Heuristic Evaluation of Usability – a Case study with the Learning Management Systems (LMS) of IFPE

4 authors:

Marcelo Penha
Federal University of Pernambuco
18 PUBLICATIONS   **111** CITATIONS

SEE PROFILE

Walter Correia
Federal University of Pernambuco
53 PUBLICATIONS   **168** CITATIONS

SEE PROFILE

Fabio Campos
Federal University of Pernambuco
80 PUBLICATIONS   **217** CITATIONS

SEE PROFILE

Marina Barros
Federal University of Pernambuco
14 PUBLICATIONS   **34** CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:

Project   Modelo de Avaliação Ergonômica de Produtos com Interface Gestual View project

Project   "Virtual environments: influence of the optical aspects of image composition on the quality of user experience" View project

Heuristic Evaluation of Usability - a Case study with the Learning Management Systems (LMS) of IFPE

Marcelo Penha

Walter Franklin Marques Correia

Fábio Ferreira da Costa Campos

Marina de Lima Neves Barros

Departamento de Design
Universidade Federal de Pernambuco – UFPE
Av. Moraes Rêgo
s/n - 50670-901 – Recife
PE - Brazil

Abstract

This paper presents a heuristic evaluation of the usability of the interface of the Learning Management Systems (LMS) used in undergraduate Environmental Management offered in the e-learning at Instituto Federal de Pernambuco (IFPE). The data collected in the evaluations performed with usability experts were analyzed from the 10 Nielsen usability heuristics. The results showed that this method of assessment is effective in pointing various usability issues in the virtual environment assessed.

Keywords: Heuristic evaluation; usability, Learning Management Systems

1 - Introduction

The e-learning is characterized by being a teaching mode where the learning process is carried out from the physical or geographical separation between participants and timeless. According to Maia and Mattar (2007) and Moran (2002), this mode uses different communication technologies, especially telematics technologies such as the Internet.

According to Barbosa and Mendes (2010), to conduct the mediation involved in e-learning, it is necessary to use a Learning Management Systems (LMS), which is characterized by being a tool of interaction based on the features available internet.

Preece, Rogers and Sharp (2005) state that an interaction tool must be a very efficient system, having as a result highly productive users. According Cybis (2007), a tool can provide satisfactory interactions from its usability, defined by ISO 9241 (1998) as "the ability of a product to be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a context specific use."

The check the usability of a system can be made from various application techniques evaluation (Preece, Rogers and Sharp, 2005). One such technique is the heuristic evaluation of usability.

2 - Theoretical Framework

This topic explains, from literature, the theoretical foundation of the issues relevant to meet the objective of the research, a heuristic evaluation of the virtual environment *IFPE*.

2.1 - Learning Management Systems

The release of internet for commercial use in the early '90s, with the technology of graphic windows operating systems arising GUI, alter significantly the functionality of these systems, bringing new opportunities for distance education . Today, learning management systems (LMS) accessed via Internet enable communication regardless of time and place in which each participant is, and are characterized as spaces that organize resources and tools for the relationships between teachers and students.

According Litto (2009), institutions wishing to offer e-learning courses via the Web are four choices for defining the type of LMS to be used: (1) to develop local human resources with the appropriate software to manage the content and activities learning, ensuring access and maintenance of the same, (2) build a LMS based on open source software, provided free of charge (such as Moodle and TelEduc), (3) use open source software, offered by companies that do not charge license to use, but the support (like Sun and IBM), (4) hire companies that offer services using their " platform " and " hosting " in their own servers and is solely responsible for content preparation and learning activities.

It is up to each institution to perform a contextual analysis to identify the most important variables of each tool available, identifying them may restrict or promote particular learning process.

According to Barbosa and Mendes (2010), among the main LMS currently available, we highlight the MOODLE (open source software) and Blackboard (proprietary software), both featuring a large set of tools necessary for the development of educational processes.

Besides them, other LMS may be mentioned (Table 1).

