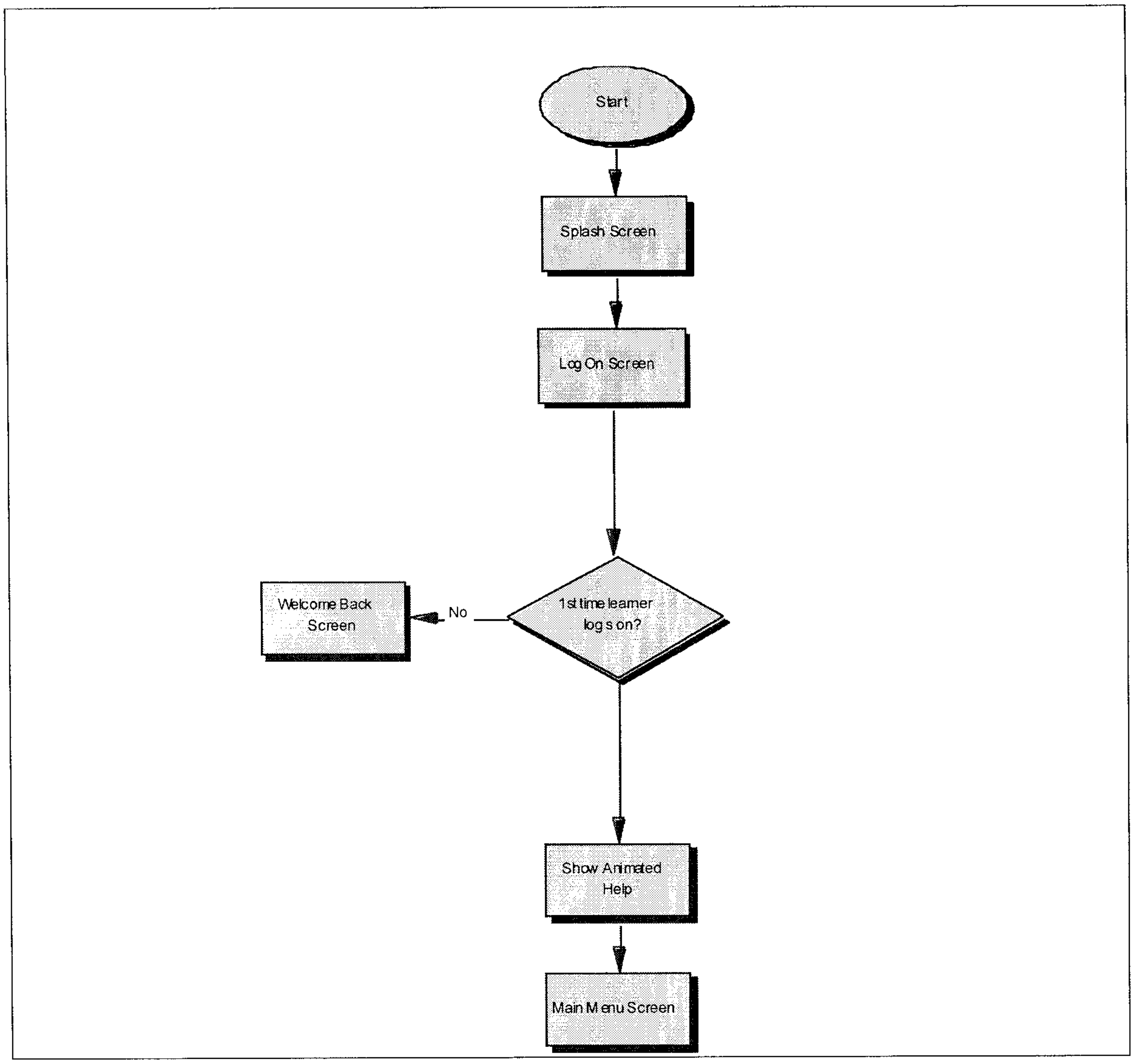
The course progress map was accessible at any point during the course on the main interface.

Replay Button

While in a presentation, the learner can replay the animation sequence for the current screen/step by pressing this button.

