How do non-expert users deal with a Web-based environment? An empirical study

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Abstract

This investigation describes an empirical study of user’s actions in a virtual environment. Participants were a group of university students, selected from among 121 participating in a Web-based environment designed to train personnel trainers to apply new technologies in training processes via Internet.

Static observation techniques permitted us to review traces of the user’s interaction with the browser. The logged data allowed us to determine page title, URL, how often participants visited each page, what activities they carried out, and how long they needed to perform the different activities, as well as to identify a variety of other aspects of Web-user interaction.

1. Introduction

The impact of the Internet in our society has surpassed any technology innovation in history. If the radio reached 40 millions users in 28 years and the television took 10 years, the Internet needed only 3 years to reach the same amount of users (Sánchez, 2000).

In the higher education scope, the information and communication technology (ICT) is now an essential part of universities in the administrative, teaching, learning and research activities. It would be unthinkable today for a university of any size whatsoever not to have a Web site (Debreceny & Ellis, 2000).

The new tools of ICT are specially interesting due to the enormous possibilities that may offer in the electronic learning setting. The Internet has qualities which can allow teachers to personalize the learning experience for their students. The Web-based education has promised us, among other possibilities, a more personalized and individualized learning (Kirschner & Paas, 2001). But this is not a simple issue!

In order to improve the efficiency in Web-based learning, it is necessary to know about the user’s behaviour in a virtual environment. This research scope will supply us the information required to adapt the design of a Web-based course to the different features of users.

The objective of this study is to explore the user-navigation paths in a given Web-based course, seeking different navigation patterns, their relation with the user’s prior experience and their influence in the user’s performance and satisfaction.

2. Method

2.1. Participants

The participants were 120 students who enrolled in "Personnel Training and Development", an optional course for organizational psychology majors at a public university in Spain.

2.2. The Course

The course included conventional and Web-based sections. All of the students were encouraged to take part in the on-line cyberclass about the ICT role in personnel training.
The Web-based course were made up of four sections. All course materials were organized in small units of contents. Every one was comprised of both topic explanation and exercises. Asynchronous on-line communication (electronic forum and e-mail) was built-in the virtual environment. Elemental bibliographic references, Web links, FAQ's and a glossary were supplied as additional resources. Help and "where am I?" commands were always accessible for the users. (Figure 1)

**Navigation**

![Web-based course interface](image)

*Figure 1. Web-based course interface*

### 2.3. Procedure

At the beginning of the Web-based course, students were given a survey asking them to indicate their use frequency in different internet tools. These data were useful to report on the students' experiences in new technologies. In the same way, at the end, a questionnaire was requested from the participants to collect the user's considerations about the Web-based course.

The students' on-line course activity was logged. Specifically, five static measures of on-line activity were computed (Melara, 1996; Qiu, 1994; Schroeder & Grabowski, 1995): total hypertext session, total homepage hits, average path length, total on-line time, and average path time.

The students' performance rate were assessed according to the exercises they carried out successfully.
3. Results

3.1. Network tools experience

Our students displayed variability in the use of the Internet (Figure 2). In the possible range of rates (0 to 13), the participants showed data between 3 to 12. The sample mean is 7.78 and the standard deviation is 2.53. These differences are advantageous to examine the relationship between the previous user experience and their course on-line activity.

\[
\text{Mean} = 7.78 \\
\text{SD} = 2.53 \\
\text{N} = 91
\]

![Figure 2. Network tools experience](image)

3.2. Virtual environment assessment

In general, the participants assessed the virtual environment positively (mean = 27.83). In the range between 0 to 42, we have registered 17 as the minimum punctuations and 38 as the maximum. This sample variability (standard deviation = 5.41), the same as the network tools experience data, is positive to carry out this research. (Figure 3)

\[
\text{Mean} = 27.83 \\
\text{SD} = 5.41 \\
\text{N} = 54
\]

![Figure 3. Virtual environment assessment](image)
3.3. Web-based course performance

As expected, a ceiling effect was found in this variable (Figure 4). Most students have carried out the virtual course successfully (71.7%). Table A shows the Spearman correlation coefficients between Web-based course performance, network tools experience, and virtual environment assessment. No significant correlation was found between Web-based course performance and virtual environment assessment. On the other hand, a small but significant correlation was found between Web-based course performance and network tools experience \((r = -0.207, p = 0.049)\). However, the association between these two variables was negative. That is, students with more experience in the use of network tools have got worse marks than novice user students. We propose motivation as a hypothetical variable to explain this surprising outcome. Given that the Web course contents were centered to a large extent in the use of new technologies, people with more experience have got less learning motivation about the course contents.

![Figure 4. Web-based course performance](image)

Table A. Spearman correlation coefficients

<table>
<thead>
<tr>
<th></th>
<th>Web-based course performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(r = -0.207) (p = 0.049)</td>
</tr>
<tr>
<td>Network tools experience</td>
<td>(r = -0.207) (p = 0.049)</td>
</tr>
<tr>
<td>Virtual environment assessment</td>
<td>(r = 0.079) (p = 0.584)</td>
</tr>
</tbody>
</table>

3.4. On-line course-related activity

Table B shows the descriptive statistics corresponding to all of our measures on the user’s on-line activity. The sample variability is observed in these variables. These results allow us to perform the correlative analyses to examine the hypothetical differences in the users navigation patterns, which is the aim of this descriptive study.

<table>
<thead>
<tr>
<th></th>
<th>Sessions</th>
<th>Hits</th>
<th>Path length</th>
<th>Time</th>
<th>Time length</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>Mean</td>
<td>5.03</td>
<td>166.13</td>
<td>41.48</td>
<td>10945.33</td>
<td>2699.76</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>3.72</td>
<td>117.38</td>
<td>36.23</td>
<td>7667.50</td>
<td>1683.02</td>
</tr>
<tr>
<td>Minimum</td>
<td>1</td>
<td>9</td>
<td>4.5</td>
<td>107</td>
<td>53.5</td>
</tr>
<tr>
<td>Maximum</td>
<td>19</td>
<td>603</td>
<td>280</td>
<td>49148</td>
<td>10483</td>
</tr>
</tbody>
</table>

Table B. Descriptive statistics of users on-line activity measures.

3.5. Correlational analyses

Inspection of the Spearman correlation coefficients between network tools experiences and on-line activity measures (Table C) indicates that different navigation strategies were associated to the user’s experience. The participants with more network tools experience have performed their on-line activity in more hypertext sessions \((r = -0.220, p = 0.036)\) with shorter path length \((r = -0.395, p = 0.001)\) and time length \((r = -0.232, p = 0.027)\) in each session. No significant correlations were found between virtual environment assessment and user navigation measures.
In relation to the variable of Web-course performance, we found significant correlation coefficients between this variable and the following variables: hypertext sessions ($r = .292$, $p = .001$), total homepage hits ($r = .346$, $p = .000$), and total on-line time ($r = .343$, $p = .000$). From this outcome, we think it is specially interesting its relation with the variable of hypertext sessions. This correlation indicates the association between the success in a Web course performance and the user’s on-line working organization.

4. Conclusions

In this exploratory study, by employing static measures to assess navigation in hypertext, we have identified a different on-line working style of users with prior experience using network tools. They share out the course tasks in a larger number of shorter and less intensive sessions. It is specially interesting to observe the positive influence of this kind of on-line working organization in the students’ Web-course performance.

The results obtained encourage us to continue studying in depth and developing a better understanding of how users navigate hypertext. Dynamic measures proposed by McEneaney (2001) are very promising and we consider them a good next step to carry out our hypertext research.

5. References


