Studies an IR interfaces II[1]: A Study of Learning and Retention with a Web-based IR Interface

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[1] For Part I, see Ahmed, McKnight and Oppenheim (2004)

Abstract

This paper reports on an empirical study on novices' learning and retention with the Web-based interface to the Web of Science. The aim was to evaluate the performance of novice searchers in initially learning to use the search interface and in later use. Their performance in both sessions was measured in terms of time taken to perform tasks, search terms used, success of the tasks performed, and error rates. At the end of each session, novices' subjective satisfaction with the interface was also measured. The results showed that novices' performance was better in the learning session. Their performance in the retention session declined significantly in terms of success score as they forgot the interface functionalities from one search session to another. Novices' subjective satisfaction with the interface was also higher in their learning session. Their satisfaction rating with the interface declined sharply in the retention session. The Web of Science interface suffers from usability problems which made its functionalities difficult to learn and remember for naive searchers.

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1. Introduction

During the past decade, Web-based user interfaces have become a common method of accessing online databases. Since the mid-1990s, several IR systems have developed Web-based operations that either replaced or coexisted with earlier versions. Today, almost all major IR systems offer Web access to their databases. The fundamental characteristic of Web-based IR systems is that they are inherently interactive and provide low cost access to a variety of online databases. The Web has also made online searching more accessible to naive users. However, despite these improvements, critics argue that many Web-based IR interfaces are still difficult to learn and use (Shneiderman, 1997; Borgman, 2000). The need for better IR interface design that helps ready learnability and retention of interface functionalities remains.

In an earlier study (Ahmed, et al 2004), we reported that both novice and experienced searchers had considerable difficulties in searching the Web of Science interface (available at: http://wos.mimas.ac.uk). Therefore, we decided to carry out a separate study on novices' learning and retention using the same interface, equipments, tasks and environment. Novice volunteers took part in this study. None of them had participated in our earlier study. They participated in two sessions. The first session measured their learning with the interface after a brief tutorial session. The second search session was conducted four weeks after the initial learning session to measure their retention of searching skills. Novices also rated their subjective satisfaction with the Web of Science interface at the end of both sessions. The main aim of this study was, therefore, to examine novice searchers' learning and retention with a Web-based IR interface.

2. Previous research

A few studies have investigated novices' learning with online search systems. Early studies show that novices could learn to conduct simple searches when a brief training was provided (Lancaster, 1972; Fenichel, 1980). More recent studies show similar

results. Sullivan et al. (1990) found that novices could learn to do online searches effectively after brief tutorial sessions. More recently, Ahmed et al. (2004) found that novices could learn to do simple search tasks after 15-mintues of free exploration of a Web-based system. All these studies also reported novices' problems with searching online databases. They tend to be slower, less successful, and make more errors when compared with experienced searchers. It should be noted here that none of the studies cited above examined novice's retention of search skills after their original learning.

Some Web-based IR interfaces are optimised for effective use by novice searchers. They usually display lists of available databases with short descriptions to help users select appropriate databases. Several Web-based systems provide easy search option for novice users. Ahmed et al. (2004) reported that novice users are more satisfied with the Web-based IR interfaces compared to experienced searchers. Novices' initial use of an IR system may have positively influenced their attitude with the interface. Davis (1989) argued that in the earliest stage of learning, novices' perceptions about ease of use may be formed both by the surface look of the interface, such as the use of icons, colour, information presentation, etc., and by the result of hands-on experience with the interface.

Several studies have examined the role of mental models in using IR systems. These studies noted that users must have an appropriate mental model of the system to be able to use it correctly. Some of these studies argued that training would help novices to develop a more complete and accurate mental model of the search system. A number of studies showed that novices who have received hands-on training had more completely understood both the concepts and functions of the computer applications (Olfman and Mandviwalla, 1994; Santhanam and Sein, 1994; Simon et al., 1996).

Another important factor in novices' learning with an online IR system may involve individual differences. It seems that novices' age might have influenced their learning abilities. Studies of older novices learning to perform a variety of computerised tasks consistently showed slower learning for older novices compared to younger novices (Czaja et al. 1989; Mead and Fisk, 1998). In addition, general computer experience is likely to be an important factor for older novices' success in using an online database. Mead et al. (2000) studied the effect of novices' general computer experience and age

on their search performance on a library database system. The results showed lower success rates for older novices than younger adults with similar computer experience. Older novices having low computer experience perform much better than older adults having no computer experience at all. Novices' sex may also affect on their search performance. Sullivan et al. (1989) reported that women made more errors than men. In contrast, Ahmed et al. (2004) found that women performed better than male users. Thus, age, the level of general computer experience, sex, etc., can affect novices' search performance with IR systems.