Table 1 – LMS

LMS	URL
Moodle	http://moodle.org
Blackboard	www.blackboard.com
Teleduc	http://teleduc.nied.unicamp.br/
Aulanet	http://www.eduweb.com.br
Amadeus	http://www.softwarepublico.gov.br

2.2 - Usability

With respect to the interface of a system, according Cybis (2007), usability is a quality that depends on an agreement between the characteristics of users to pursue goals and use cases, and given the characteristics of its interface. Consequently, is not a quality inherent in the system, but applied in their development through the knowledge of the user interface and content.

More specifically, Preece, Rogers and Sharp (2005) divide the usability of targets:

- To be effective in Use (effectiveness).
- Be efficient in use (efficiency).
- Be safe in use (safety).
- Be of good utility (usefulness).
- Be easy to learn (learnability).
- Be easy to remember how to use (memorability).

A system is effective when it allows users to learn well, does their work efficiently access the information they need. When the user can do with the system that is expected of it, it has been effective.

The aid that the system offers the user in accomplishing tasks shows its degree of efficiency. It is expected that from the time that users have learned how to use a system in performing their tasks, they maintain a high level of productivity.

The security goal is to protect users from unwanted situations and dangerous conditions of use. The system should offer assistance to any user, in any kind of situation to avoid the dangers in making accidental unwanted actions. The usefulness of the system is reflected in the availability of functions that allow users to perform all your tasks the way they want.

An easy to learn and use and requires little time for the start of their core tasks, as well as for learning the set of operations required to carry out a wider range of tasks shows the ability of learning (learnability) that the system offers.

Finally, the ability to remember (memorability) refers to the types of support that provides the interface with the goal of helping users to remember how to perform tasks once I've learned how to do them, especially in systems and operations used with little frequency.

These goals can turn into usability criteria according to how they are used. Preece, Rogers and Sharp (2005) put the time for a task to be completed (efficiency), the learning time of a task (learnability) and the number of errors in performing a task in a given time period (memorability) as criteria usability commonly used in the usability evaluation of artifacts.

2.3 - Usability Evaluation of Interfaces

The assessment activity relates to the process of determining the usability and acceptability of the artifact (Nielsen, 1994). Several criteria will determine these qualities, as the number of errors that users make.

Cybis (2007) puts the techniques for usability evaluation are diagnostic and are based on checks and inspections of interfaces seeking problems of interaction between the user and the system.

According to Preece, Rogers and Sharp (2005), have the exact knowledge than assessing the importance of evaluation and when to evaluate constitute fundamental tasks of interaction design in the search for systems that are easy to learn and use, as well as effective efficient, safe and satisfactory properties expected by users.

For carrying out the evaluation of the usability of a system interface, a technique which can be used according Preece, Rogers and Sharp (2005) is the heuristic evaluation.

2.4 - Heuristic Evaluation of Usability

According to Santa Rosa (2008), web developers were designing websites improperly. As websites became richer in resources such as graphics and animations, the number of usability problems increased. This fact occurred largely due to training developers are limited only to web authoring tools and languages.

According to Nielsen (2005), usability problems can be located in one location of the interface in two or more of a problem as the general structure of the interface and as something that needs to be included in the interface.
One way around these problems is to conduct a heuristic evaluation of the interface. According to Andrade (2007), unlike other methods that require the application during the design or development of the system, the heuristic evaluation can be applied in any cycle, even after the system implementation. Used to identify usability problems in a user interface when performing specific tasks in context, the techniques of usability heuristics are formed by a set of principles. According to Preece, Rogers and Sharp (2005), usability principles are used mainly for the evaluation of prototypes and existing systems.

According to Santa Rosa (2008), only an appraiser can perform a heuristic evaluation, but as it cannot find usability problems existing in the interface, it is important to employ more than one appraiser. We suggest three to five reviewers. According to Nielsen (2005), from a number of reviewers, the errors are found to be the same, being unnecessary to consider many evaluators.

To perform a heuristic evaluation, according to Santa Rosa (2008), it is necessary to adopt a list of principles to guide the inspection. Several researchers of usability and human-computer interaction, such as Smith and Mosier, Nielsen and Bastien and Scapin defined their list of principles for projects and systems software interfaces for web environment, also called ergonomic criteria from experiments and scientific methods.

According Penha, Correia and Campos (2010), in an article on mapping of research on interaction design in distance education in the international arena, it was found that Nielsen is the benchmark most used in research, taking part in 60 % of cases.

