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Is Moodle Accessible for Visually Impaired People?

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Abstract. Most educational centers are currently using e-learning tools to provide the pedagogical resources for the students, especially in higher education. Nevertheless, some students are not able to access to this information because these authoring tools are not as accessible as they should be. The main aim of this paper is to evaluate if one of the most widely e-learning tool used around the world, Moodle, is accessible for visually impaired people. The evaluation shows that the accessibility guidelines provided by the World Wide Web Consortium (W3C) are not accomplished by the tool. Moreover, it shows that people using screen readers are not able to access to the majority of the functionality of Moodle.

Keywords: e-learning, Moodle, accessibility, visual impairments, screen reader

1 Introduction

Nowadays, we are involved in a world where technology is essential. In the educational environments, for example, the conventional education is being adapted to new technologies. A new concept, e-learning, emerged as a complementary mechanism to traditional classroom teaching. This learning concept allows students to learn when and where they want regardless of their physical conditions or the technology they use. Students only need an Internet connection to access to learning resources.

Many educational institutions use Learning Content Management Systems (LCMSs) to manage their courses. These e-learning tools are usually Web-based tools which make course management easier for teachers and directors. Oftentimes, the LCMS is even the only tool given students for communicating with peers and teachers or for accessing particular learning resources. Most of teachers who are sensitive to the accessibility barriers in education are focused on creating accessible resources for their students but the main problem is that if the LCMS is not accessible then it does not matter if the pedagogical resources are or not accessible, because the students are not able to access to the information either. That is why these e-learning tools should be accessible and easily to use for everyone. Otherwise students with different functionality or access conditions could not access the learning resources and the educational gaps will become higher, failing one of their current main objective: provide inclusive education and equal access for all.

This paper is focused on identifying the accessibility problems that visually-impaired people face when they interact with LCMSs. Specifically, the paper evaluates the accessibility problems of the widely used authoring tool called Moodle¹.

Most of visually-impaired people use assistive tools for accessing websites and to surf on LCMS's. There are different assistive technologies for each disability [1]; so, each user chooses the best tool to help her/him to access the system according to her/his disabilities. Particularly, visually-impaired people, users with low vision or blindness use screen readers, screen magnificent tools or refreshable Braille displays among others. Each of these tools has different features, for example, the screen readers read text aloud; screen magnificent tools get bigger the information showed in the screen; or refreshable Braille displays convert the web contents to Braille.

The goal of this work is to evaluate the Moodle's accessibility focusing on visual impairments. This paper presents manual evaluations from a user perception and an accessibility expert. This work is part of a complete investigation where automatic and semi-automatic accessibility evaluations are included. This complete investigation gets best results because it uses a combination of manual and automatic evaluation methods [2].

The evaluation presented here is divided into two main parts: a user evaluation and an expert evaluation. Firstly, the user evaluation was carried out by a person with accessibility knowledge and with a low-medium level of screen reader use but without any visual impairment. Because of this, she simulated blindness while she was using two different screen readers for interacting with the system. Next, an expert evaluation was completed in order to analyze Moodle's accessibility in terms of W3C² guidelines.

The paper is organized as follows: section 2 presents the state of the art. Then, section 3 describes the evaluation method and main results obtained. Finally, main conclusions and further research are presented in section 4.

2 Previous Work

This section presents the state of the art in e-learning systems, accessibility guidelines and standards, assistive technologies used by people who are visually impaired and previous studies related to accessibility barriers in educational systems.

2.1 E-learning

E-learning has become a new way of learning which could be considered as the evolution of learning distance [3]. The concept of e-learning has many definitions, maybe the easiest could be "Access online to learning resources every moment and everywhere" [4]. The main difference with traditional learning is that the student

¹ Moodle, LCMS Authoring tool. Available in: <http://download.moodle.org/windows/> [June 2010]

² W3C: The World Wide Web Consortium. Available in: <http://www.w3.org/> [June 2010]

decides how to study: what, when and where. So, it provides a huge freedom to the user.

