

# Usability in e-Learning Platforms: heuristics comparison between Moodle, Sakai and dotLRN

Ludivine Martin<sup>1,5</sup>, David Roldán Martínez<sup>2,5</sup>, Olga Revilla<sup>3,5</sup>, Maria José Aguilar<sup>4,5</sup>, Olga C. Santos<sup>1,5</sup>, Jesús G. Boticario<sup>1</sup>

<sup>1</sup> aDeNu Research Group, Artificial Intelligence Department, Computer Science School, UNED, C/Juan del Rosal, 16. 28040 Madrid, Spain  
{ludivine.martin,ocsantos,jgb}@dia.uned.es

<sup>2</sup> Proyecto AEEVA, Universidad Politécnica de Valencia, Camino de Vera, s/n 46022 Valencia, Spain  
[darolmar@upvnet.upv.es](mailto:darolmar@upvnet.upv.es)

<sup>3</sup> itakora.com  
[itakora@gmail.com](mailto:itakora@gmail.com)

<sup>4</sup> [mariajoseaguilar.com](http://mariajoseaguilar.com)  
[i.infodisenio@gmail.com](mailto:i.infodisenio@gmail.com)

<sup>5</sup> Cadius community of usability professionals  
<http://www.cadius.org/>

**Abstract.** Recently, educational institutions largely adopted open source e-learning platforms. Several studies and comparisons between those platforms were conducted. However, these analyses were more focused into purely technical issues (standards support, development platform used, scalability, etc.) than into functional issues. It was noted that most of the e-learning solutions are not optimal from the end-user point of view: they can be hard and tedious to use, potentially resulting in higher abandon rates. There is therefore a need to focus into usability to work toward more usable and user-centered e-learning platforms. This paper details the used methodology based on heuristics to allow an objective usability evaluation of three of the main e-learning open source platforms: Moodle, Sakai and dotLRN. The results of the comparative evaluations are exposed.

**Keywords:** Usability, heuristics, eLearning, LMS, VLE, Moodle, Sakai, dotLRN.

## 1. INTRODUCTION

E-learning is widely adopted by educational centers at all stages, especially in higher education institutions trying to support the life-long learning (LLL) paradigm. It removes time and space barriers. Numerous sites and articles provide reviews of Learning Management Systems (LMS), mostly concentrated in comparative study of their technical features [1], [2]. Disappointment and frustration are common in e-learning, due to poor features, lack of pedagogical guidance, ineffective evaluation procedures and usability issues [3]. A direct correlation has been established between the key aspects in the usability field and their effect on learning [4]. From a usability perspective, LMS have particularities as compared to other Web sites

- Out-of-the box product. Usually an institution will adopt an existing LMS, not build a new one. Therefore the LMS already exists. It is not built for a very specific purpose and audience.
- Variety of needs. LMS have to be flexible enough to address a variety of teaching, learning and collaborative styles.
- High level of customization. LMS usually offer a wide range of configuration options at the admin level, the tutor level and the student level. This flexibility affects the overall usability of the system.
- Captive audience. The end-user (students and tutors) doesn't choose the LMS. Instead, the end-user chooses a learning institution and then has to adopt the institution's LMS. If the user gets frustrated by the LMS, she cannot leave it; she has to bear with it. It points out the need to assess also the user satisfaction of the product and not only the efficiency of the product.
- Educational standards. In order to facilitate the reusability of the author work (e.g. reusability of contents and instructional designs) and facilitate the adaptability of the course to the learner, the LMS has to comply with educational standards (IMS, SCORM). These standards are usually complex and impact on the LMS user interface, therefore the user experience.
- Container/contained relationship. When evaluating the overall usability and accessibility of a LMS, we need to look at three different elements: the platform, or "shell" or "receptacle" where the course materials are stored and delivered; the formal content, or packaged course materials, compliant to educational standards, the content generated by users, or content produced by the entire community.

Three of the most widely used open source LMS are Moodle<sup>9</sup>, Sakai<sup>10</sup> and dotLRN<sup>11</sup>. Moodle defines itself as an "open source software package designed using sound pedagogical principles, to help educators create effective online learning communities", Sakai as an "online collaboration and learning environment", and dotLRN as an "enterprise-class open source software" for "supporting e-learning and digital communities". Although these three solutions call themselves differently, they are direct competitors. In the field of e-learning, those three solutions –or platforms– are commonly called Learning Management Systems (LMS), Virtual Learning Environments (VLE) or Course Management System (CMS). The LMS are used by a variety of users –students, tutors and administrators– with a variety of goals. The three platforms are entirely free and developed by open source communities.