The literature suggests that novices could learn to do simple online searches when a brief training is provided. The searches were not without their difficulties, perhaps due to the poor design of interfaces, the low level of training and the individual differences. There is a need to systematically examine searches conducted by novices to understand their information searching behaviour so that interfaces for improving their strategies can be built into future search systems.

3. Methods adopted in our research

3.1 Participants

Ten (10) novice volunteers took part in this study. They were postgraduates, research students, and research staff recruited from various departments at Loughborough University, UK. They comprised of six postgraduates, three research students, and one member of research staff. None of them reported having used online search systems prior to this study. There were five male and five female participants.

3.2 Research Design

Novices came one at a time for the experiment. They participated in two sessions spaced four weeks apart. In the first session (learning), they were asked to fill in a recruitment questionnaire (see Appendix 2), which assessed their age, sex, status and computer experience. They were then given a 15-minutes "hands-on" training to learn the basic conventions of the Web of Science interface. All participants were then given the search tasks (see 3.3 below) and told to try to work on their own. They were also told that if any task took more than twenty-minutes to complete, they would be stopped and asked to proceed to the next task. If the participants felt that they would be unable to complete a task and wanted to move on, this would be allowed. They were also free to consult the online help available in the Web of Science interface. After completion of all tasks, participants were asked to complete a questionnaire (see Appendix) on their satisfaction with the Web of Science interface. In the second session (retention), held four weeks later, the same procedure was followed except that the training was not repeated. The task set was the same as in the first session. Satisfaction with the Web of Science interface was measured again at the end of the session.

3.3 Search tasks

The search tasks are shown in Appendix 1. The first five search tasks were obtained from a survey conducted with users of the Web-based IR systems at Loughborough University, UK. Task 6 and Task 7 were taken from the *Web of Science: Questions and Workbook*, available at http://wos.mimas.ac.uk/documentation.html. Task 1 constituted a phrase and Task 2 consisted of a single word. Task 3 and Task 4 required the use of Boolean operators. Task 5 required author searching. Most of the search queries were about general themes, but some dealt with specific topics (e.g., Task 3 and Task 4). In addition, truncation, proximity, and spelling variations could be tested in several cases (e.g., Task 4 and Task 6). Since the Web of Science allows address and cited reference searching, Task 6 and Task 7 could be used to test these search facilities.

3.4 Data collection

The study used a combination of data collection methods. These included transaction logs, computer screen recordings, and the questionnaires. The transaction logs captured each user's server requests. The logs were obtained from MIMAS at the University of Manchester. Data recorded by transaction loggings included: database used, search interface used (Easy Search or Full Search), search terms used, and system response (number of hits, error message, etc.). Lotus ScreenCam was used to record each user's entire search session. It recorded how each user was using the Web of Science. After capturing a search session, the screen recordings were analysed and compared with transaction logs. At the end of both search sessions, novices were asked to complete a questionnaire (see Appendix 3) about the Web of Science interface. This questionnaire was based on QUIS (Chin et al., 1988).

3.5 Variables Studied

The data gathered from both learning and retention sessions were analysed according to the following performance and satisfaction measurement criteria:

3.5.1 *Performance variables:*

- *Time taken:* The total time taken to complete each search task. These times were extracted from the transaction logs and the computer screen recordings.

- *Search terms used:* The number of different search terms used for each task was calculated from transaction logs.

- *Success score*: Successful completion of each search task, as well as requested termination, and termination as a result of the twenty-minute time limit was counted from screen recordings.

- *Error rates:* Number of errors made was tabulated from transaction logs and computer screen recordings.

3.5.2 *Subjective satisfaction:*

The QUIS measured novices' subjective satisfaction with the interface on a 7-point scale. The questionnaire covered items such as overall reaction, screen, terminology and system feedback, learning, and system capabilities.

3.6 Hypotheses

The null hypotheses developed for the study were:

H1: There is no difference between learning and retention in total time taken to complete search tasks.

H2: There is no difference learning and retention in total number of search terms used.

H3: There is no difference between learning and retention in total success score of search tasks.

H4: There is no difference between learning and retention in total number of errors made.