There are different e-learning tools which help to organize, store and modify efficiently e-learning courses. These tools are divided into three groups: LMSs (Learning Management Systems), LCMSs (Learning Content Management Systems) and CMSs (Content Management Systems) [5]. Each one has different features: CMSs permit to manage contents; LMSs are focused on administrative and assistive tasks in learning environment; and LCMSs provide authoring tools for learning. Particularly, this paper evaluates Moodle LCMS which is a free and open source tool and is one of the most widely used by learning institutions around the world³

2.2 Accessibility Standards

E-learning tool designers should consider different guidelines and standards to design e-learning tools if they want to make these tools accessible for all. There are different institutions like: W3C or IMS⁴ which supply guidelines to develop accessible websites or educational resources.

W3C provides guidelines to help designers to create accessible components. For instance, WCAG guidelines [6] for websites content; ATAG guidelines [7] for authoring tools; or UAAG guidelines [8] for user agents. Then, LCMS and every authoring tool should be in accordance to ATAG guidelines. Also, they should fulfilled WCAG guidelines because these authoring tools produce Web pages and Web contents..

Besides, IMS has developed guidelines to create e-learning tools and make accessible its content like IMS Access For All Specification [9] adopted by ISO/IEC SC36. These IMS guidelines are based on six principles: allow the user to customize the website, provide equivalent alternatives to visual and additive content, provide compatibility to assistive tools and provide access to all tasks through keyboard, provide context and information, follow IMS specifications and other relevant specifications, and consider the use of XML.

Moreover, designers should use Universal Design to provide for all. This approach has been adapted to learning by creating Universal Design for Learning (UDL) [10]. In particular, the characteristics of Universal Design have been tailored to e-learning tools like Moodle [11].

2.3 Assistive Technology: Screen Readers

Disabled people use different assistive technologies to access computers and the Internet. This technology helps them to complete tasks such as: sending emails, read

³ Zacker. Higher-ed LMS market penetration: Moodle vs. Blackboard+WebCT vs. Sakai Available in: <http://www.zacker.org/higher-ed-lms-market-penetration-moodle-vs-blackboard-vs-sakai> [July 2011]

⁴ IMS. Global Learning Consortium. Available in: <http://www.imsglobal.org/> [July 2011]

the newspaper and so on. There are different assistive technologies which have been adapted to different disabilities. For example, if a person has a paralysis, weakness, or other problems with movement of limbs, s/he can use keyboard with larger, more widely-spaced keys. Besides, if a person has visual impaired problems, s/he can use screen magnificent or screen readers.

Screen readers are used by people who are blind, visually impaired or illiterate or learning disabled people to help them when they are using the computer. These people are not able to read the screen's text so they need an assistive technology which repeats the text loudly or transforms it to Braille. As there is a huge variety of screen readers, users can choose the best screen reader for their needs. There are screen readers which have been developed to provide better support for different browsers; while others are open-source, free or commercial software and so on.

To carry out this presented work two screen readers have been selected: JAWS⁵ and NVDA⁶. JAWS is still the primary screen reader, but its usage is being decreased while the use of NVDA and VoiceOver has been significantly increased.⁷ JAWS is commercial software and it has been improved to read websites in Internet Explorer browser and other user agent like Mozilla Firefox or Safari with a limit support. On the other hand, NVDA is an open source and free software which is able to surf on the Internet in different browsers such as: Mozilla Firefox or Internet Explorer. It is also able to show the text information of the screen reader in audio or Braille in more than twenty different languages, including Spanish.

2.4 LCMS's Accessibility Studies

Accessibility evaluations in e-learning tools can be found in literature. Some of them are centered in e-learning content accessibility. For instance, Fitchen [12] shows that most e-learning content is not accessible for disabled people. Particularly, documents with Flash technology, videoconferences or PowerPoint presentations online are usually inaccessible. Fisseler [13] suggested different solutions for these problems. For example, including alternative texts for images; provide a good structure for the content or a good color contrasts among others.

Other research works evaluate the accessibility features on e-learning tools. For instance, Power [14] evaluates accessibility of three different e-learning tools. The LCMSs evaluated are: Moodle, dotLRN⁸ and Blackboard⁹. This study concludes that all of them have serious accessibility problems and none of them are in accordance to WCAG 1.0 accessibility guidelines.

