INDIANA UNIVERSITY'S KNOWLEDGE BASE SYSTEM: FORMAL USABILITY STUDY

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EXECUTIVE SUMMARY

Introduction

The goal of this study is to test the usability of the Indiana University Knowledge Base system (http://kb.iu.edu). This managed database of question-answer sets is interfaced by the public using a search engine to retrieve solutions for a wide array of technical problems at all campuses belonging to Indiana University. More specifically, our usability goals are to uncover how efficient the Knowledge Base is at searching for solutions, how intuitive the interface is to the users, and how well the instructions help to complete the task. To analyze these goals we studied three users who were requested to search for solutions addressing two separate tasks. Each individual test including both tasks was expected to take about 40 minutes.

Target Population

Target subjects include students, faculty, and staff at all Indiana University campuses. The student user group consists largely of new and freshman students who are less familiar with the university. The faculty user group is generally older than the student group and in many cases not as technologically savvy. The staff group is similar to the faculty group in age. New staff will probably interact with knowledge base the most, while experience staff would use knowledge base to help students and faculty or direct students and faculty to the knowledge base.

Top Successes

- A simplistic and intuitive initial design
- Search queries return an abundance of information
- Personalized user feedback form

Top Problems

- Standardization; no consistency in wording of search results
- Representation of information; difficult to interpret which is the correct selection in returned search results
- Links only open in the same window; user can not reference the directions while navigating another window at the same time
- No visual aids to convey information; purely textual

Data Analysis and Recommendations

After examining user recommendations and considering our usability goals, we decided to elaborate on user recommendations as well as our own. These suggestions are targeted

towards improving efficiency, ease of navigation, interface intuitiveness, and overall user experience. We propose the following changes:

- 1. Incorporate text spacing feature into Knowledge Base CSS to increase readability of text throughout the website.
- 2. Include a "Frequently Asked Questions" tab on the menu bar.
- 3. Standardize presentation of search result wording and include a small description of the topic.
- 4. Include screen shots as visual aid to textual directions. See appendix for example.
- 5. Have all exterior link on instructional pages open in a blank window.
- 6. Include less hyperlinks and peripheral information.

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INTRODUCTION

Application Description

The goal of this study is to test the usability of the Indiana University Knowledge Base system (Figure 1). The Knowledge Base is currently in its third iteration as a content management and workflow system that is managed by University Information Technology Services (UITS). The system is designed to compile and display online answers to information technology questions at Indiana University. After navigating to the main screen of the Knowledge Base (http://kb.iu.edu), users are greeted with a simple interface prompting for a search term. Last year the Knowledge Base received over 10.5 million hits and currently contains more than 12,500 documents. Typing a search query into the text box and clicking submit will return any of the 12,500 documents that include all the search terms. It is updated by UITS editors dedicating over 500 hours each week for document revisions, new links, maintenance scripts, etc.

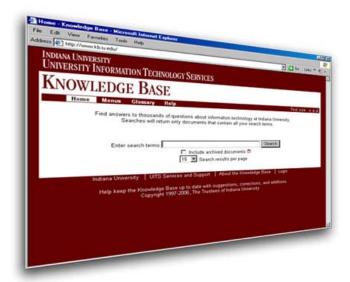


Figure 1: Indiana University Knowledge Base Main Screen

Test Objectives

For this usability study, three subjects are requested to search for solutions addressing two separate tasks. First the user is briefed on the process, given an informed consent sheet, and then a pre-questionnaire to fill out. Next the user is observed and recorded while attempting to complete both tasks. Finally a post-questionnaire is given to receive additional feedback after the subject has completed the tasks. Each test including both tasks was expected to take about 40 minutes.

Target Population

For the purposes of this study, target subjects included students, faculty, and staff at the Indiana University – Bloomington campus. We chose to focus on students and experienced faculty only because university staff would probably have similar qualities to that of a faculty member. The student users tested consisted of two new graduate students who are less familiar with the university. An experienced faculty user was also tested. This veteran faculty lecturer was more familiar with the systems at IU and could possibly use the Knowledge Base to help other target users, like new students. Users were tested by asking them to locate specific information concerning the tasks and also requesting them to follow the information to complete them. This

was to test not only the searching efficiency and usability of Knowledge Base but also to test whether the search results are effective enough to help the user, complete the test entirely.

METHODOLOGY AND TASK LIST

A variety of data-collection methodologies were employed in our study to obtain empirical data. We utilized pre-test questionnaires, scenario and task-based analyses, observation, the "talk-aloud" protocol, as well as post-test interviews.