The overall aim of this usability test is restricted to heuristics: we want to compare usability checkpoints compliance between Moodle, Sakai and dotLRN, focusing only on the students' aspect, perspective and tasks. Because this study is based only on an expert evaluation, it does not intent:

1. To detect all usability issues on the platform, but rather the most likely to be found by typical users.
2. To replace any study with real users, which is essential and should also be conducted for a comprehensive usability evaluation

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<sup>9</sup> Moodle website: <http://moodle.org>

<sup>10</sup> Sakai website: <http://sakaiproject.org>

<sup>11</sup> dotLRN website: <http://dotlrn.org>

3. To assign absolute values or grades, but rather to provide numerical data to allow comparisons between the three platforms.

The used methodology is detailed in the next section, followed by the results section.

## 2. METHODOLOGY

The study took place in January 2008. The three platforms were set up beforehand using the default layout and configuration (as provided by the stable version in each site) on which we built a class environment with fictitious contents to simulate a real situation. The content was exactly the same on the three platforms. It included a class introduction, class forums and class documents. Five usability experts participated in this study, while three experts is the minimum recommended [5]. These five experts belong to the Cadius community, which stands for Information Architecture and Usability Community (in Spanish: Comunidad de Arquitectura De Información y USabilidad). Cadius is a community of usability, information architecture and interaction design professionals. It is organized by a distribution list and periodic meetings in several cities. It was created in 2001 and nowadays it involves more than 2000 members all over the world, especially in Spain and Latin-America.

Each expert evaluated the platforms remotely in a random order. For each platform, they were asked to proceed with a series of tasks. The goal was to test the main features offered by an e-learning platform in order to support asynchronous student learning. These tasks – frequent or critical for students – were as follows:

1. Register to the platform.
2. Sign up to a class.
3. Leave a post in a forum.
4. Download a document.
5. Add a personal event in the calendar.

Each evaluator could take as much time as needed to explore the platform. After completing the tasks, each evaluator filled a data log sheet. This spreadsheet was based on the 10 Nielsen Heuristics [6], which are as follows.

1. Visibility of System Status
2. Match Between System and the Real World
3. User Control and Freedom
4. Consistency and Standards
5. Help Users Recognize, Diagnose, and Recover from Errors
6. Error Prevention
7. Recognition Rather than Recall
8. Flexibility and Efficiency of Use
9. Aesthetic and Minimalist Design
10. Help and Documentation

These 10 heuristics are detailed into more than 300 usability checkpoints [7].

Irrelevant checkpoints to e-learning platforms were removed to end up with about 200 checkpoints. For each checkpoint, the expert had to decide if it was or not respected or if it didn't apply to the site (NA: Not Applicable). For the data treatment, the NA values were removed and scores were transformed in percentage.

If a checkpoint was not respected, the expert had to attribute a severity score: low, medium, serious or critical. The severity scores were attributed according to the following definitions:

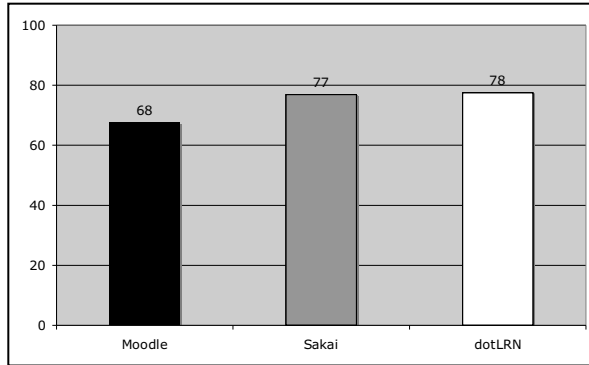
- Critical: This usability problem will make some users unwilling or unable to complete a common task. It should be fixed urgently.
- Serious: This usability problem will significantly slow down some users when completing a common task and may cause users to find a workaround. It should be fixed as soon as possible.
- Medium: This usability problem will make some users feel frustrated or irritated but will not affect task completion. It should be fixed during the next “business as usual” update.
- Low: This is a quality problem, for example a cosmetic issue, a spelling error or a grammatical mistake.