The following is the set of usability principles Nielsen (2005), which was used in this research:

   H1-Visibility of system status
   H2-compatibility between the system and the real world
   H3-Freedom and control to the user
   H4-Consistency and standards
   H5-Support for the user to recognize, diagnose and recover errors
   H6-Error prevention
   H7-Recognize instead of remembering
   H8-Flexibility and efficiency of use
   H9-Design aesthetic and minimalist
   H10-Help and Documentation

3 - Object of Research

The *IFPE* offers courses in the distance on the technical level, higher and postgraduate. The evaluations performed on this cooperative research were carried out using the environment of the graduate in Environmental Management. The LMS has the *IFPE MOODLE* platform software.

4 - Heuristic Evaluation Environmental DEAD/IFPE-PE

The evaluation was guided by heuristics Nielsen 10, and held by four evaluators (Table 2).

Table 2: Profile of Evaluators

Evaluator	Gender	Age	Graduation	User Expertise	
				Usability *	e-learning **
1	M	36	Design	Yes	Yes
2	M	31	Internet Systems	Yes	Yes
3	M	25	Internet Systems	Yes	Yes
4	M	41	Networks and Operating Environments	No	Yes

The table considers experienced usability evaluators* those who have already had some contact with usability principles used in the evaluation and has performed heuristic evaluation of other interfaces. Are considered experts in e-learning** those evaluators with experience in distance learning and LMS using Moodle, is the environment itself *IFPE* or other institutions.

Instructions for completion of the evaluation, and a list of tasks to be performed were previously transmitted to the evaluators from a form of guidance provided by the researcher.

The tasks to be performed by the users should be as follows:

    1 - Access the virtual environment IFPE: http://dead.ifpe.edu.br/moodle/
    2 - Log into the environment from the user specified;
    3 - Edit your profile (change image, insert description, change password);
    4 - Access the Course "*Sistemas de Informações Geográficas*";
    5 - Access the Course Calendar and find out the commitments of the month of May;
    6 - Access the Material "*Aulas* 1 e 2";
    7 - Perform the deployment of Task "*Envio de arquivo* 6";
    8 - Enter a post on the sixth week, the topic Classroom attendance;
    9 - Enter a message in the Chat online tutoring, one week;
    10 - Send a Message to Tutor Carlos Viana;
    11 - Visit the Notes;
    12 - Log off.

According to Santa Rosa (2008), the tasks and the evaluation of the interface must be made in isolation by each evaluator. This way of working prevents the findings of an evaluator judgment and interferes with findings of other evaluators.

Each evaluator initially navigated the virtual environment to be familiar with the interface. Then, a new navigation was carried out in order to inspect each element in order to compare the results with the heuristic list of usability.

The results of evaluations have been described by reviewers as a report and subsequently consolidated by the researcher, excluding results repeated by more than one evaluator.

4.1 - Analysis of Cooperative Assessments

Evaluators after navigate and perform tasks proposed in the LMS of the *IFPE* prepared a report with a list of usability problems found in the system. Table 3 shows the number of problems found by each evaluator and the aggregation of these.

Table 3: Number of Problems Identified

Evaluator	Number of problems identified
Evaluator 1	22
Evaluator 2	21
Evaluator 3	15
Evaluator 4	13
Overall	71

Assessments by evaluators generated a list of 71 problems identified. Some of these problems were common to more than one appraiser. The intersection of all the problems resulted from a list of 54 issues of usability, which are classified identified by the heuristic presented in Table 4.