Test Setup

We conducted usability tests on three separate users at the Informatics Graduate computer laboratory between the hours of 4:00pm-6:00pm on Sunday September 17, 2006. A predetermined number of three subjects, including one faculty and two students, with varying levels of experience were used to represent the diverse array of Knowledge Base users in a user group size suitable to our time constraints. To prevent disturbances, this computer lab was unoccupied aside from the test facilitator, observers, and the user. We recorded the user's facial expressions and onscreen actions using a Logitech webcam and Camtasia screen capturing software. During each usability test we greeted the user, administered an informed consent form and pre-test questionnaire, then observed subject's interaction with Knowledge Base, and finally conducted a post-test interview. The entire usability test took between thirty to forty minutes. The tests were designed to simulate common uses of the Indiana University Knowledge Base.

Questionnaire

After the informed consent form was signed by the user, we began the usability test by administering a pre-test questionnaire comprised of ten questions. These questions were designed to provide insight into the user's general demographic information, computing proficiency, familiarity with Knowledge Base and search engine preference. Understanding the user's general computing knowledge compared to their Knowledge Base expertise enables us to gauge the overall level of user experience within the context of this test. Information regarding the user's preferred search engine may explain reasoning behind textual and operator choices within submitted search entries.

"Thinking-Aloud" Walkthrough

After the questionnaire was filled out, the facilitator introduced the user to the basic principles of the "thinking-aloud" protocol. Under the guidance of the facilitator, the user navigated through the Knowledge Base website, while describing what they were doing as they were doing it. The thinking-aloud protocol may reveal valuable information about how users arrive at their choices, however it may seem unnatural for the user initially.

Observations

Once the user was comfortable with the thinking-aloud process, three of us observed the user until the entire test was complete. Will Odom and Erik Johnson noted the user's behavior, verbal feedback, and interactions, while Sindhia Thirumaran kept track of the completion time and user click behavior for each task. During the data analysis phase, we reviewed the video, audio, and screen captures for each user to document the correlation between user facial expressions and onscreen behavior.

Scenario and Task Description

With the user familiar with the talk-aloud protocol, we began the scenario and task phase of the testing. This phase is divided into two different scenarios, each with a task requiring the subject to locate helpful information on Knowledge Base and use it to resolve the scenario. This is the first scenario presented in testing:

You are new to the university and you've heard about the knowledge base from your colleague. Consider you got a new computer at home. You are planning to configure outlook Express to read your e-mail account.

To complete the scenario the user had to solve this task:

Configure MS Outlook Express to be able to read your IU e-mail more easily. Use knowledge base if you need any help.

Step1: Open your Internet browser and go to the Knowledge Base URL: http://www.kb.indiana.edu

Step 2: Find and use information in the Knowledge Base to configure Outlook Express.

Using applications such as Outlook Express to manage and send e-mails efficiently and effectively is vital in the University atmosphere today. The goal of this scenario is to replicate a situation common to users new to the Indiana University system. We decided to test outlook express particularly because it is an e-mail client application found on UITS campus machines. This task was intentionally non-user specific in order to compensate for students or faculty tested. Initially step 2 requested the user to enter the search keywords and follow the instructions to complete the task. Following the feedback we revised step 2, helping us analyze how intuitive knowledge base is to the users.

The second scenario presented in the testing:

You are a student at Indiana University and you are assisting a friend to create their IU Steel account. You have forgotten the exact method for creating this account.

To complete the scenario the user had to solve this task:

Using knowledge base, try to create your steel account.

Step1: Open your Internet browser and go to the Knowledge Base URL: http://www.kb.indiana.edu

Step 2: Find the information in the Knowledge Base which will tell you how to create your Steel account.

The Indiana University System has a number of unique accounts for students and faculty. The Steel account provides access to a Unix-based environment where users can, among other things, publish personal and educational websites. The goal of this scenario is to create a situation in which the user must use Knowledge Base—an Indiana University application—to setup an account unique to the IU system. The rationale for presenting this task is to explore how valuable and efficient information presented in Knowledge Base is in relation to account protocols specific to IU.

