

# Older Adults and Web Usability: Is Web Experience the Same as Web Expertise?

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## Abstract

Level of Web experience is often a factor for which researchers attempt to control while conducting experimental studies on Web usability. It is typically measured by some means of self-assessment that often includes questions regarding long-term usage, frequency of use, and the types of activities performed while using the Web. A common assumption is that Web experience is the same as Web expertise (high experience = high expertise). In our research studies primarily focused on Web usability and older adults, we found that even when Web *experience* is controlled, older adults still demonstrated less Web *expertise* than younger adults. Our research has supported the hypothesis that Web expertise is significantly influenced by *how* users learned the Web - or their cumulative time spent in collaborative learning environments (learning from and with others) - rather than just how *long* or how *often* they have used it. Preliminary results in our labs demonstrate a positive correlation between opportunities for collaborative learning and Web expertise, as well as a negative correlation between opportunities for collaborative learning and age. These results support the need to reassess how best to measure Web expertise and how we might improve Web interaction for older adults.

**Categories & Subject Descriptors:** H.5.2 [Information Interfaces and presentation]: User Interfaces — theory and methods, evaluation/methodology; K.4.0 [Computers and Society]: General

**General Terms:** Human Factors; performance.

**Keywords:** Universal usability; aging; Web experience; collaborative learning; Web expertise.

## INTRODUCTION

Older adults represent the fastest growing demographic worldwide. By 2030, it is estimated that there will be about 70 million older adults in the U.S., which is more than twice their number in 2000 [9]. Statistics from other countries, including Canada [7], France [4], and England [5] reveal a similar pattern of the growing senior demographic. A recent Nielsen NetRating report demonstrated that the over 65 internet group increased 25 percent in one year. Since October 2002, the senior online demographic grew from 7.6 million to 9.6 million users. This represents 7 percent of the total online population in October 2003 [6].

The rapidly growing older population is becoming an in-

creasingly important demographic to understand. While several studies [1, 2, 3] have demonstrated performance differences between older and younger users, few studies have adequately controlled for level of Web experience between age groups. Therefore, when performance differences are observed, it is difficult to know whether these differences are age-specific or experience-specific. Additionally, little research has been conducted to understand how best to measure Web experience.

A recent study by Rodgers [8] examined the question of how best to measure Web experience in college-age students. They sampled 168 students, asking them to provide ratings on three factors: conative (what they “do” online), cognitive (what they “think” online), and affective (what they “feel” online). Their preliminary analysis suggests that what people feel (confidence, enjoyment, etc.) and what people do (activities) online is a better measurement of Web experience than just measuring time and/or frequency. While suggesting that additional factors influence Web expertise, these results do not assist us when trying to understand older users since their overall experience with the Web may be quite different than that of college-age students.

This paper describes a series of research studies conducted in our usability labs that lead us to begin hypothesizing a relationship between Web expertise and collaborative learning. These studies suggest that while level of Web *experience* may be accurately described by understanding Web usage patterns (how often a user accesses the Web, how long they have been accessing the Web, what type of activities they do on the Web), this measure is not the same as Web *expertise* or how well they will perform on the Web, especially for older users.








## Measuring Experience – 4 Research studies

In two preliminary age-related usability studies conducted in our labs, we attempted to control for PC/Web experience using a 5-pt scale (0 to 4) based on frequency of use. Participants were asked to report their levels of PC experience and Web experience separately on the following scale: 0=none to 4=use daily. These scores were then added to-

gether to provide an overall PC/Web experience rating from 0 to 8.

In two subsequent studies, we increased the screening questions to include frequency of Web use, long-term use (e.g., how many years they've been using the Web), and types of activities done on the Web (i.e. email, banking, auctions, research, etc.). The more activities done on the Web, the higher the score for that criterion. For each of the three measures participants could score a 0-4, with a total possible high score of 12.