**Table 4: Consolidated Report Identified Problems**

Consolidated report identified problems		
Nº.	**Problem**	**Heuristic**
1	There is no clear link for the user profile. You must click on the user name to access their profile	H1
2	By clicking the "Update Profile", no message is displayed in relation not only to the success or process.	H1
3	The labels of some links just repeat the name of the link itself.	H1
4	Difficult to know whether and which user was identified. The information is located at the bottom.	H1
5	The link that the access profile is located at bottom of page.	H1
6	When you enable the display of only one week, there is no clear indication that there are other hidden weeks.	H1
7	Access Screen displays chat message with technical terms"(Version without frames and JavaScript)."	H2
8	The buttons that allow you to display/hide the weeks of the course does not have visual identification of their functions.	H2
9	The list of courses is organized in alphabetical order and there is the option for the student to do it.	H3
10	There is an option to choose a month in the calendar directly. It is necessary to go month to month.	H3
11	Materials in PDF format open in the same window. There is no option for the user to choose whether to open in another window or the same.	H3
12	There is a link that leads directly to the chat from the forum page.	H3
13	Access to notes page is only available on the course home page.	H3
14	The calendar should be on the left, as well as other particulars relating to the course are on the left.	H4
15	Some links change position in the layout according to the screen accessed.	H4
16	The search option courses is located at the end of the page, it may go unnoticed.	H4
17	The mark of OPSI is not available on all pages.	H4
18	The formatting of course does not follow a standard aesthetic.	H4
19	Had the expectation that the login was left or right of the atmosphere at the top.	H4
20	I clicked on one and two classes, not too sure what they really were, opened a material pdf (imagine) without giving me download option where all my previous navigation structure is lost, encountering me with a new structure.	H4
21	The change password button should stay with the other tabs.	H4
22	The search form forum is outside the area that would be recommended to position. One area where information "search form" is dependent on "information forum".	H4
23	The link is at the end off the layout, next to the name.	H4
24	When sending a message is displayed an error message in English " ERROR: could not instantiate mail function."	H5

| 25	By accessing the documentation link, a page is opened in the same window that offers no link to return to the environment *IFPE*.	H5
26	On the profile page there are clear options of what I do or indication where to go, so I took the criterion clicking on bread crumb " Virtual Environment " what brought me back to the main page.	H5
27	It took me a bit to find the option desired course because, amid the visual clutter, is at the bottom.	H5
28	The Reports button opens a page with just a link to the home page.	H5
29	Some fields have asterisks profile editing of different colors but there is no indication of their meaning.	H6
30	Confuse the login screen with the banner explanatory use.	H6
31	Navigated to the main page of the environment and the bottom of the page I found the teacher profile "Carlos Viana", clicked the send message button and I came across a popup without the field to write the message.	H6
32	The user should be automatically taken to the area where the screen is displayed the contents of the selected month.	H6
33	There is provided a "back" button on pages accessed. You have to use your browser's back button.	H6
34	The banner full banner explanatory and are confused, there is no sync between them and this hinders the transmission of the information they post.	H7
35	The titles in blue are mixed with the links, because they have similar colors and that blue is indicative of strong link. You only find out that it is a link or not to pause the mouse over.	H7
36	Through the link "participants", went to the page of all participants, commanded by name and could not find Carlos Viana.	H7
37	There are association classes/days.	H7
38	The same problem classes. There is a pool day/File Upload	H7
39	The options present in "Events Selection" do not show clearly what they are for.	H7
40	Navigating the calendar is complicated, with lots of information, making it difficult to check for available events.	H8
41	The title "My courses", located on the right side of the layout, it opens the list of available courses. You must click the "+" button to access the list.	H8
42	Materials in multimedia format do not offer an alternative option.	H8
43	Could not insert message forum because I did not notice any field intended for this purpose, the only thing I saw was the button "add a new discussion topic".	H8
44	The user cannot change the photo by clicking on the photo.	H8
45	When you enter the chat site, it is still necessary to click another link to the chat is actually open.	H8
46	After clicking on any link, to return to the page that was previously the same back to the top, forcing the user to locate where he was before the click.	H8
47	Pages with extensive content not provide anchors to return to top.	H8
48	I missed a Find button in the environment.	H8
49	The system login option is not visible in the layout. You need to scroll the page to get the user and password fields.	H9
50	The home page has lots of information and banners.	H9
51	There are many different font sizes on the main page without being logged.	H9
52	The log out link at the bottom of the page contains inappropriate font size.	H9
53	Some pages have content very extensive, requiring recurrent use of the mouse wheel or the scroll bars.	H9
54	The environment does not help itself. The documentation available is the MOODLE platform itself, with technical information.	H10

4.2 – Data Analysis

After analysis of the consolidated list of issues identified from heuristic evaluation performed in the LMS of *IFPE*, it was observed that all heuristics were violated. Figure 1 shows the percentage for each of the heuristics. Note that the heuristics Consistency and Standards (H4) and Flexibility and efficiency of use (H8) showed the largest number of problems detected with 19% and 17%, respectively.