Courseware Start-up and Exit

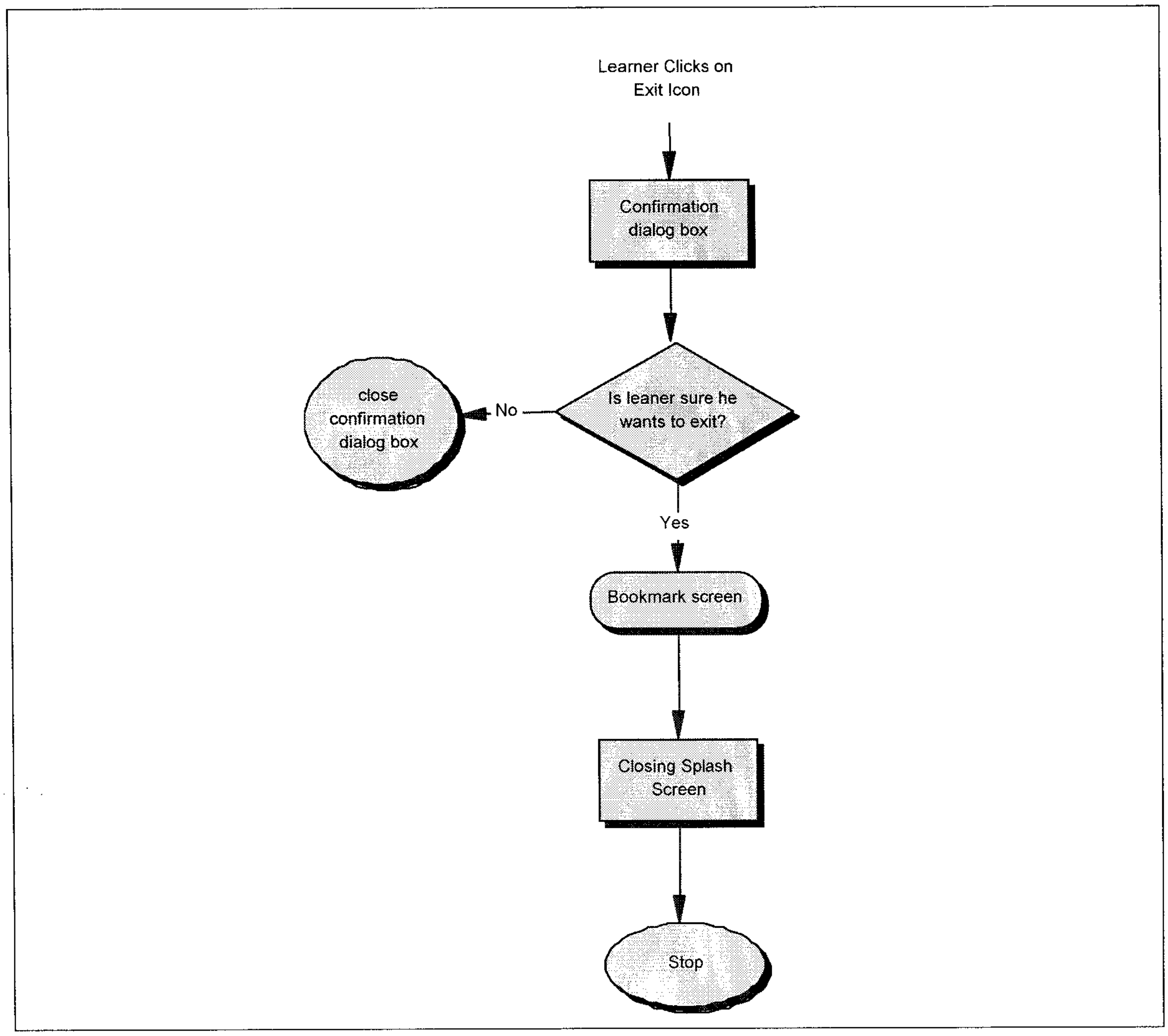
***Figure 2**: Start-up Sequence*



Note:

- The Splash screen will have a Skip option.

Figure 3: *Exit Sequence*



Chapter 3

Evaluation Method

A formative evaluation study of the Siebel Basic Navigation e-learning Course was performed. This evaluation had two objectives first, to measure usability and effectiveness of the e-learning course and, second, to measure the impact of usability on performance.

Participants

The participants for this study were not randomly selected from the general population. This is because the course is designed for a specific user group and it would be difficult to randomly select the sample group. The characteristics of the participants were not controlled; they were selected for the study as long as they met minimum requirements.

Participants were professionals from the Pharmaceutical and Banking industry. Five participants had Bachelor's degrees, one had a Master's Degree, and one had a Doctoral degree. The mean age of the participants was 3 and the standard deviation for age was 8.81. Of the seven participants, four were male (57%) and three were female (43%).

The level of computer knowledge differed between participants from intermediate to advanced level. All of them use computers to complete everyday tasks, and they were familiar with other e-learning courses.