We also developed a 20-question User Expertise Quiz that was intended to be an objective measure of Web expertise (Figure 1). This survey consisted of several graphic images of typical elements seen on Web pages and browsers. For each image, participants chose the multiple-choice answer that accurately describe that element's function.

| Picture  | Select One Choice for Each  |
|--|---|
| 1.    | A. Scrolls left<br>B. Brings you forward one page<br>C. Brings you to the last page you viewed<br>D. I'm not sure                             |
| 2.    | A. Sends an email<br>B. Returns you to your home page<br>C. Opens another browser window<br>D. I'm not sure                                   |
| 3.    | A. Makes the text larger<br>B. Allows you to search the Internet<br>C. Connects to the Internet<br>D. I'm not sure                            |
| 4.    | A. Displays your favorite sites list<br>B. Saves your favorite emails<br>C. Creates a new folder<br>D. I'm not sure                           |
| 5.  Address  | A. Where you type in a site address or URL<br>B. Where you type in search terms<br>C. Where you type in your email address<br>D. I'm not sure |
| 6.    | A. Refers to child-proof products<br>B. Refers to your shopping cart<br>C. Refers to grocery stores<br>D. I'm not sure                        |

**Figure 1. User Expertise Quiz**

For every question, there was also a choice labeled "I'm not sure," and we urged participants to answer truthfully in order to avoid guessing. Participants were also given a web page screenshot as a reference, with each element on the quiz circled in context.

The goal of the User Expertise Quiz was to learn whether level of Web experience would be related to Web expertise as determined by quiz score. We were also interested in analyzing the relationship between quiz score and performance to learn whether the quiz was an accurate reflection of Web expertise.

**Measuring Collaboration**

Even when level of Web experience was controlled between age groups, older users still had lower quiz scores, lower performance, and increased usability problems. This indicated to us that other factors influence Web expertise aside from Web usage patterns. We began to hypothesize the possible relationship between Web expertise and collaborative learning experience and we started adding some preliminary questions to the background questionnaire regarding time spent using the Web in either a school or work environment. We began seeing strong correlations

between time spent in a collaborative learning environment and Web expertise.

Next, we developed a more extensive questionnaire (Table 1) which we distributed to all participants of the last two research studies. The questionnaire asked them to rate the frequency with which they used or learned the Web with various people under the following three conditions: Was taught by, Mutual learning, Teaching.

**Table 1. Collaboration Questionnaire**

|                                     | Was taught by ... | Mutual learning by working together with... | Teaching ... |
|-------------------------------------|-------------------|---|--------------|
| <b>Family</b>                       | 0 1 2 3 4         | 0 1 2 3 4                                   | 0 1 2 3 4    |
| <b>Friend(s)</b>                    | 0 1 2 3 4         | 0 1 2 3 4                                   | 0 1 2 3 4    |
| <b>School Instructor(s)</b>         | 0 1 2 3 4         | 0 1 2 3 4                                   | 0 1 2 3 4    |
| <b>Classmate(s)</b>                 | 0 1 2 3 4         | 0 1 2 3 4                                   | 0 1 2 3 4    |
| <b>Coworker(s)</b>                  | 0 1 2 3 4         | 0 1 2 3 4                                   | 0 1 2 3 4    |
| <b>Adult Course Instructor(s)</b>   | 0 1 2 3 4         | 0 1 2 3 4                                   | 0 1 2 3 4    |
| <b>Senior Center aide(s)</b>        | 0 1 2 3 4         | 0 1 2 3 4                                   | 0 1 2 3 4    |
| <b>Library/Lab facility aide(s)</b> | 0 1 2 3 4         | 0 1 2 3 4                                   | 0 1 2 3 4    |
| <b>Other:</b>                       | 0 1 2 3 4         | 0 1 2 3 4                                   | 0 1 2 3 4    |

The goal of the questionnaire was to learn from users how often they had worked with other people or groups of people while learning or interacting with the Web.

**RESULTS**

The primary focus of each research study was not to understand more about how Web experience and collaboration may be related. However, as we conducted each experimental study, each with its unique goals, we began analyzing the correlations between experience ratings, age, expertise, and performance and found some surprising results.

The results reported here focus on the relationships between these factors rather than fully explaining the primary goals, methods, or results of each study.

**Study 1 Overview**

The primary purpose of Study 1 was to learn more about how age affects Web usability. Twenty-seven participants completed tasks on a Web site and both performance and subjective data were collected. Performance scores were calculated combining both task duration and task completion scores. Participants were asked to rate their level of

Web/PC experience based on frequency of use using a scale of 0-4 (0=none to 4=daily). A combined experience score therefore could be from 0 to 8.