Besides, other evaluations are focused on visual impairments too, as Open University evaluation, which evaluates accessibility of Moodle v1.6 [15] using JAWS

⁵ JAWS. Screen reader. Available in: <http://www.freedomscientific.com/products/fs/jaws-product-page.asp> [June 2010]

⁶ NVDA. Screen reader. Available in: <http://www.nvda-project.org/> [May 2010]

⁷ Screen Reader User Survey #3 Results, Available in: <http://webaim.org/projects/screenreadersurvey3> [July 2011]

⁸DotLRN. Screen reader Available in: <http://www.dotlrn.org/> [May 2010]

⁹Blackboard. Available in: <http://www.blackboard.com/> [May 2010]

7.0 and Internet Explorer as browser. The evaluation concludes that Moodle is not accessible because there are important accessibility errors of WCAG 1.0. Recently, Buzzi [16] has evaluated accessibility of Moodle for visual impaired people using WCAG 2.0. This work shows that Moodle should improve its accessibility.

Besides, there is a study which evaluates the user experience and the user opinion, while the user fills out an assessment task created with Blackboard LMS [17]. This study concludes that visual impairment users have some accessibility or usability errors to complete the online assessment.

The evaluation carried out in [18] is one of the last published evaluations related to the accessibility of Moodle. The paper evaluates the accessibility of three LCMSs (Moodle, Sakai and ATutor) from the point of view of four parameters: templates and themes, content editor, Javascript and tables for layout. Finally, it concludes that all LCMSs present accessibility problems according to WCAG 1.0 and ATAG 2.0 guidelines.

To our knowledge, during last years, Moodle's community has been trying to solve the accessibility problems of the tool which have been improved in its last versions. Also, the accessibility and the usability of the screen readers have been improved. So probably the results in previous accessibility studies based on previous versions of the Moodle and screen readers are obsoletes.

On the other hand, preceding accessibility studies evaluated a tiny percent of tasks of the tool and even they did not take into account the administrator profile. Furthermore, an exhaustive expert evaluation based on ATAG guidelines is not found in literature. That is why this paper presents a new accessibility evaluation of Moodle taking into account all these things.

3 Evaluation

The evaluation presented in this paper checks the accessibility of Moodle version 1.9 in the Internet Explorer 6.0 browser and in Windows XP operating system. It is important to emphasize that the version 1.9 is not the last version of Moodle; however, it is the most used nowadays (see Figure 1).

The Moodle's accessibility is evaluated in two different ways. Firstly, a user evaluation is made simulating blindness and using two different screen readers (JAWS version 10 and NVDA version 1010.2) for accessing Moodle. Secondly, it is evaluated by an accessibility expert in accordance to W3C ATAG 2.0 guidelines (because Moodle is an authoring tool) and WCAG 2.0 guidelines (because Moodle is a Web-based system and a web-site). WCAG 2.0 is the current W3C recommendation and it was used in this paper. Although ATAG 2.0 is not a W3C recommendation, it is under development. ATAG 2.0 has been chosen for the evaluation used in this work because is compatible with WCAG 2.0.

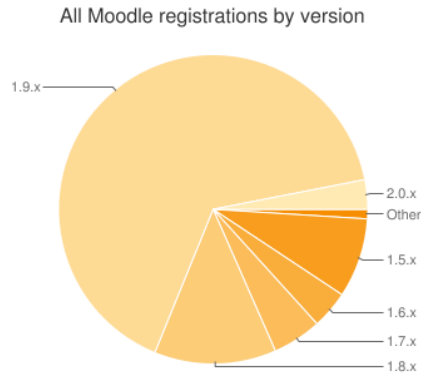


Figure 1. Moodle Registrations by Version¹⁰

Both accessibility evaluations have centered in the accessibility evaluation of basic tasks related to the management of a course; so it has been evaluated: the administration of courses and the administration of students (the full list of task are showed in Table 1 and Table 2). However, fall outside the scope of this evaluation, is the multimedia content generated by the editing tools like what-you-see-is-what-you-get (WYSIWYG) HTML and XML editors due to a strong dependence on specific tool integrated in Moodle. It is important to specify that the evaluation carried out of generated web content have been made with the Greenie theme, which does not present accessibility barriers related to the contrast colors and its structure was easier and clearer than the default theme.

The study is centered in the evaluation of tasks that users can execute in the application. In Moodle, administrators have full permissions meanwhile teachers and students have permissions only for subsets of tasks of Moodle. That is why the evaluations are carried out with the administration profile, but the evaluations results can be applied to all the Moodle profiles (students and teachers) too.