Figure 1: Percentage of Problems Identified x Heuristics
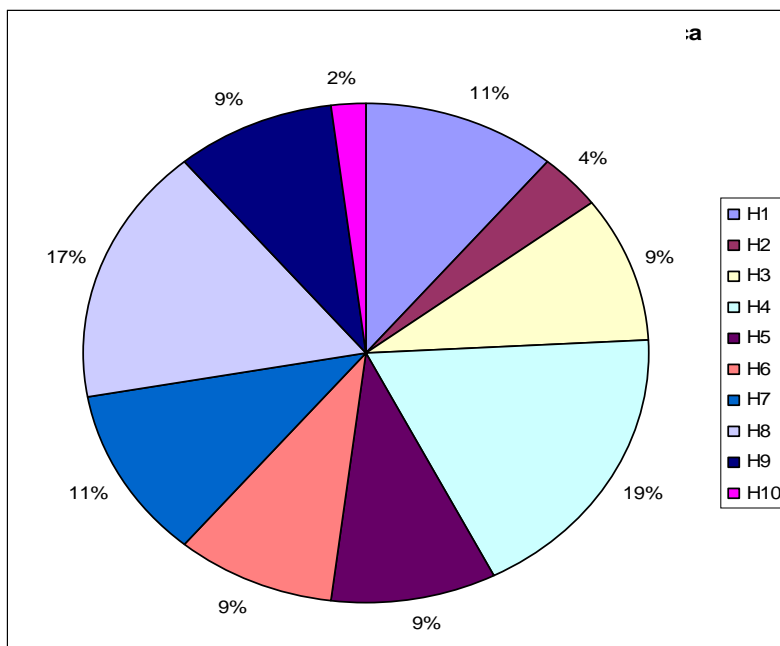
The high percentage of problems identified in H4 is mainly due to the lack of consistency of the layout of the environment. Many screens have completely different layouts in relation to the previous screen accessed by the user (Figure 2).

**Figure 2: Lack of Consistency in Layout**
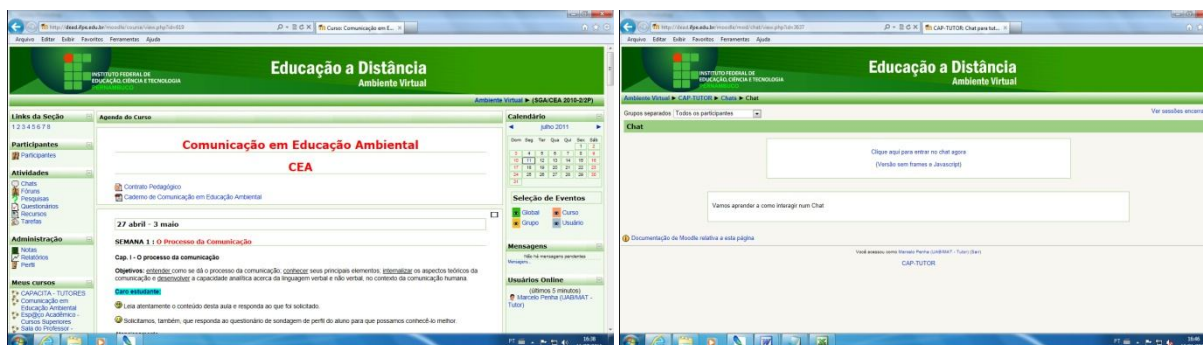
Another factor that contributes to this high percentage is due to the fact that many standards used on the Web are not followed by the environment. An example that illustrates this point is the positioning of the "Exit" button, at the bottom of the layout.

The lack of a logical organization of some items in the interface, as the position of the "Calendar", which is not on the left side of the layout, where other indications are related to the course and location of search options also contributes to the high percentage of H4.