H5: There is no difference between learning and retention in subjective satisfaction with the Web of Science interface.

Novices were again grouped, this time according to their age, sex, computer experience, and status. Further hypotheses developed were:

H6: There is no difference in search performance among novices in terms of age groups.

H7: There is no difference in search performance among novices in terms of sex.

H8: There is no difference in search performance among novices in

terms of their previous computer experience.

H9: There is no difference in search performance among novices in terms of their status.

4. Results of the study

Means and standard deviations were calculated for the time taken to complete each search task. Table 1 shows the task completion time for both learning and retention sessions. It can be seen that original learning session required longer time in searching five out of seven search tasks. For Task 6, the mean time taken was lower for learning than for retention. Task 1 was tied for both sessions.

	Time taken (mins.)		***Search terms used***		***Success score***		***Error rates***	
	Learning	*Retention*	*Learning*	*Retention*	*Learning*	*Retention*	*Learning*	*Retention*
Task 1	2.90 (1.29)	2.90 (1.85)	1.30 (0.48)	1.30 (0.95)	1.00 (0.00)	1.00 (0.00)	0.20 (0.42)	0.20 (0.63)
Task 2	1.70 (0.95)	1.60 (0.84)	1.00 (0.00)	1.20 (0.42)	1.00 (0.00)	0.90 (0.32)	0.00 (0.00)	0.30 (0.48)
Task 3	2.50 (1.35)	2.00 (0.94)	1.30 (0.48)	1.50 (0.53)	0.60 (0.52)	0.50 (0.53)	0.60 (0.70)	0.80 (0.63)
Task 4	2.20 (1.14)	2.00 (1.05)	1.70 (1.25)	2.00 (1.15)	0.60 (0.52)	0.60 (0.52)	0.60 (0.70)	0.70 (0.67)
Task 5	2.50 (1.58)	1.80 (0.92)	1.80 (1.14)	1.40 (0.70))	0.80 (0.42)	0.70 (0.48)	0.90 (0.99)	0.70 (0.82)
Task 6	7.30 (4.57)	7.80 (4.39	3.20 (1.14)	2.80 (1.55)	0.60 (0.52)	0.20 (0.42)	2.00 (1.33)	1.50 (0.97)
Task 7	4.70 (3.37)	3.50 (0.97)	2.20 (2.10	1.20 (0.42)	0.80 (0.42)	0.70 (0.48)	0.70 (1.89)	0.30 (0.48)
Overall results	*23.80 (9.463)*	*21.60 (6.62)*	*12.50 (3.66)*	*11.40 (1.71)*	*5.40 (2.07)*	*4.60 (1.78)*	*5.20 (3.97)*	*4.50 (1.51)*

Table 1: Means and standard deviations (in parentheses) of novices' performance data

“Success” of a search task was scored as 1 if the search task was successful or 0 if it unsuccessful. No partial credit was given. So, the maximum average success score for a task was 1, if all naive searchers in a session were successful. Table 1 shows the average success score for each session. As can be seen, novices were quite successful in searching Task 1 and Task 2 in both learning and retention sessions. Only one searcher failed to complete Task 2 in the retention phase. Task 3 and Task 4 required searchers to use Boolean operators. Six naive users could complete both these tasks in the learning session. In the retention session, however, the success score declined as five novice searchers were successful in completing Task 3. A similar pattern could be observed for Task 5 in which eight novices were successful in the initial learning stage compared to seven in the retention phase. However, the situation was worse in the case of Task 6 where six novices were initially successful, but only two searchers retained the skill for the later session. The success score for the cited reference search (Task 7) also declined in the retention session.

The total number of errors made in both learning and retention sessions was counted separately. Table 1 shows the average number of errors made by novices. The novices started off well with relatively low error rates. Their error rates began to climb up from Task 3 in both sessions. Task 6 resulted in the most errors in both sessions. In general, novice searchers performed better in the learning session than the retention.

Table 1 presents novices’ overall performance data for each search session. Novices required an average of 23.80 minutes to complete all search tasks in the learning session. They took 21.60 minutes in the retention session. In terms of search terms, they used 12.50 terms on average in learning while they used and average of 11.40 search terms in the retention phase. Overall, novices were more successful in learning than retention. They scored 5.40 in learning compared to 4.60 in retention session. Novices made 5.20 errors on average in learning compared to 4.50 errors in the retention session.