3.1 Evaluation Simulating Blindness

This evaluation was carried out by an evaluator with technical knowledge about accessibility but without any visual disability. It is important to emphasize that there are different levels of screen reader use and some full-featured screen readers have a very steep learning curve. This evaluator could simulate a user with low-medium level. She switched off the PC screen in order to simulate blindness. After that, she tried to complete each Moodle task by NVDA and JAWS screen reader. Then, she checked if the task presents accessibility difficulties and if it can be finished by a visual impaired person.

During the evaluation, different accessibility difficulties were frequently found by the user. These difficulties are listed below and Figure 2 shows a graphic of the

¹⁰ Moodle. Moodle Statistics. Available in: <http://moodle.org/stats/> [July 2011]

percentage for each error. This percentage is calculated after counting how many times the error occurs. It is divided by the number of tasks in the application:

- **E1:** Not all text and combo boxes have associated descriptive texts.
- **E2:** Pages refresh without asking the user.
- **E3:** Moodle redirects the user to another page without warning the user.
- **E4:** The Look & Feel of Moodle changes in some tasks.
- **E5:** Tables are used for layout.
- **E6:** Images of text are used to convey information
- **E7:** It is difficult to know how to complete the task or it is confusing for the user
- **E8:** There is text in English when the selected language of the tool is Spanish
- **E9:** There is not a button that allows the user to cancel the operation.
- **E10:** The table is not well designed so the screen reader is not able to read it well.
- **E11:** There are not page or table headings.
- **E12:** There are many rows in the table and it is difficult to read, s/he has to memorize the table structure.
- **E13:** There is a text that only can be modified with a Windows Editor which is not accessible. The Appendix A shows a description about it.
- **E14:** Text description is not correct.
- **E15:** The application does not check the data inserted into. It is not easy for the users to guess what the problem is.
- **E16:** The screen reader does not read the text correctly.

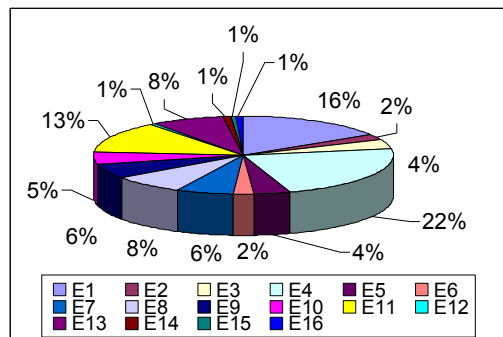


Figure. 2. Error frequency

Table 1 and 2 detail the accessibility difficulties found for each Moodle task. First column in the tables presents which profiles can make the task (A: Administrator; T: Teacher; S: Student). Second and third column present the group's task and the task's name. Fourth column presents the accessibility difficulties found during the evaluation (numbered according previous list).

Finally, last column shows if the task can be completed by the user or not. This column has three different values: *Yes*, if the task can be completed without difficulties; *Yes**, if the task can be completed but there are accessibility problems

that make difficult to complete the task for visual impaired people and *No*, if the task cannot be completed by the user.

Table 1. Accessibility difficulties found for Moodle tasks related with reports, questions, files, groups, events, calendar, forums and profiles.

User Profile	Functionality (group)	Task Name	Errors	Can it be completed?
A/T/ S	General	Login user	E1	Yes*
A/T/S	General	Change language Moodle	E1/E2	Yes*
A	Users/ Authentication	Manage authentication	E8 /E10	Yes*
A	Users/ Authentication	Email-based self-registration	E5	Yes*
A	Users/ Authentication	No login	E7	Yes*
A	Users/ Authentication	Manual accounts	E5	Yes*
A	Users/Accounts	Browse list of users	E7/E5/E9/E10	Yes*
A	Users/Accounts	Bulk user actions	E2/E11	Yes*
A	Users/Accounts	Add a new user	E6/E8/E11/E13	Yes*
A	Users/Accounts	Upload users	--	Yes
A	Users/Accounts	Upload user pictures	--	Yes
A	Users/Accounts	User profile fields	E3/E7/E13	Yes*
A	Users/Permissions	Define roles	E7/E8/E13	Yes*
A/T	Users/Permissions	Assign system roles	E1/E9	Yes*
A	Users/Permissions	User policies	E8/E9	Yes*
A/T*	Courses	Add /Edit courses	E4/E13	Yes*
A	Courses	Enrollments	E9/E11	Yes*
A/T/S	Courses	Participants	--	Yes
A/T	Courses	Backup	--	Yes
A/T	Courses	Restore a course	E5/E7/E9/ E10/E11	No
A/T	Courses	Import	E4/E5	Yes*
A/T	Courses	Reset course	E4	Yes*
A	Grades	My preferences grader report	E1/E3/E4/E6/ E7/E11	Yes*
A/T/S	Grades/View	Overview report	E1/E4	No
A/T	Grades/View	Grader report	E1/E4	Yes*
A/T/S	Grades/View	User report	E1/E4/E10	Yes*