Post-Test Interview

Following the completion of the scenario and task phase, we asked the user a number of questions. User responses were recorded in audio and video and later reviewed for post-test reactions and recommendations. The questions were asked in the following order:

- 1. How easy did you find knowledge base to use?
- 2. If you had not known about knowledge base how would you have completed the given tasks?
- 3. Did you encounter any problems while doing the tasks?
- 4. What did you do in this case?
- 5. Did you have to search multiple times to find the correct information?
- 6. Did knowledgebase guide you through the entire process?
- 7. Were they any parts of knowledgebase that were confusing?
- 8. Is there anything you would change about knowledgebase?
- 9. Will you use knowledgebase in the future?

The purpose of these questions was to understand where the user encountered problems, why they had these problems, and how they solved them. We decided to use a post-test interview opposed to a questionnaire, because subjects conveyed a greater quantity and quality of information when responding orally.

EVALUATION METHODS WITH RESULTS

Usability Goals

This study aims to uncover how efficient the Knowledge Base is at searching for solutions, how intuitive the interface is to the users, and how well the instructions help to complete the task. Efficiency is determined by understanding how well Knowledge Base interprets a user's search queries and displays the search results in a way that minimizes the time users spend locating the information. In addition, we developed an understanding about how intuitive the interface is by analyzing the ease with which the user is able to navigate through knowledge base. This project requires users to engage in a set of tasks by locating and following specific information to resolve the scenario. This methodology tests the searching efficiency and usability of Knowledge Base as well as whether the search results are valuable enough to help the user complete the entire task. Using quantitative and qualitative analyses of observations, data and feedback from users, we are able to determine how well each of these usability goals are met.

Data Analysis

This study consisted of three levels of users: expert (User 1), intermediate (User 3) and the novice (User 2). Data collected from the pre-test questionnaire and post-test interview functioned as our primary orientating tool for determining these levels of proficiency.

We collected and analyzed both quantitative and qualitative data. Quantitative analysis involved counting and measuring numerical values, which are statistically analyzed for comparison to judge efficiency to complete the required tasks. (i.e. - assessing how many clicks it took an expert user to complete a task compared to a novice) Qualitative analysis included reviewing written and verbal comments made before, during, and after testing as well as user's facial expressions throughout the test.

Quantitative analysis of data

In order to understand and logically organize our data for effective analysis, we created logging sheets (Table 1) displaying collected quantitative data. The results gathered were compared with what we felt was appropriate to accomplish these tasks (par). The par number of clicks, search terms, overall searches, total time, etc..., was set with the shortest and most efficient possible method of completion in mind. Although our sample size is too small to generalize the results, using a comparative analysis between the frequency of user and par actions can produce key inferences about potential usability problems

Scenario	Quantitative data	User 1	User 2	User 3	Par
	Total Number of clicks taken to				
	complete the tasks in the scenario	39	86	48	32
	Number of Search terms used				
		3	3	2	1
	Number of Searches				
Scenario 1		1	1	3	1
	Time Taken to search for the				
	correct data that is being	2	< 1	3	< 1
	searched(minutes)				
	Used Ctrl + F option (To find the				
	keyword in the site	0	1	0	0
	Number of times switching between				
	KB and the application	0	13	15	0
	Total time taken to complete the				
	tasks(minutes)	4	10*	14*	4
	Total Number of clicks taken to				
	complete the tasks in the scenario	16	48	24	10
	Number of Search terms used				
		3	9	2	1
Scenario 2	Number of Searches				
		2	2	6	2
	Time Taken to search for the				
	correct data that is being searched	2	9	3	< 1
	Used Ctrl + F option (To find the				
	keyword in the site)	0	0	2	0
	Browsing through different				
	webpage's while searching	0	0	8	0
	Total time taken to complete the		_		
	tasks	5	10	5	2

Table 1: Quantitative analysis of Data

In measuring clicks and total time taken to complete tasks, we discovered that novice and intermediate users were able to locate the correct information, but encountered major problems understanding how to apply the directions. These users became confused while deep within steps in Outlook Express and ultimately were not able to fully configure the e-mail client. The first user had expert proficiency with knowledge base and outlook express, allowing him to avoid complications and not bringing this problem to our attention until the second user test.

^{*}Task aborted. User found the solution but encountered complications understanding the directions.

Qualitative analysis of data

Qualitative data moves away from the mathematical analysis used in quantitative collection. Our criteria for collecting qualitative data centered upon externalized user reactions to problems encountered in the system, such as verbal comments and facial expressions. Observers noted behavioral patterns arising in specific tasks among multiple users. We used video and screen capture recording equipment to transcribe user responses and behaviors. Working from these recordings and observer notes, we systematically categorized and analyzed the qualitative data, which is displayed in the table below.