Thirty percent of the participants had prior database experience (intermediate and advanced levels of Access); however, eighty percent of the Participants had no prior Siebel experience.

Research Setting

This study was conducted on a one-to-one basis. There were no prior preparations from participants required to participate in this research. There was no communication amongst the participants.

Upon verbal consent to participate, all participants were informed of the procedure and time required for this research.

The following points were emphasized before the evaluation:

- Participation is voluntary and they can withdraw from this study without any consequence.
- The purpose of this research is to evaluate the usability of the Siebel Basic Navigation e- learning course.
- The suggested time needed to review the Siebel Navigation course is forty-five minutes.
- After the course review, the participants will fill out a Generic User Interface satisfaction questionnaire. It will take approximately fifteen to twenty minutes to fill out the printed Generic User Interface Satisfaction Questionnaire.

Each participant was presented with the Siebel Basic Navigation Course on the laptop (same equipment was used for all the sessions). The participants had to complete all five modules in the course and pass the test at the end. After review of the Siebel Basic

Navigation Course, participants were presented with an envelope that contained the Generic User Interface Satisfaction Questionnaire. Participants were given a sufficient amount of time to complete the questionnaire. The questionnaire was anonymous and was completed on a voluntary basis. The participants had the opportunity to go back to the e-learning course, if they wished to do so. Once the questionnaire was completed, the participants were asked to place it into the envelope and seal it.

Thirteen candidates were contacted for this experiment, seven candidates agreed to participate in this experiment. A total of seven participants reviewed the course, completed the test, and filled out the Usability Questionnaire.

All participants completed all modules in the course and took the test. The e-learning course was designed so that learners had to navigate through the course in a linear manner. This ensured that the participants had no access to the test until they successfully completed all modules in the course.

All the data were entered into an MS Excel spreadsheet.

Sixty percent of the participants did not answer the question about supplemental reference material; one participant indicated that this question was not applicable. The unanswered question was not taken into account during the data analysis.

Materials

Siebel Basic Navigation course is an introductory course to Siebel Relational Database. The course is presented in French and English. The English version of the course was used in this study.

The e-learning course had three main parts, Log-in Intro, Content, and the Test. The Log-in Intro introduced all interface components and navigation techniques. All navigation components that were used in this course were demonstrated and explained during this introduction. The content of the course includes five modules that cover Screen Components, Navigation, List, Form, and Query topics. When all content was completed, the test option became available. The test had ten questions. Questions included multiple choice, scenarios, and simulations.

Siebel Basic Navigation course included simulations of Siebel to teach learners where something is located and/or how to do something in the application. All presentations were narrated, explaining each step as it is played out. Real-life scenarios were used whenever applicable to illustrate the usage of each new feature introduced. Participants were able to replay the last "step" shown by clicking the Replay button underneath the sidebar. Whenever a long procedure was being taught, the steps were summarized on the sidebar as a memory aid.

The learners were only able to progress through the course linearly. The e-learning course included three options for navigating to another part of the course; Menus, the Progress Map, and the Forward/Back Buttons.

Menus provided direct navigation to any module or lesson, at any point during the course.

Once inside a given lesson, the participants were able to navigate to a presentation or exercise using the tabs on the Lesson Bar.

The Forward/Back Button allowed learners to navigate to the next or previous screen/step in a presentation. These buttons are located below the Lesson Bar. In order to prevent the learners from clicking through the exercises without reading or completing the exercise requirements, the Back and Forward buttons were disabled until successful completion of the exercises.

The Forward, Back, and Replay buttons were used to navigate within the lesson step-by-step. The Media Bar allowed learners to navigate to the beginning or end of the lesson, as well as adjust the volume of the narration.

The course provided two orientation indicators: the Lesson Bar, and Progress Map.

The Lesson Bar included a position indicator to identify to the learner his current position in the course or exercises. The Progress Map enabled the learner to navigate directly to a given module, lesson, presentation, or exercise by clicking its name in the Progress Map.

Instrumentation

The usability evaluation was performed through the Generic User Interface Satisfaction Questionnaire (Chin, et al. 1988) that participants filled out after the completion of the Basic Siebel Navigation e-learning course (please see the instrument in Appendix 1).