A *t*-test was carried out to see the differences between learning and retention sessions in terms of time taken, search terms used, success score, and the number of errors made. The result of the *t*-test is shown in Table 2.

Performance variables	***t-value***	***df***	***Sig. (2-tailed)***
Time taken	1.002	9	.342
Search terms used	1.000	9	.343
Success score	2.449	9	.037
Errors made	.685	9	.511

Table 2: The related *t*-test for time taken, terms used, and success and error rates

Table 2 results show that there were no significant differences in total time taken, search terms used and error rates by naive searchers in learning and retention sessions (H1, H2 and H4). However, there are significant differences ($p<0.05$) between learning and retention in terms of success score. Thus, the null hypothesis (H3) is rejected.

A two-way mixed model ANOVA was run individually for age, sex, general computer experience, and status of the users. Search sessions were within subject factors, while age, sex, computer experience, and status were the between subject factors. The results showed that age difference was significant ($F=4.88$, $p<0.05$) for task completion time. Thus, the null hypothesis H6 is rejected. The two-way ANOVA results for sex difference showed that there was no significant difference between male and female naive searchers in terms of search performance (H7). The ANOVA results showed that success score was significant ($F=7.81$, $p<0.05$) in between-subject factor among novices with different levels of computer experience. The Duncan's test (Cramer and Howitt, 2004, p. 53) suggested that novices with 3-5 years and 6-10 years of general computer experience scored significantly better than novices with 1-2 years of computer experience. Therefore, the null hypothesis H8 is rejected. The novices' status did not have any significant effect on their search performance (H9).

Subjective satisfaction with the Web of Science interface

Data collected through the QUIS at the end of both learning and retention tests are summarised in Table 3. Novices' subjective satisfaction with the Web of Science was measured on a 7-point scale.

Question	***Learning***	***Retention***	***Question***	***Learning***	***Retention***
Overall reactions			***Terminology and System feedback***		
Terrible vs. wonderful	5.30 (0.48)	5.20 (0.92)	Simple and natural dialogue	4.90 (0.88)	4.90 (1.20)
Unimpressive vs. impressive	4.90 (1.10)	5.10 (0.88)	Terms used in the system	5.10 (0.57)	5.20 (1.14)
Difficult vs. Easy	5.40 (1.26)	5.10 (1.60)	Position of message	5.20 (0.92)	5.50 (0.71)
Inefficient vs. efficient	4.90 (0.99)	5.20 (1.48)	Prompts for input	4.70 (1.83)	4.90 (1.29)
Useless vs. Useful	5.90 (1.10)	5.50 (1.08)	Inform about work progress	4.70 (1.57)	5.20 (1.03)
Unfriendly vs. friendly	5.30 (1.49)	4.50 (1.72)	Error messages	3.50 (1.72)	4.10 (0.74)
Frustrating vs. satisfying	5.60 (1.17)	4.80 (1.93)	***Learning***		
Ineffective vs. powerful	5.30 (0.95)	5.30 (1.05)	System learning	5.60 (1.51)	5.10 (1.91)
Dull vs. stimulating	4.40 (0.97)	4.50 (1.65)	Exploring by trial and error	4.60 (1.51)	4.30 (1.83)
Rigid vs. flexible	4.70 (1.34)	4.60 (1.58)	Remembering commands	4.90 (1.20)	4.20 (1.87)
Screen			Performing tasks is simple	5.40 (1.51)	4.90 (0.88)
Reading characters	5.90 (0.88)	4.90 (1.60)	Help messages on the screen	4.90 (1.29)	4.30 (0.95)
Onscreen information	5.00 (1.49)	5.20 (1.03)	Help access	4.44 (0.88)	4.40 (1.35)

Information arrangement	5.60 (0.84)	5.00 (1.05)	***System capabilities***		
Easy to find information	5.00 (0.82)	4.78 (1.48)	System speed	3.80 (1.75)	4.50 (1.58)
Screen sequencing	5.60 (0.84)	4.60 (1.35)	System reliability	4.90 (1.73)	4.10 (1.79)
Screen back track	4.20 (1.81)	3.90 (1.91)	Correcting mistakes	4.40 (0.84)	4.10 (1.45)
Back to main screen	5.33 (1.41)	5.89 (1.05)	Designed for all levels of users	4.30 (1.34)	4.20 (2.04)

Table 3: Novices satisfaction rating for the Web of Science interface

The data showed that novices were generally more satisfied with the Web of Science in their initial learning session. Most of their mean satisfaction rating ranged between 4 and 6. However, their attitudes towards the search interface changed greatly in the retention stage of the experiment. Most of their mean satisfaction ratings were lower in the retention stage compared to the earlier learning stage.