We categorized users to be in three proficiency groups: expert, intermediate and novice. Table 2 shows the result of qualitative analysis of the usability test based on verbal protocol, data logging sheet, and the post-test interview.

Data	User 1 (expert)	User 2 (novice)	User 3 (intermediate)
Impression of KB Usability	Moderate	Moderate "Task 1 – very easy" "Task 2 – very hard"	Hard, "awkward", "not getting along"
Did KB guide the entire process?	Moderate	Less Moderate	Less Moderate
Confusing parts of KB	Low "Ordering of search results"	Moderate "Appropriate words were not used"	High "Description itself is confusing"
Will you use the KB in the future?	Yes " Enormous amount of data"	Sometimes "if I need to do so"	Not directly "use KB, if directed towards the KB site"
Failed to notice the fault while doing task 1		Once	Once
Problems encountered during the task	Less "To find the correct search item from the list"	Moderate "Browsed many pages to reach desired page."	More "Search titles"
Completion of task 1	Could do it by memory	Incomplete	Incomplete
Completion of task 2	Complete	Complete	Complete
Facial expression during the entire process	Mostly Calm, happy	Mostly worried, little frustrated	Mostly frustrated

Table 2: Qualitative Analysis of Data

USABILITY PROBLEMS

From the quantitative and qualitative data analysis, we determined the following problems users encountered during testing.

Quantitative problems

- 1. An excess of time wasted for locating the correct link.
- 2. Requires numerous searches to locate page with correct information.
- 3. Difficulty in mitigating Knowledge Base and given application.

A great disparity between the number of clicks employed by the user compared to the shortest possible amount of clicks (par) indicates a significant usability problem. In addition, a disproportionate amount of time taken by the user to complete given tasks compared to the par time is suggests another area of user difficulty. Overuse of clicks and inefficient use of time are the major indicators of user error.

Quantitative	Problem Severity	Comments
Locating Correct Link	Global	Causes user to waste an excess of time.
Multiple searches to	Global	User loses trust in search engine after
locate correct page		inadequate results are returned.
Switching between	Global	Difficult for user to follow instructions due to
KB and Application		link opening in the same window.

Qualitative problems

- 1. Search results listed closely together with a lack of text spacing.
- 2. Lack of prioritization and standardization of search results.
- 3. Confusing informational presentation on direction pages.
- 4. Obstructive color scheme.

These problems resulted in frustration and confusion among the users. During testing, users mentioned search results were listed closely to each other and they encountered a difficult time determining the correct link. Search result pages often appeared overloaded with information peripheral to the primary instruction, causing user to easily overlook essential directions. Users were familiar with using the color blue to indicate hyperlinks, the appearance of red hyperlinks confused subjects familiar with the blue convention. Red is typically used to draw visual persuasion and indicate importance, in this case the abundance of red links influenced users to click on seemingly unrelated links.

Qualitative	Problem Severity	Comments
Text Spacing	Local	Very difficult for user to determine desired link
Standardization	Local	Searches return seemingly unrelated content.
		User spends excess time scanning through it.
Informational	Global	Difficult for user to discern instructions while
Presentation		they are embedded in general information.
Color Scheme	Global	Visually confusing and disorienting.

RECOMMENDATIONS

User Recommendations

Through qualitative data collection and analysis, we collected meaningful information in regards to user recommend changes. The following suggestions were proposed by users while performing tasks and in the post-test interview.

- Standardization of search results
- Change of color scheme
- Additional search pages not required
- Screen shots to be included along with instructions
- Incorporate common operator searching conventions

A frequent problem users conveyed to us was the disruptive nature of Knowledge Base's aesthetic design scheme. The combined effect of interspersed red hyperlinks and black text evoked a "vertigo-like" disorienting feeling for users. Users preferred to rephrase their keyword searches opposed to advancing deeper into the search result pages. The pre-test questionnaire requested users to provide information on the search engines they use most. Users noted that they tried to incorporate searching conventions common to engines they often use, however when implemented in Knowledge Base a set of unrelated results were provided.