The questionnaire contained twenty-four questions with answers in a scale of ten (10) values ranged from zero (low) to nine (high). Questions were further grouped into five main categories: Overall Reactions to the Software, Screen, Terminology and System Information, Learning, and System Capabilities. Questions in each category rated different interface components using adjectives such as Inconsistent – Consistent, Confusing – Very Clear, Rigid – Flexible, *etc.*

The Generic User Interface Satisfaction Questionnaire was based on a human computer interface questionnaire developed by Shneiderman (1987), and further developed and researched by Chin et al. (1988), and focused exclusively on user evaluations of the interface.

Chin et al. (1988) state that "...in addition to performance measures, the time it takes to learn a system and the retention of acquired knowledge over time are associated with how effectively a system can be used. User acceptance of a system (*i.e.*, subjective satisfaction) is also a critical measure of a system's success. Although a system is evaluated favorably on every performance measure, the system may not be used very much because of the user's dissatisfaction with the system and its interface" (p. 213).

Past studies have examined the types of questions that would be appropriate for questionnaires. Root and Draper (1983) found that checklist questionnaires were not sufficient in evaluating systems since they did not indicate what new features were needed. Open-ended questions were suggested as a possible supplement for checklists.

Coleman, Williges, and Wixon (1985) found that users preferred concrete adjectives for evaluations. In addition, they found that specific evaluation questions appeared to be more accurate than global satisfaction questions. This Generic User Interface satisfaction questionnaire included specific evaluation questions for the five main categories. Furthermore, each question included concrete adjectives to identify user satisfaction.

Student performance was measured by the test score. The scores of the test were calculated as follows: for each correctly answered question, one point was given while for the incorrect ones no points were given. The final score was normalized in the range of one to one hundred.

Analysis

The first objective was to test the usability and effectiveness of the e-learning course. Descriptive Statistics were calculated for each component of the instrument.

The distribution of the scores were calculated and high median (the middle value of a set of data), and high range were identified.

The median was calculated to identify where in the answers the point at which exactly half of the data are above and half below. These halves meet at the median position. The number of questionnaires was odd (sample size = 7), the median fits perfectly and the depth of the median position was whole number.

The second objective of this study was to measure the impact of the environment usability on student performance. This was measured by comparing the data from the Generic User Interface satisfaction questionnaire (Chin, et al. 1988) and relating it to scores obtained from completing the Siebel Basic Navigation Course test.

Correlation coefficients ***(r)*** were calculated to express the relationship and direction between the usability questionnaire results and the posttest results. This identified how effectively individual scores on one measure (Generic User Interface satisfaction questionnaire) are associated with their scores on the posttest measure (Basic Siebel Navigation posttest).

A considerable effort was made to create suitable evaluation conditions in order to diminish the influence of other parameters on the examined variables:

- The evaluation was performed in controlled conditions (software, hardware) to eliminate the uncertainty of a typical e-learning situation.
- All the students involved had no previous experience of use of the software modules involved.
- The participants had similar characteristics in terms of their background and subject matter knowledge.
- For the purpose of this study, the e-learning course was presented on the same laptop. This allowed for the control of the system's speed and loading time.

Chapter 4

Results

Descriptive statistics were calculated for each participant. The median was calculated to find out the middle point of a scores distribution. This would identify the scores that are above the median and below the median. The median is less sensitive to extreme scores than the mean and this makes it a better measure than the mean for highly skewed distributions. Most of the questions that showed low median were in Overall Reactions to the Software section: “Frustrating – Satisfying”, Median = 7, “Dull – Stimulating”, Median = 6, “Rigid – Flexible” Median = 7, and one question in Learning section: “Remembering Names and Use of Commands (Difficult – Easy)”, Median = 7 (Table 1).

Table 1: Low Median Scores (gray lines indicate relatively low medians; boldface lines are relatively large ranges)