### Study 2 Overview

The primary purpose of Study 2 was to learn if we could redesign the prototype used in Study 1 to address the specific usability issues we observed in older users. Twenty-two participants completed tasks on a Web site and both performance and subjective data was collected. Level of Web experience was calculated as described in Study 1.

### Study 3 Overview

The primary purpose of Study 3 was to learn more about how age and gender may affect user subjective reactions to homepages, including levels of trust. Forty-one participants completed tasks on Web sites and provided subjective ratings. In this study we used a revised experience rating system described earlier in this paper that considered frequency of use, long-term usage, and types of activities typically performed. This new rating scale had a range from 0 to 12. We also administered the User Expertise Quiz to all participants.

### Study 4 Overview

The primary purpose of Study 4 was to learn what Web homepage components users of various age and gender would prefer on a financial services homepage. Thirty participants took part in the study. Level of Web experience was calculated as described in Study 3, including the administration of a User Expertise Quiz. No performance data was collected in this study.

### Demographics

For each study we attempted to control for experience level between age groups. Table 2 demonstrates the average experience and quiz scores for each age group in each study.

**Table 2. Demographics for 4 Research Studies**

|                | Age  |      | Experience |     | Quiz       |            |
|----------------|------|------|------------|-----|------------|------------|
|                | < 55 | 55+  | < 55       | 55+ | < 55       | 55+        |
| <b>Study 1</b> | 35.9 | 69.2 | 6.0        | 5.9 | n/a        | n/a        |
| <b>Study 2</b> | 34.6 | 65.6 | 5.9        | 5.9 | n/a        | n/a        |
| <b>Study 3</b> | 38.6 | 68.0 | 10.4       | 9.7 | <b>78%</b> | <b>58%</b> |
| <b>Study 4</b> | 37.2 | 67.7 | 9.4        | 9.5 | <b>71%</b> | <b>62%</b> |

It is important to note that even when Web experience was similar between age groups, older adults still scored lower on the user quiz. These findings compelled further research into what other factors may be influencing Web expertise in older adults.

### Correlations Between Age, Experience, Quiz, and Performance

For each study there were different methods and primary goals. However, some measures related to experience and

age were collected for each study. Table 3 demonstrates the correlations between each of these measures. Every study did not collect every measure. N/A appears in the table if a measure was not collected for a study.

**Table 3: Correlations between age, performance, experience, and quiz scores (\* p<.05, \*\* p<.01)**

|                                   | Study 1<br>(N=27) | Study 2<br>(N=22) | Study 3<br>(N=41) | Study 4<br>(N=30) |
|-----------------------------------|-------------------|-------------------|-------------------|-------------------|
|                                   | r =               | r =               | r =               | r =               |
| <b>Performance vs. Age</b>        | ** - 0.60         | * - 0.51          | ** - 0.51         | n/a               |
| <b>Performance vs. Experience</b> | ** 0.49           | * 0.46            | * 0.44            | n/a               |
| <b>Age vs. Experience</b>         | - 0.09            | 0.15              | * -0.30           | 0.00              |
| <b>Quiz vs. Performance</b>       | n/a               | n/a               | ** 0.55           | n/a               |
| <b>Quiz vs. Age</b>               | n/a               | n/a               | ** - 0.68         | ** - 0.36         |
| <b>Quiz vs. Experience</b>        | n/a               | n/a               | ** 0.48           | ** 0.38           |

When comparing the relationship between age, experience, quiz, and performance we observed some interesting trends.

- Even when level of PC/Web experience is controlled using frequency of use, older adults experience significantly more usability issues on the Web than younger adults.
- Overall performance and quiz score are strongly correlated. The higher the quiz score, the better the user performs.
- Even when level of Web experience is controlled using a more detailed rating system, quiz score was significantly lower for the older adults.
- Experience rating and quiz score are also correlated, but less significantly than performance and quiz score.
- Age and quiz score demonstrate the strongest correlation. The older users were, the lower they scored on the user expertise quiz, independent of experience. (no correlation between age and experience).

These trends suggested that even though Web usage patterns are at least part of the picture when it comes to what comprises Web experience (hence, the correlations between experience and quiz and performance), additional factors influence the lower performance of older adults. The strongest predictor of performance and quiz score was age, independent of experience.

During our research studies, we gathered considerable subjective feedback from older users. This feedback led us to

begin hypothesizing about how lack of collaborative learning (working with others while using the Web) might be at least part of the reason older adults perform lower even when level of experience is controlled.