Observer Recommendations

After examining user recommendations and considering our usability goals, we decided to include elaborations on user recommendations as well as our own. These suggestions are targeted towards improving efficiency, ease of navigation, interface intuitiveness, and overall user experience. We propose the following changes:

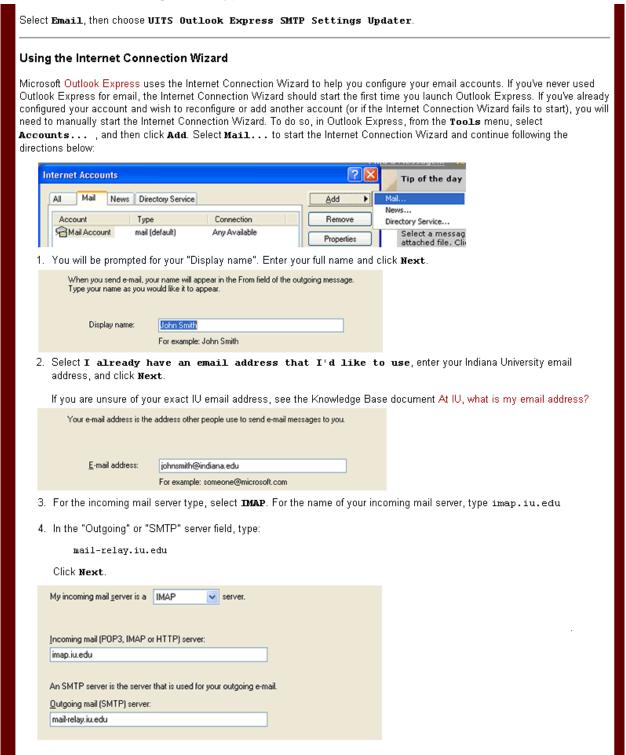
- 1. Incorporate text spacing feature into Knowledge Base CSS to increase readability of text throughout the website.
- 2. Include a "Frequently Asked Questions" tab on the menu bar.
- 3. Standardize presentation of search result wording and include a small description of the topic.
- 4. Include screen shots as visual aid to textual directions. See appendix for example.
- 5. Have all exterior link on instructional pages open in a blank window.
- 6. Include less hyperlinks and peripheral information.

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APPENDIX

Recommended Redesign Prototype



Informed Consent Statement

Indiana University – Bloomington Informed Consent Statement

User study to evaluate the Knowledge Base of Indiana University.

Investigators: [Jacob, Baizil bkjacob@indiana.edu], [Johnson, Erik Matthew, johnsoem@indiana.edu], [Odom, William wodom@indiana.edu] [Thirumaran, Sindhia sinthiru@indiana.edu]

You are invited to participate in a usability study to evaluate a user interface for IU Knowledge base.

Procedures

This study is to test the usability of a web site. The study is expected to last roughly 40 minutes. Participants in this study will be asked to do a set of tasks, think aloud while doing these tasks, fill out opinion questionnaire, and take part in an interview. Performance data, such as the number of errors or time to complete a task may be collected; also. Opinion data may be collected and the participants' performance will be videotaped.

Purpose and Benefits

Your participation will help in improving the design of user interfaces, which will help in clarifying user's needs and issues.

Risk

There are no foreseeable risks, stress or discomfort associated with this usability testing.

Confidentiality

Participants' names and the data collected during the study will be kept confidential. It will be reviewed only by investigators and not be retained for more than a year.

Videotape

We would like to videotape the session for research purposes only.

Participation

Your participation in this study is voluntary; you may refuse to participate without penalty. If you decide to participate, you may withdraw from the study at any time.

Consent

I have read this form and received a copy of it.	I have had all my questions answered to my satisfaction.
agree to take part in this study.	

Subject's signature	Date

Pre-test Questionnaire

Pre-test Questionnaire				
1. What is your name?				
2. Contact Information?				
3. What is your gender?MaleFemale				
4. Which age group do you fall in? 17-2425-2930-3940-4950-5960-65				
5. What is your occupation?				
6. What is the highest level of education you have finished?High schoolBachelorMasterPhDOther:				
7. How would you rate your level of computer expertise (please circle one)? Na $\"{}$ Na $\~{}$ Na $\~{} Na\~{} Na$				
8. How often do you use a computer (check one)?neverrarelymonthlyweeklydaily				
9 Have you used Indiana University Knowledge Base?yesno				
a) If yes, how often do you use it?				
rarelymonthlyweeklydaily				
b) If not, why?				
10 Which search engine does often use?googleyahoomsnwikipediaother				

Script for Test

Script for Test

Thank you for giving up some of your time to help us test the Indian University Knowledge Base. Knowledge Base is maintained by the University Information Technology Services department. Knowledge Base is a powerful tool for searching and locating informational procedures on how to configure, manage, and use a variety of computer applications and accounts provided by Indiana University.