Category		Question	Score						Median	Range
			4	5	6	7	8	9		
Overall Reactions to the Software	1	Overall Reactions to the Software(Terrible - Wonderful)	0	0	0	**5**	**2**	0	7	1
Overall Reactions to the Software	2	Overall Reactions to the Software(difficult - easy)	0	0	0	**2**	**3**	**2**	8	2
Overall Reactions to the Software	3	Overall Reactions to the Software (Frustrating - Satisfying)	0	0	**1**	**4**	**2**	0	7	2
Overall Reactions to the Software	4	Overall Reactions to the Software (inadequate power - adequate power)	0	0	0	0	**2**	**5**	9	1
Overall Reactions to the Software	5	Overall Reactions to the Software (dull - stimulating)	0	**2**	**4**	**1**	0	0	6	2
Overall Reactions to the Software	**6**	**Overall Reactions to the Software (rigid - flexible)**	0	**2**	**0**	**3**	**1**	**1**	7	**4**
Screen	**7**	**Characters on the Screen (Hard to read - easy to read)**	0	**1**	**1**	**1**	**3**	**1**	**8**	**4**
Screen	8	Highlighting on the screen simplifies the task (not at all - very much)	0	0	0	**2**	**3**	**2**	8	3
Screen	9	Organization of information on screen (confusing - very clear)	0	0	0	**2**	**4**	**1**	8	3
Screen	10	Sequence of screens (confusing - very clear)	0	0	0	0	**3**	**4**	8	2
Terminology and System Information	11	Use of terms through the screens (Inconsistent - Consistent)	0	0	**1**	0	**3**	**3**	9	1
Terminology and System Information	12	Computer terminology is related to the task you are doing Never - Always)	0	0	0	**1**	**4**	**2**	8	3
Terminology and System Information	13	Position of messages on screen (Inconsistent - Consistent)	0	0	0	**1**	**2**	**4**	9	2
Terminology and System Information	14	Messages on screen which prompt user for input (confusing - very clear)	0	0	0	**1**	**4**	**2**	8	2
Terminology and System Information	15	Computer keeps you informed about what it is doing (Never - Always)	0	0	**1**	0	**4**	**2**	8	3
Learning	16	Learning to Navigate the system (Difficult - Easy)	0	0	0	0	**3**	**4**	9	1
Learning	17	Exploring new features by trial and error Difficult - Easy)	0	0	**1**	**2**	**2**	**2**	8	3
Learning	18	Remembering names and use of commands(Difficult - Easy)	0	0	0	**4**	**2**	**1**	7	2
Learning	19	Tasks can be performed in a straight-forward manner (Never - Always)	0	0	0	0	**3**	**4**	9	1
Learning	20	Help/Feedback messages on the screen (Unhelpful - Helpful)	0	0	0	**3**	0	**4**	9	2
System Capabilities	**21**	**System Speed (Too slow - Fast Enough)**	**1**	**0**	0	**0**	**3**	**3**	**8**	**5**
System Capabilities	22	System Reliability / stability (Unreliable - Reliable)	0	0	0	0	**1**	**6**	9	1
System Capabilities	**23**	**Experienced and inexperienced users' needs are taken into consideration (Never – Always)**	**0**	**1**	**1**	**1**	**3**	**1**	**8**	**4**

The range was calculated to identify the spread of the values around the central tendency. The high range was identified for the following questions: System Speed (Too Slow – Fast Enough)", Range = 5 "Overall Reactions to the Screen (Rigid – Flexible)", Range = 4, "Characters on the Screen (Hard to read – Easy to read)", Range =4, System Capabilities: Experienced and inexperienced users' needs are taken into consideration (Never – Always), Range = 4. In addition to that, the spread of values Range = 3, were found for following questions:

Screen:

Highlighting on the screen simplifies the task (Not at all - Very much),

Organization of information on screen (confusing - very clear),

Terminology and System Information:

Computer terminology is related to the task you are doing Never - Always).

Computer keeps you informed about what it is doing (Never - Always),

Learning:

Exploring new features by trial and error (Difficult - Easy)

Correlation of Scale Items with Posttest Score

Correlation coefficient ***(r)*** was calculated to evaluate the degree and direction of relationship between posttest and questionnaire scale items (for each increment in one variable there is a corresponding increment in the other). If there is no relationship, the coefficient will be zero. Degrees of freedom for this evaluation were $df = 5$, alpha = .05, the null hypothesis was rejected when $r_{crit} \geq .75$. When $r_{crit} \geq .70$ (alpha = .10) the relationship was considered close to significant and interpreted in light of the small power to find significant correlations.