The Wilcoxon Matched Pairs test was carried out to examine the difference between learning and retention sessions in subjective satisfaction with the interface. The results showed that twenty cases were negatively signed after ranking and eleven cases were positively signed after ranking. There were two cases where the ranking was tied. It seems clear that retention session tends to have lower values than learning session. The Z value is –2.01 which has a two-tailed probability of $p<0.05$. This suggests that the difference between novices' subjective satisfaction with the interface in learning and retention was significant at the 5% level. Thus, the null hypothesis H5 is rejected.

5. Discussions and conclusions

This study was intended to find out if differences exist between novices' learning and retention with a Web-based IR interface. The study examined their original learning immediately following training and retention of the interface functionality four week

after the initial learning. The results of the original learning phase of the study showed that novices could readily pick up the interface functionality when some training was provided. This result is consistent with earlier studies on online searching (Fenichel, 1980; Sullivan et al., 1990; Ahmed, et. al., 2004). Novices' retention of search skills, however, weakened over time. The results showed a significant decrease in success score in the retention session. Novices' subjective satisfaction with the interface also diminished significantly in the retention phase.

The key question arising from these results is why novices performed reasonably better in the initial learning than the retention session. Assuming that the training did contribute to their success, there are several possible explanations. The training was provided "hands-on" which is largely agreed as the best method of teaching computer applications. Most importantly, perhaps, the "one-to-one" training certainly boosted novices' confidence in searching databases. In the first session, novices were trained in Boolean and proximity operators. Evidently the approach had worked, as they were reasonably successful in using them in the learning session. However, as time passed and the training became more distant, novices' success score declined significantly.

The study looked at error rates as another test of learning. It was expected that novices would start with high error rates and then their error rates might go down from that initial high rate. The training appeared to have stood the novices in good stead because most started their search with a low error rate. However, error rates did not fall off much in the retention session. This suggested that they forgot from one session to another. Similarly, task completion time and search terms use also did not change much over time. Training appeared to have been useful for novices in learning online searching. Novices succeeded reasonably well in constructing searches and getting results immediately after training, but it was evident that training was not enough to make them into successful online searchers. Novices' success score in both learning and retention sessions suggest that the interface was not easy to learn and remember.

The study of individual differences also provided some interesting results. The results showed that the general computer experience and age influenced search performance. Novices with higher levels of computer experience in general were significantly more successful than novices with lower levels of computer experience. Younger novices

performed better than older ones in time taken to complete the tasks. This finding is similar to other studies on the effect of individual differences on search performance. However, this result was not compelling as one of the age groups had only one case.

The study showed that novices' subjective satisfaction with the Web of Science interface decreased from initial learning to retention. It is clear that novices through hands-on training become more proficient at manipulating the search system. As a result, they become more satisfied with the interface. This finding is consistent with Davis (1989). However, novices' satisfaction rating with the Web of Science interface declined sharply as they forgot the system functionality from one session to another.

This study has showed that even with a brief training session, novices were able to perform online searches in the Web-based IR systems. However, retention of search skills between the original learning and the retention session was poor. Likewise, subjective satisfaction with the interface became lower in the retention session. The interface did not help novices to remember the system functionalities. The interface design did not take into account novices' information searching behaviour. As a result, the Web of Science interface suffers from usability problems which made its functionalities difficult to learn and remember for naive searchers. We have used these results to develop a prototype IR interface, which we believe addresses some of the problems we have identified. This will be described in a further paper in this series.

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APPENDICES

Appendix 1

Task 1: Find information on the topic of computer-aided design

Task 2: Find information about e-commerce

Task 3: Find information on concurrent engineering in construction

Task 4: Find information about applications of fibre optics

Task 5: Find information about the works of Lawrence R Rabiner

Task 6: Find work produced by the researchers in the Chemical Engineering department at UMIST

Task 7: Find articles citing work by M. Smith published in the journal of *Addictive Behaviors*

Appendix 2

Recruitment Questionnaire

Please tick boxes where appropriate

1. Name:

2. Department:

3. Status: ☐ Staff ☐ Postgraduate student ☐ Research student ☐ Others (please specify)

4. Age: ☐ 18-24 ☐ 25-34 ☐ 35-44 ☐ 45 or above

5. Sex: ☐ Male ☐ Female

6. How long have you been using computers?

   ☐ Less than 1 year ☐ 1-2 years ☐ 3-5 years ☐ 6-10 years ☐ More than 10 years

7. Do you have any experience on how to conduct searches on an IR system, such as FirstSearch, Dialog, or LEXIS/NEXIS, etc.?