### **3. RESULTS**

This section presents the results of the analysis of the 5 data log sets produced by the experts after the corresponding heuristics evaluation. The results presented first show the overall scores. Then, the strengths and weaknesses detected are identified. Finally, the severity of the usability issues is addressed.

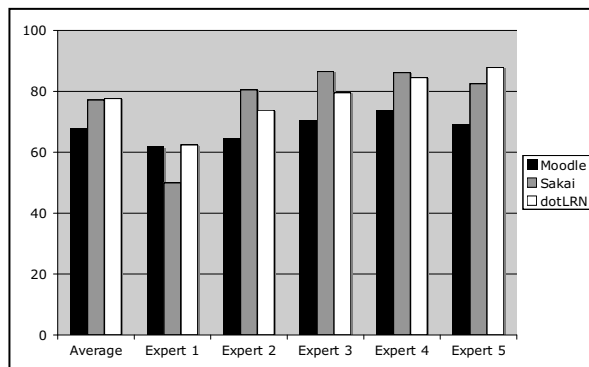
#### **3.1 Overall scores**

The following figure shows the overall scores obtained by Moodle, Sakai and dotLRN, respectively. None of the platforms reaches the 80% of compliance. dotLRN reached the score of 78% compliance to usability checkpoints. Very close to dotLRN is Sakai with 77%. Moodle is significantly behind with a score of 68%.



**Fig. 1.** This figure illustrates the overall score obtained by the platforms, in percentage of compliance to the usability checkpoints.

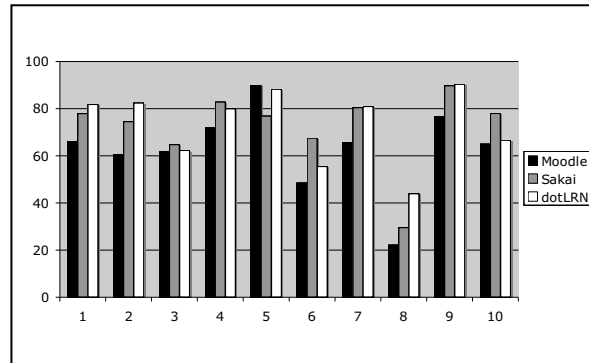
In turn, Fig. 2 shows an overall consistency across the experts' opinions regarding the overall scores of the platforms. Four experts out of five significantly gave lower scores to Moodle. dotLRN and Sakai scores are tight, since three out of five experts gave the highest score to Sakai while the other two, gave the highest to dotLRN. Moreover, expert 4 scores for Sakai and Moodle are almost similar, just slightly higher for Sakai.



**Fig. 2.** This figure illustrates the distribution of scores by the 5 experts (in percentage) of compliance to the checkpoints

### 3.2 Strengths and weaknesses

Now, we discuss the results obtained in each of the 10 heuristics by each platform.



**Fig. 3.** This figure illustrates the score (%) obtained by the platforms in the 10 heuristics.

Fig. 3 shows the strengths and weaknesses of the platforms as compared to the others. Moodle gets its highest score (90%) in “5. Help Users Recognize, Diagnose, and Recover from Errors” and its worst score (22%) in “8. Flexibility and Efficiency of Use”. Sakai and dotLRN are again quite similar. Both get their highest score (90%) in “9. Aesthetic and Minimalist Design” and their worst score (Sakai 30%, dotLRN 44%), as Moodle, in “8. Flexibility and Efficiency of use”.

In more detail, the results for each of the platforms as compared to the others are:

- **Moodle.** Moodle scores better than the other platforms on the following point: “5. Help Users Recognize, Diagnose, and Recover from Errors”. Moodle scores worst than the other platforms on all the other points, except “3. User Control and Freedom” (score equal to dotLRN), other said, in 8 out of 10 checkpoints.
- **Sakai.** Sakai scores better than the other platforms on the following points: “3. User Control and Freedom”, “4. Consistency and Standards”, “6. Error Prevention” and “10. Help and Documentation”. Sakai is worst than the other platforms on the following point: “5. Help Users Recognize, Diagnose, and Recover from Errors”.
- **dotLRN.** dotLRN scores better than the other platforms on 5 out of 10 heuristics: “1. Visibility of System Status”, “2. Match between System and the Real World”, “7. Recognition Rather than Recall”, “8. Flexibility and Efficiency of Use” and “9. Aesthetic and Minimalist Design” (same score as Sakai on this last one). dotLRN got the lowest score of the 3 platforms, but equal to Moodle for “3. User Control and Freedom”.