Table 2: Correlation between posttest and questionnaire variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	1.00																						
2	0.00	1.00																					
3	-0.14	0.59	1.00																				
4	0.40	0.42	0.14	1.00																			
5	0.14	0.30	0.75	-0.14	1.00																		
6	-0.87	-0.14	0.35	-0.30	-0.02	1.00																	
7	-0.14	0.00	-0.05	0.39	-0.30	0.19	1.00																
8	0.00	0.20	0.24	0.00	-0.24	0.23	0.00	1.00															
9	0.41	0.19	0.03	0.55	-0.26	-0.23	0.71	0.47	1.00														
10	0.14	-0.30	0.40	-0.14	0.30	0.31	0.23	0.48	0.42	1.00													
11	-0.09	0.00	-0.26	0.73	-0.65	0.12	0.65	0.00	0.46	-0.19	1.00												
12	0.55	0.57	-0.03	0.73	-0.19	-0.62	0.42	0.16	0.75	-0.19	0.42	1.00											
13	0.06	0.26	-0.13	0.81	-0.48	-0.08	0.79	0.00	0.68	-0.18	0.91	0.71	1.00										
14	0.35	0.30	-0.40	0.64	-0.65	-0.47	0.48	0.24	0.71	-0.30	0.65	0.87	0.79	1.00									
15	-0.68	-0.20	-0.24	0.00	-0.72	0.68	0.48	0.33	0.16	0.00	0.62	-0.16	0.42	0.24	1.00								
16	0.55	0.38	0.19	0.73	-0.19	-0.30	0.19	0.62	0.75	0.26	0.42	0.71	0.51	0.65	0.00	1.00							
17	-0.13	0.37	0.50	0.13	0.06	0.38	-0.16	0.90	0.24	0.37	0.04	0.04	-0.03	0.06	0.30	0.60	1.00						
18	0.37	0.52	-0.18	0.50	-0.44	-0.50	-0.18	0.42	0.31	-0.44	0.28	0.68	0.35	0.75	0.00	0.68	0.41	1.00					
19	-0.09	0.38	0.65	0.09	0.26	0.33	-0.48	0.62	-0.13	0.26	-0.17	-0.17	-0.28	-0.26	0.00	0.42	0.88	0.28	1.00				
20	-0.09	-0.76	-0.26	-0.55	-0.19	0.33	0.19	0.31	0.17	0.71	-0.17	-0.46	-0.28	-0.26	0.31	-0.17	0.04	-0.51	-0.17	1.00			
21	0.44	0.12	-0.53	-0.06	-0.16	-0.78	-0.53	-0.28	-0.28	-0.70	-0.25	0.28	-0.19	0.29	-0.47	-0.08	-0.36	0.55	-0.25	-0.43	1.00		
22	0.26	0.54	0.09	0.65	-0.09	-0.34	0.73	0.00	0.77	-0.09	0.47	0.88	0.80	0.73	0.00	0.47	-0.11	0.32	-0.35	-0.35	-0.04	1.00	
23	0.35	-0.44	0.30	-0.11	0.40	0.11	0.04	0.24	0.26	0.93	-0.26	-0.26	-0.29	-0.40	-0.24	0.19	0.17	-0.48	0.19	0.65	-0.53	-0.23	1.00
Posttest	**0.59**	**0.67**	**0.81**	-0.15	-0.38	**0.60**	-0.19	-0.15	0.04	-0.03	-0.07	0.02	-0.15	0.21	-0.21	-0.01	-0.42	0.11	-0.46	0.39	0.54	-0.22	0.19

Overall satisfaction with the tool: Frustrating - Satisfying correlated significantly with the posttest scores $\boldsymbol{r}$ = .81 (items #3 and #24). This suggests that the higher the satisfaction with the course the posttest score was also higher.

Since the student performance is only partly related to usability and can be a result of other parameters, such as skill, knowledge, practice, previous experience, and so forth, such a strong correlation would have discredited to a certain extent, the results of the usability evaluation.

The posttest scores correlated with Overall Reactions to the Software (Terrible – Wonderful) $\boldsymbol{r}$ = .59, (Difficult – Easy) $\boldsymbol{r}$ =.67, (Rigid – Flexible) $\boldsymbol{r}$ =.60, was not large enough to reject the null hypothesis with this sample size, however if the sample size were to be increased, these correlations could be significant. This finding suggests that participants who scored high in the post test had positive perception of the course, and find it flexible and easy to use.

Chapter 5

Discussion

In spite of the fact that the Siebel Basic Navigation Course examined during this study was quite rudimentary, correlation results demonstrated that the usability of the system influenced the performance.