Heuristics 8 turn showed a weak environment for not offering shortcuts to facilitate access to certain features of the environment, or, as in the case of exchange of profile picture, offer no option for task accomplishment (figure 3), either through a link, and either by clicking on the image itself.

Figure 3: Display "Edit Profile"
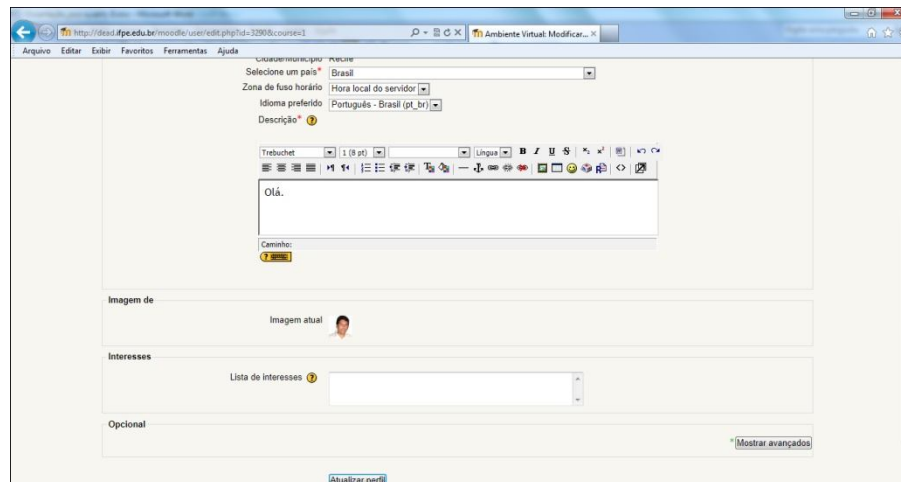
Heuristics Visibility System State (H1) and recognize in Time for Remembering (H7) involved 11% of the usability problems.

Featured negative for H1. In some situations the environment leaves the student without knowing what is happening. The main observations of the evaluators are related to lack of supply of information confirming the execution of tasks, such as login and profile editing. Figure 4 shows the screen to change the profile after profile and click the "Update Profile". There is no indicator that the task was successful.

Figure 4: Screen Displayed after Profile Update
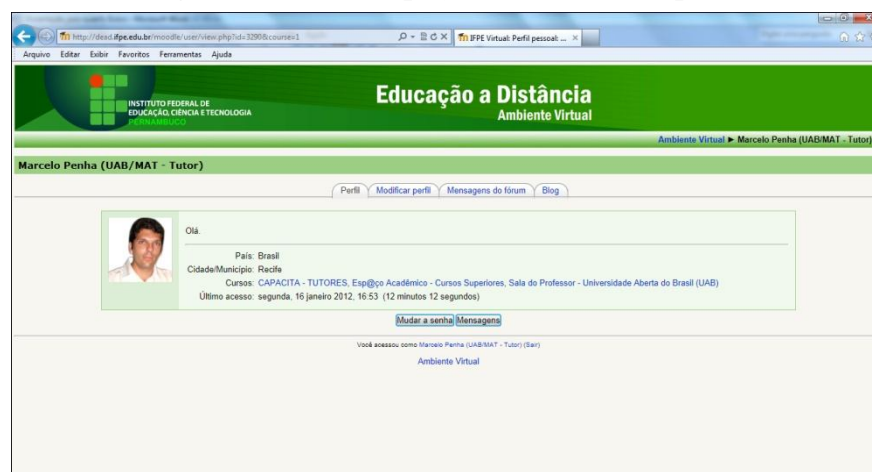
As a result, the heuristics appear to Freedom and Control User (H3), Error Prevention (H5) and Aesthetic Design Minimalist and (H9), with a percentage of 9%. Regarding the H9, most of these problems are related to excessive content of information on some screens, inappropriate use of sources (size) and banners confused. On the login screen (Figure 5), for example, due to the large amount of information presented, the field access is only visualized with the use of the scroll bar. This same screen has a banner at the top left which puzzled the evaluator 2.