### Collaboration

When we first began to hypothesize the relationship between collaborative learning and Web expertise, we added two questions to our background questionnaire asking how much time, if any, people spent using the Web at work and/or school. Preliminary results from these questions demonstrated a strong correlation between Web expertise and time spent in collaborative learning environments (Table 4).

**Table 4. Preliminary Collaboration Questions (\*\* p<.01)**

|                      | Age vs. | Quiz vs. | Exp vs. |
|----------------------|---------|----------|---------|
| <b>Collaboration</b> | -0.66** | 0.56**   | 0.43**  |

These results lead us to hypothesize that time spent learning from and with others is a better predictor of Web expertise than measuring frequency or duration of time spent working on the Web (alone).

We developed a detailed collaboration questionnaire as described earlier in this paper and sent it to both Study 3 (post hoc) and Study 4 participants. We received a total of 41 responses from participants in both Studies 3 and 4.

Table 5 displays the correlations (r values) for each of the collaboration measures compared to age, quiz, and experience.

**Table 5. Study 3&4 Collaboration Correlations (\* p<.05, \*\* p<.01)**

| Collaboration Type vs.       | Age     | Quiz   | Exp  |
|------------------------------|---------|--------|------|
| <b>Been Taught by Others</b> | -0.37*  | 0.08   | 0.18 |
| <b>Taught Others</b>         | -0.61** | 0.46** | 0.26 |
| <b>Learned Together</b>      | -0.53** | 0.25   | 0.15 |
| <b>Combined Score</b>        | -0.58** | 0.31*  | 0.22 |

This demonstrates that older adults experience significantly less collaborative learning on the Web as compared to their younger counterparts. Additionally, quiz score was shown to have a positive correlation to collaborative learning experience (the more collaboration, the higher the quiz scores). Lastly, the experience rating (that incorporates frequency of use, long-term usage, and types of activities done on the web) has no relationship to the amount a user collaborates.

Our findings demonstrate that performance and quiz score are correlated, meaning that quiz score may be a good predictor of performance. Quiz score is also correlated to overall collaboration experience, meaning that the more users have collaborated with others while using the Web, the higher their quiz score will be. This ultimately implies that the more collaboration experience users have, the better they will perform on the Web. Our study has demonstrated that older users have significantly less collaboration

experience (most likely related to the lack of the Web presence during their work years), which might help to explain why older users have more usability problems when using the Web, independent of Web usage patterns (i.e., frequency of use, long-term use). While correlations do not show causality, they do indicate relationships between variables.

### DISCUSSION

In order to understand Web experience, we must look beyond measures that examine usage patterns and concentrate more on qualitative Web experience – *how* users learn the Web. More complete data sets along with more rigorous statistical analysis, including multiple regressions, will help us to understand more about how collaborative learning might affect performance. Additionally, to address the fact that older adults suffer more Web usability problems, we need to consider providing them more opportunities for collaborative learning.

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### REFERENCES

1. Chadwick-Dias, A., McNulty, M., Tullis, T. Web Usability and Age: How Design Changes Can Improve Performance. *Proceedings of the 2003 Conference on Universal Usability*, November 2003.
2. Coyne, K., and Nielsen, J. Web Usability for Senior Citizens: 46 Design Guidelines Based on Usability Studies with People Age 65 and Older, Nielsen Norman Group Report (2002).
3. Groff, L., Liao, C., Chaparro, B. & Chaparro, A. Exploring How the Elderly Use the Web. *Usability News* 1.2 (1999).
4. INSEE France. France in Figures, Edition 2000. Available at <http://www.insee.fr/en/ffc/intfrcbref.pdf>
5. National Statistics. Population Estimates England and Wales 2000. Available at <http://www.statistics.gov.uk/>
6. Nielsen NetRatings Report. *Senior Citizens Lead Internet Growth*. November 2003.
7. Statistics Canada. Age and Sex Statistics. 2001 Census. Available at <http://www.statcan.ca/start.html>
8. Rogers, B.L. Measuring Online Experience: It's About More Than Time! *Usability News*, 5.2, 2003. <http://psychology.wichita.edu/surl/usabilitynews/52/experience.htm>
9. U.S. Administration on Aging and U.S. Bureau of the Census. A Profile of Older Americans: 2001.