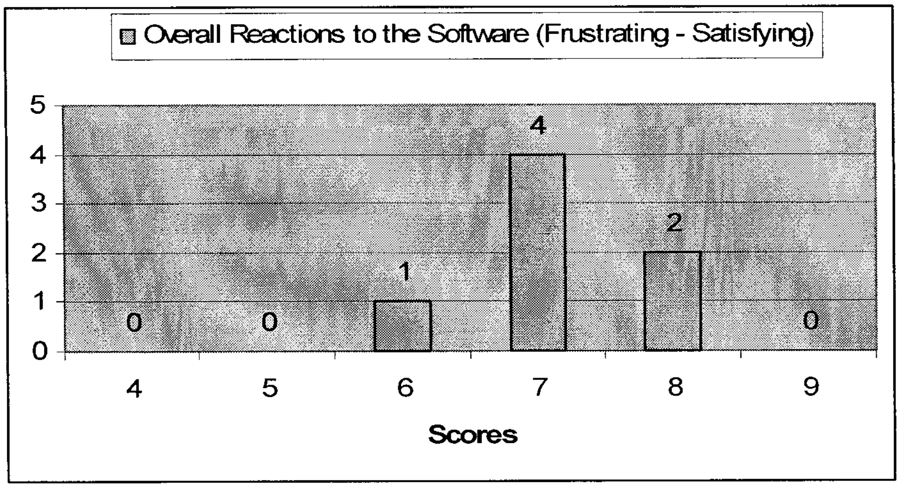
Some correlations between performance and overall reactions to the e-learning course could have been potentially higher due to a very low power sample.

The posttest scores correlated with Overall Reactions to the Software (Terrible – Wonderful) $r = .59$, (Difficult – Easy) $r = .67$, (Rigid – Flexible) $r = .60$, was not significant to reject the null hypothesis with this sample size, however if the sample size were to be increased, these correlations could be significant.

Therefore, this finding shows that technology-based learning environments are less neutral since they have an influence on the educational process.

Descriptive Statistics for Overall Reactions to the Software (Frustrating – Stimulating) identified that most of the results were concentrated around the median (Median = 7) (Table 3).

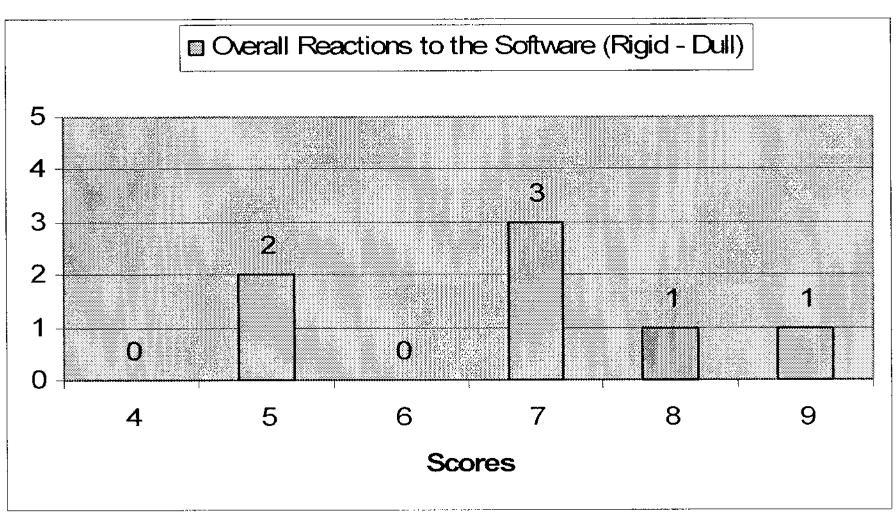
Table 3: Overall Reactions to the Software (Frustrating – Stimulating) distribution



Descriptive statistics findings pointed out the areas of the interface where participants had major differences in their opinions. This allowed identifying potential problem areas in the Siebel Basic Navigation course interface.

High spread of the values that was found for questions in Overall Reactions to the Software (Rigit – Flexible). Answers indicated that it was different opinions regarding the flexibility of the course and most of the answers were concentrated on the lower part of the median (Table 4)

Table 4: Results of Overall Reaction of the Software (Rigid – Dull) distribution



Three additional questions that had high spread of the values were Screen: Characters on the screen (Hard to read – Easy to read) and System Capabilities (Too slow – Fast enough) and System Capabilities: Experienced and inexperienced users' needs are taken into consideration (Never – Always) indicate that opinions regarding these components differed.

Further recommendations from these findings for the Siebel Basic Navigation Course interface are the following: a more flexible interface that takes into consideration personal choices, allows for personal modifications (change the interface from left side to right side), the ability to switch between French and English languages at any point in the e-learning course, simplification of the navigation system and media bars.

Implementation of these findings would improve the flexibility of the course, make it more user friendly and allow for personalizing the interface.

It is important to keep in mind that the naming convention used in the identification or labeling of the components should use the terms that are common and familiar to most users. It confirms that understanding the interface components is a critical part during the learning process and should not to become an obstacle or deterrent to the learning experience.