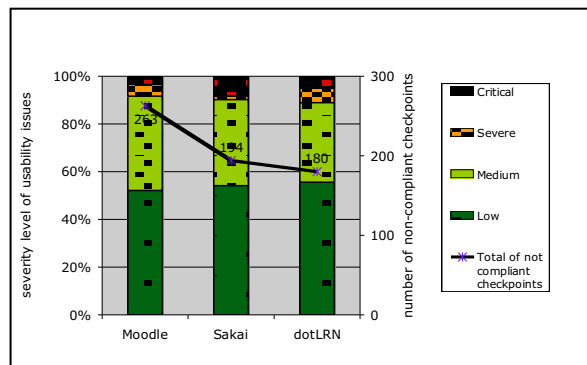
From this analysis, it can be concluded that the experts gave low scores on “8. Flexibility and Efficiency of Use” for the three platforms (none reached 50% compliance). This heuristic says that “accelerators-unseen by the novice user-may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions. Provide alternative means of access and operation for users who differ from the “average” user (e.g., physical or cognitive ability, culture, language, etc.)”. However this heuristic was sustained by only 6 relevant checkpoints (as opposed to an average of 20 checkpoints by heuristic)

In turn, the three platforms scored around 80% in heuristics 5. and 9.. Both Moodle and dotLRN scored over 80% in “5. Helping Users Recognize, Diagnose, and

Recover from Errors” which relates to “Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.”. Both Sakai and dotLRN score over 80% in “9. Aesthetic and Minimalist Design”. This heuristic says that “dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility”. Moreover, Sakai and dotLRN also score around 80% in 1, 4 and 7 heuristics. Heuristic 1 says that “the system should always keep user informed about what is going on, through appropriate feedback within reasonable time”, heuristic 4 says that “users should not have to wonder whether different words, situations, or actions mean the same thing. follow platform conventions.” and heuristic 7 says that “objects, actions, and options should be made visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate”.

### 3.3 Severity of usability issues

Overall for the 3 platforms, about 90% of the usability issues found were of low or medium importance.



**Fig. 4.** This figure illustrates the distribution of the severity of the usability issues found in each platform.

The platform with more non-compliant checkpoints is Moodle. In turn, Sakai and dotLRN score very similar, having dotLRN a few less checkpoints.

**Table 1.** Severity of the usability issues found in each platform

	Moodle	Sakai	dotLRN
Non-compliant	263 ncp	194 ncp	180 ncp

checkpoints				
Severity (%)	Low	52 %	54 %	56 %
	Medium	40 %	36 %	33 %
	Severe	5 %	2 %	6 %
	Critical	3 %	8 %	5 %

From the above table, it can be summarized the following:

- **Moodle** has the largest number of non-compliant checkpoints (263): 46% more than dotLRN and 35% more than Sakai. However, 92% of the issues found in Moodle are of low or medium severity, but 8% are severe and critical.
- **Sakai** has a medium score of non-compliant checkpoints, 90% low or medium and 10% severe or critical.
- **dotLRN** has the lowest number of non-compliant checkpoints, 89% low or medium. However, it has the highest percentage of severe or critical (11%), just one point above Sakai.

#### 4. CONCLUSIONS AND FUTURE WORKS

This paper has presented a usability evaluation of three of the most well known open learning management systems: Moodle, Sakai and dotLRN. Five usability experts participated in this study following a task-based approach. After completing the tasks, each evaluator filled a data log sheet. This spreadsheet was based on the 10 Nielsen Heuristics, which are detailed into more than 300 usability checkpoints.

The results have shown that dotLRN got the highest score within this heuristics study, whereas Sakai obtained a second position, very closed to dotLRN score. In turn, Moodle is significantly behind. However, as said earlier, testing with real users in real-life situation is essential to have a comprehensive overview of the usability of each platform. This analysis was an initial attempt to compare the three platforms from a users' experience perspective, in contraposition to the traditional analysis focused on technical issues and functionality.

Regarding the methodology, we took notes of potential improvements for future study. One improvement would be to add more challenging tasks to test the platforms further and facilitate filling the checkpoints, such as register with the same username (to force an error), upload a heavy file (to check for the waiting time and the waiting message) or delete an uploaded file (to check action reversal). Another improvement is to refine even more the checklist by removing the checkpoints that were notified as irrelevant to all 3 platforms.