☐ Yes ☐ No

8. Have you received any training on online information searching?

☐ Yes ☐ No

9. Have you ever used the ISI Web of Science databases?

☐ Yes ☐ No

10. If yes, how long have you been using the Web of Science databases?

☐ Less than 1 year ☐ 1-2 years
☐ 3-5 years ☐ Over 5 years

11. If yes, how often do you use the Web of Science?

☐ Only used once before ☐ Regularly, up to 4 times per month
☐ Rarely ☐ More than 5 times per month

Appendix 3

Questionnaire for User Interface Satisfaction (QUIS)

Please circle the numbers, which most appropriately reflect your impressions about using the system. Try to respond to all the items and for items that are not applicable, use: **NA**.

Overall reactions

1.	terrible	**1**	**2**	**3**	**4**	**5**	**6**	**7**	wonderful	**NA**
2.	unimpressive	**1**	**2**	**3**	**4**	**5**	**6**	**7**	impressive	**NA**
3.	difficult	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**
4.	inefficient	**1**	**2**	**3**	**4**	**5**	**6**	**7**	efficient	**NA**
5.	useless	**1**	**2**	**3**	**4**	**5**	**6**	**7**	useful	**NA**
6.	unfriendly	**1**	**2**	**3**	**4**	**5**	**6**	**7**	friendly	**NA**
7.	frustrating	**1**	**2**	**3**	**4**	**5**	**6**	**7**	satisfying	**NA**
8.	ineffective	**1**	**2**	**3**	**4**	**5**	**6**	**7**	powerful	**NA**
9.	dull	**1**	**2**	**3**	**4**	**5**	**6**	**7**	stimulating	**NA**
10.	rigid	**1**	**2**	**3**	**4**	**5**	**6**	**7**	flexible	**NA**

Screen

11. Reading characters	hard	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**
12. Onscreen information	inadequate	**1**	**2**	**3**	**4**	**5**	**6**	**7**	adequate	**NA**
13. Information arrangement	illogical	**1**	**2**	**3**	**4**	**5**	**6**	**7**	logical	**NA**
14. Easy to find information	never	**1**	**2**	**3**	**4**	**5**	**6**	**7**	always	**NA**

15. Screen sequencing	confusing	**1**	**2**	**3**	**4**	**5**	**6**	**7**	very clear	**NA**
16. Screen back track	difficult	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**
17. Back to main screen	difficult	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**
Terminology and system feedback										
18. Simple and natural dialogue	never	**1**	**2**	**3**	**4**	**5**	**6**	**7**	always	**NA**
19. Terms used in the system	inconsistent	**1**	**2**	**3**	**4**	**5**	**6**	**7**	consistent	**NA**
20. Position of message	inconsistent	**1**	**2**	**3**	**4**	**5**	**6**	**7**	consistent	**NA**
21. Prompts for input	confusing	**1**	**2**	**3**	**4**	**5**	**6**	**7**	clear	**NA**
22. Informs about work progress	never	**1**	**2**	**3**	**4**	**5**	**6**	**7**	always	**NA**
23. Error messages	unhelpful	**1**	**2**	**3**	**4**	**5**	**6**	**7**	helpful	**NA**
Learning										
24. System learning	difficult	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**
25. Exploring by trial and error	difficult	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**
26. Remembering commands	difficult	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**
27. Performing tasks is simple	never	**1**	**2**	**3**	**4**	**5**	**6**	**7**	always	**NA**
28. Help messages on the screen	confusing	**1**	**2**	**3**	**4**	**5**	**6**	**7**	clear	**NA**
29. Help access	difficult	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**

System capabilities

30. System speed	too slow	**1**	**2**	**3**	**4**	**5**	**6**	**7**	fast enough	**NA**
31. System reliability	unreliable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	reliable	**NA**
32. Correcting mistakes	difficult	**1**	**2**	**3**	**4**	**5**	**6**	**7**	easy	**NA**
33. Designed for all levels of users	never	**1**	**2**	**3**	**4**	**5**	**6**	**7**	always	**NA**