Squires et al. (1996) states that "*the interface should place a low cognitive demand on the learner and functionality should be obvious. The same symbols, icons and names used to represent educational 'objects' and concepts should be used consistently throughout an application.*" (p. 3).

Limitations of the Study

One of the limitations of this study was the low power sample size. If a larger sample were used, it would clarify the correlations that were high, but not high enough to be significant at $df = 5$.

The emphasis, when designing online courses, should be on the learner's characteristics and proficiency in specific areas of professional knowledge as well as skills and understanding. Thus, it is crucial to understand the differences between the typical software users and the users as learners. It is important to identify the unique needs of learners that go beyond those of typical users. (Hsi et al. 1998)

The Generic User Interface satisfaction questionnaire (Chin, et al. 1988) was originally designed with typical software users in mind; in addition to that, it did not take any professional experience into account. For future investigations, it would be beneficial to customize the User Interface Satisfaction questionnaires so that they take into account the user's characteristics as well as professional experience.

This leads to the conclusion that designers of the software tools should be concerned with how to develop adequate techniques to diminish any negative influence of the tool itself on the educational process. This objective becomes more difficult in cases when the task and context of use of the software are far more complex than the one discussed in this evaluation.

Recommendations for Future Evaluations

Additional investigation for the design of the user/learner interface and usability attributes to be considered: consistency, system speed, informative feedback, and visual clarity. Research should be directed towards a systematic approach of effective detailed measurement individual usability attributes that were are not considered while measuring usability in this study.

In more detail future evaluations should use more extensive questionnaire that includes open ended questions, which will give better understanding and explanation of the user's perceptions towards interface. Further more the questionnaire should address all major interface components, in another words specific questions should be included to measure the media bar, navigation bar, side bar components.

In addition to this questionnaire should include demographic questions, which will give better background information for the participants. It is recommended that this evaluation should be completed using a larger sample, and a more complex and extensive evaluation test.

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Appendix 1

SIEBEL NAVIGATION e-LEARNING COURSE EVALUATION
Questionnaire

User #

User Evaluation of an Interactive Computer System
(For each of the following questions, fill in 0-9 or leave blank if question is not applicable)

OVERALL REACTIONS TO THE SOFTWARE

terrible — wonderful
0 1 2 3 4 5 6 7 8 9

difficult — easy
0 1 2 3 4 5 6 7 8 9

frustrating — satisfying
0 1 2 3 4 5 6 7 8 9

inadequate power — adequate power
0 1 2 3 4 5 6 7 8 9

dull — stimulating
0 1 2 3 4 5 6 7 8 9

rigid — flexible
0 1 2 3 4 5 6 7 8 9

SCREEN

· Characters on the computer screen

hard to read — easy to read
0 1 2 3 4 5 6 7 8 9

· Highlighting on the screen simplifies task

not at all — very much
0 1 2 3 4 5 6 7 8 9

· Organization of information on screen

confusing — very clear
0 1 2 3 4 5 6 7 8 9

· Sequence of screens

confusing — very clear

TERMINOLOGY AND SYSTEM INFORMATION

· Use of terms throughout system

inconsistent — consistent
0 1 2 3 4 5 6 7 8 9

· Computer terminology is related to the task you are doing

never — always
0 1 2 3 4 5 6 7 8 9

· Position of messages on screen

inconsistent — consistent
0 1 2 3 4 5 6 7 8 9

· Messages on screen which prompt user for input

confusing — clear

0 1 2 3 4 5 6 7 8 9

· Computer keeps you informed about what it is doing

never — always

0 1 2 3 4 5 6 7 8 9

LEARNING

· Learning to navigate the system

difficult — easy

0 1 2 3 4 5 6 7 8 9

· Exploring new features by trial and error

difficult — easy

0 1 2 3 4 5 6 7 8 9

· Remembering names and use of commands

difficult — easy

0 1 2 3 4 5 6 7 8 9

· Tasks can be performed in a straight-forward manner

never — always

0 1 2 3 4 5 6 7 8 9

· Help/Feedback messages on the screen

unhelpful — helpful

0 1 2 3 4 5 6 7 8 9

· Supplemental reference materials

confusing — clear

0 1 2 3 4 5 6 7 8 9

SYSTEM CAPABILITIES

· System speed

too slow — fast enough

0 1 2 3 4 5 6 7 8 9

· System reliability/stability

unreliable — reliable

0 1 2 3 4 5 6 7 8 9

· Experienced and inexperienced users' needs are taken into consideration

never — always

0 1 2 3 4 5 6 7 8 9