The primary objective of this study is to test the usability of the Knowledge Base website. During the course of this study, you will be asked to work through a few different tasks, relying on Knowledge Base for help and guidance. During the course of the test, we would like to capture your mouse movements on the screen, as well as use a webcam to record your facial expressions. This may reveal further insight into the cognitive steps users take while navigating the Knowledge Base. This video will be kept confidential and only be reviewed by us for research purposes. Remember, your participation is voluntary and you have the right to withdraw from this study at any time.

Ok, if you could just fill out these sheets of information before you start. We need this information so we can make sure we test different sort of people who might use the Knowledge Base website. Remember that we keep all information confidential.

We'll start this study by giving you a few minutes to look around and become familiar with the Knowledge Base site. Then, we'll give you some tasks to accomplish on the site. If you can't perform some of the tasks do not feel as though you've done something wrong or made a mistake.

While you're doing the tasks, we would like you to tell us what you're thinking as you interact with the Knowledge Base. For example, if you are looking for something, explain to us what you're thinking as you look. If you think you might have looked in the wrong place for something, let us know, and tell us why you looked where you did.

For example, if you are becoming confused about which button to click on, you may think aloud: "The instructions have directed me to click on the proceed button, but now I am becoming confused because there are many different buttons on the screen."

It is important to not analyze your thoughts, but simply verbalize them and talk continuously. While you're doing the tasks, we might ask you to tell us what you're thinking fairly often. We apologize if this is annoying; thinking out loud can be difficult at times, but it reveals information that is very important to us.

Although I may be sitting next to you during the test, I can't help you out with the tasks. If we help you, we can't find problems latent within the Knowledge Base. If you become really stuck on a task and don't feel like you can complete it, then let us know and move on to the next task.

Do you have any questions before you begin the test?

Now if you could take a few minutes to familiarize yourself with the site...?

Scenarios and Tasks

Scenario 1

You are new to the university and you've heard about the knowledge base from your colleague. Consider you got a new computer at home. You are planning to configure outlook Express to read your e-mail account.

Task 1:

Configure MS Outlook Express to be able to read your IU e-mail more easily. Use knowledge base if you need any help.

- Step1: Open your Internet browser and go to the Knowledge Base URL: http://www.kb.indiana.edu
- Step 2: Enter you search terms and proceed
- Step 3: Configure Outlook Express with the information provided

Scenario 2

You are a faculty member at Indiana University and you are assisting a student to create their IU Steel account. You have forgotten the exact method for creating this account.

Task 2:

Using knowledge base, try to create your steel account.

- Step1: Open your Internet browser and go to the Knowledge Base URL: http://www.kb.indiana.edu
- Step 2: Enter you search terms and proceed
- Step 3: Create your still account with the information provided

Post Study Interview Questions

<u>Post Study Interview Questions</u> (This is a list of possible questions being asked. Actual questions will be selected depending on the situation.)
1. How easy did you find Knowledge Base to use?
Very HardHardModerateEasyVery Easy
2. If you had not known about knowledge base how would you have completed the given tasks?
a) Outlook Express
b) Steel account
3. Did you encounter any problems while doing the tasks?
3a). If so, what did you do in this case?
4. Did you have to search multiple times to find the correct information?
12345more than 5 times
5. Did knowledgebase guide you through the entire process?
Not at all =12345 = completely
6. Were they any parts of knowledgebase that were confusing?
7. Is there anything you would change about knowledgebase?
8. Will you use knowledgebase in the future?
YesNo

Data Logging Sheets

Scenario 1

Correct User Action	<u>Yes</u>	<u>No</u>	Errors/Comments
Enter "X" in search terms field			
Click search button			
Choose:			
"At IU, how do I configure Outlook Express for Windows to read my mail on the Cyrus mail			
system?"			
Click or Scroll to the section of the page called: "Using the Internet Connection Wizard"			
"Using the Internet Connection Wizard"			
Open Outlook and follow the directions to verify			
this is the correct solution.			

Scenario 2

Correct User Action	Yes	<u>No</u>	Errors/Comments
Enter "X" in search terms field			
Click search button			
Choose: "What is Steel?"			
Locate the instructions for creating a steel account via the "Account Management Service" approximately half way down the page.			
Open the link for "Account Management			
Service" in a new window and follow the directions from the knowledge base page to set up an account.			