Figure 5: Login Screen
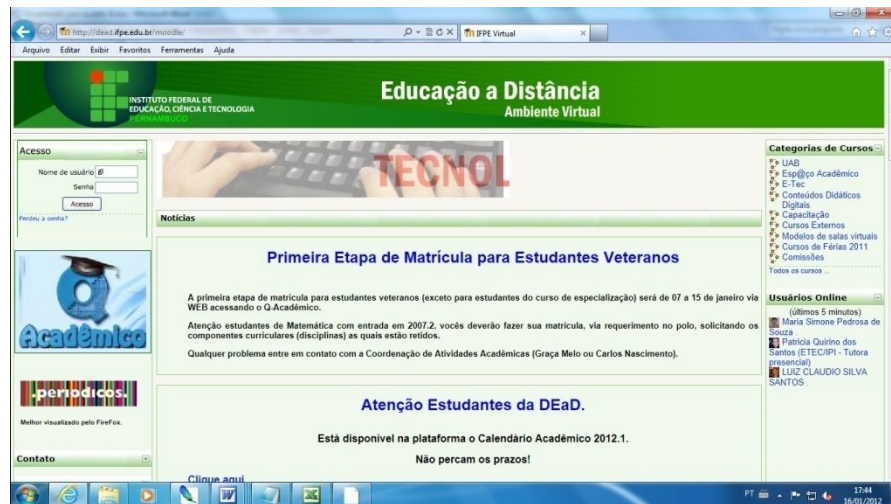
The other heuristics, albeit at a lower percentage, also presented problems detected by the evaluators.

5 - Conclusions

The technique used to perform the usability evaluation of LMS of *IFPE* was effective in pointing out several usability violations, according to ergonomic principles Nielsen. Also proved to be feasible, taking into account the number of participants required for obtaining good results is low and can be performed rapidly.

The results obtained from evaluations performed by experts in the case study showed that the LMS presents numerous deficiencies assessed usability, causing an interaction of low quality and, at times, unpleasant for users of the system.

The results showed, in general, violations of basic principles of design and usability, content as very extensive and sometimes unnecessary, lack of standard in layout, messages and inappropriate language inconsistent placement of some features.

References

Andrade, António LuisLordelo. (2007). *Usabilidade de interfaces Web*: Avaliação heurística no jornalismo on-line. Rio de Janeiro: E-papers

Barbosa, Anderson Luiz; Mendes, Leonardo de Souza. (2010). *AmbientesVirtuais de Aprendizagem*.In: 20% à distância: e agora: orientações práticas para o uso de tecnologia de educação a distância / Alda Carlini, Rita Maria Tarcia. São Paulo: Pearson Education do Brasil. p 161-170.

Cybis, Walter; Betiol, Adriana Holtz; Faust, Richard. (2007). *Ergonomia e Usabilidade, conhecimentos, métodos e aplicações*. São Paulo: Novatec Editora LTDA.

Litto, Fredric Michael. (2009) *O atual cenário internacional da EAD*. In: Educação a distância: o estado da arte. Fredic Michael Litto, Manuel Marcos Maciel Formiga (orgs). São Paulo: Pearson Education do Brasil.

Maia, Carmem, Mattar, João. (2007). *ABC da EAD*: a educação à distância hoje. São Paulo: Pearson Prentice Hall.

Moran, José Manuel. (2011). O que é educação a distância?
    [Online] Available: http://www.eca.usp.br/prof/moran/dist.htm (Mai 10, 2011).

Nielsen, Jakob. (1994). Usability engineering. San Francisco: Morgan Kaufmann.

Nielsen, Jakob (2005). Ten Usability Heuristics. 2005.
    [Online] Available: http://www.useit.com/papers/heuristic/heuristic_list.html. (Mai 15, 2011).

Preece, Jennifer; Rogers, Yvone; Sharp, Helen.(2005). Design de interação – Além da interação homem-computador. Porto Alegre: Bookman.

Penha, Marcelo; Campos, Fábio; Correia, Walter Franklin Marques. (2010). Mapeamento da pesquisa sobre design de interação na educação a distância no cenário internacional. *JournalTecnologus*, v. 5, p. 1-24.

Santa Rosa, José Guilherme; Moraes, Ana Maria de. (2008). *Avaliação e projeto no design de interfaces*. Rio de Janeiro: 2AB.