As part of the ALPE project<sup>12</sup> (European project eTEN029328), UNED is conducting several rounds of evaluations with end-users on the dotLRN platform. ALPE (Accessible eLearning Platform for Europe) is a validation project involving an accessible, standard based e-learning solution for visually impaired, hearing impaired and adult learners. The goal is to obtain quantitative data regarding user satisfaction/acceptance of the platform, with special attention to accessibility issues.

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<sup>12</sup> <http://adenu.ia.uned.es/alpe/>



Usability testing happens in several places along the e-learning cycle [8]. Those data will be both obtained from online questionnaire, real-life course follow up and one-on-one session with end-users. Results will be translated into design recommendations or technical requirements to improve the dotLRN platform usability.

Recently, there has been an increase of the importance given to usability and accessibility within Sakai community. In fact, Sakai is part of the Fluid Project<sup>13</sup>, "...a worldwide collaborative project to help improve the usability and accessibility of community open source projects with a focus on academic software for universities. We are developing and will freely distribute a library of sharable customizable user interfaces designed to improve the user experience of web applications." Therefore Sakai community works steadily toward improving the platform usability.

LMS usability is challenging: it is about ensuring usability of a highly flexible system which offers a lot of customization options at every level and which moreover integrates components (platform, course, content generated by users) coming from different sources (developers, administrators, authors, students, tutors) for different purposes. More widely, usability within the field of e-learning is a challenging domain. The main task for the student is learning [9], so usability should take into account the cognitive process involved in learning. Usability has been described as a precursor of learnability [10]. Usability shouldn't be a barrier to learning, especially because it can impact motivation. There is currently no out-of-the box widely accepted usability evaluation in e-learning, since most techniques fail to capture the pedagogical effectiveness. One definition of usability in e-learning opens the path: the ability of a learning object to support or enable a very particular concrete cognitive goal [11].

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## REFERENCES

1. Edutools Course Management System Comparisons. Retrieved January 17, 2008 <http://edutools.com/static.jsp?pj=4&page=HOME>
2. Santos, O.C., Boticario, J.G., Raffenne, E., Pastor, R. Why using dotLRN? UNED use cases. FLOSS International Conference, 2007.
3. Zemsky, R., Massy W.F. Thwarted Innovation What Happened to e-learning and Why <http://www.thelearningalliance.info/Docs/Jun2004/ThwartedInnovation.pdf>
4. Kruse, K. e-Learning and the Neglect of User Interface Design, e-LearningGuru.com, [http://www.e-learningguru.com/articles/art4\\_1.htm](http://www.e-learningguru.com/articles/art4_1.htm)
5. Nielsen, J. (1992). Finding usability problems through heuristic evaluation. Proc. ACM CHI'92 Conf. (Monterey, California), 373-380.

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<sup>13</sup> <http://www.fluidproject.org>

6. Nielsen, J. (2005). Heuristic Evaluation. Retrieved April 05, 2007, from <http://www.useit.com/papers/heuristic/>
7. Pierotti D., Heuristic Evaluation - A System Checklist. Retrieved April 05, 2007 from <http://www.stcsig.org/usability/topics/articles/he-checklist.html>
8. Martín, L., Gutiérrez y Restrepo, E., Barrera C., Rodríguez Ascaso, A., Santos O.C., Boticario, J.G. (2007). Usability and Accessibility Evaluations along the eLearning Cycle. Proc. Web Information Systems Engineering 2007 Conf. (Nancy, France), 453-458.
9. Zaharias, P. (2004). Usability and e-Learning: The road towards integration. ACM eLearn Magazine, Vol.2004 (6).
10. Smulders, D., Designing for Learners, Designing for Users, eLearn Magazine, [http://www.elearnmag.org/subpage/sub\\_page.cfm?section=3&list\\_item=11&page=1](http://www.elearnmag.org/subpage/sub_page.cfm?section=3&list_item=11&page=1)
11. Feldstein, M., (2002) What Is "Usable" e-Learning?, eLearn Magazine, [http://www.elearnmag.org/subpage/sub\\_page.cfm?section=4&list\\_item=6&page=1](http://www.elearnmag.org/subpage/sub_page.cfm?section=4&list_item=6&page=1)