Table 2. Accessibility difficulties found for Moodle tasks related with reports, questions, files, groups, events, calendar, forums and profiles (II)

User Profile	Functionality (group)	Task Name	Errors	Can it be completed?
A/T	Grades/Categories and Items	Simple view	E1/E4/E10	Yes*
A/T	Grades/Categories and Items	Full view	E1/E4/E8/E10/E12	Yes*
A/T	Grades/Scales	View	E1/E4/E10/E13	Yes*
A/T	Grades/Letters	View	E1/E4/E16	Yes*
A/T	Grades/Letters	Edit	E1/E4	Yes*
A/T	Grades/Import	CSV file	E1/E4/E9	Yes*
A/T	Grades/Import	XML file	E1/E4	Yes*
A/T	Grades/Export To	Open doc spreadsheet / Plain text file/Excel spdsht/XML file	E1/E4/E9	Yes*
A/T	Reports	Filter logs	E1/E4	Yes*
A/T	Reports	Activity report	E4/ E14	Yes*
A/T	Reports	Participation report	E4/ E8/E11	Yes*
A/T	Questions	Questions bank	E3/E8/E13	Yes*
A/T	Reports	Live logs from the past hour	E2	No
A/T	Questions	Import	E4/E7	Yes*
A/T	Questions	Export	E4/E9	Yes*
A/T	Files	List of files	E1/E4/E7/E10/E11	Yes*
A/T	Files	Upload a file	E3/E4/E8/E11	Yes*
A/T	Files	Make a folder	E1/E11/E15	Yes*
A/T	Groups	Create group	E4/E6/E11/E13	Yes*
A/T	Groups	Delete group	E4/E11	Yes*
A/T	Groups	Add/Remove users	E1/E4	Yes*
A/T/S	New event	New event	E11/E13	Yes*
A/T/S	Export calendar	Export calendar	E11	Yes*
A/T	Forums	Add / Edit a new topic	E1/E4/E11/E13	Yes*
A/T	Forums	Delete topic	E4	Yes*
A/T	Forums	Reply	E1/E3/E4/E11	Yes*
A/T/S	Profile	Change password	E4/E8/E11	Yes*
A/T/S	Profile	Edit profile	E4/E8/E11/E13	Yes*

After an exhaustive evaluation of Moodle's accessibility by using JAWS and NVDA we can conclude that the accessibility difficulties found with both screen

readers are similar. The only difference found are related to the way they read tables. When a cell is empty (has not text), NVDA reads the next column and it says aloud the number's column and its content. It is useful because NVDA shows you where you are in each moment. However, in this situation JAWS does not read in which column or row is the cursor and directly reads the next column. It is confusing for users.

As Table 1 and 2 show, most of tasks are not accessible. However, they can be completed by the user because these accessibility errors are not critical or do not affect to the main purpose of the task. There are accessibility difficulties in the tool. The most frequent errors are E4 and E1. The user can be confused because the appearance of the website is not always the same and because the content is not clear. The least frequent errors are E12, E14, E15 and E16. Although they are important, these errors are insignificant because they appear once in the tool.

3.2 Expert Evaluation

The evaluation presented in this paper analyses Moodle's concordance with W3C guidelines from the point of view of an expert evaluator. Due to Moodle is an authoring tool, it should be in accordance to ATAG 2.0 guidelines. Moreover, as Moodle generates Web-pages, it should compliance WCAG 2.0 guidelines. However, after the evaluation, the obtained results show that Moodle is not in accordance to ATAG 2.0 and WCAG 2.0 level A at least. These results are showed in Table 3 and Table 4 which show a summary of the Success Criteria failed by Moodle.

Table 2. ATAG 2.0 Fails.

Principle	Success Criteria		
	Level A	Level AA	Level AAA
A.1	A.1.1.1; A.1.2.1	A.1.1.2	A.1.1.3
A.2	A.2.2.1; A.2.2.2 ; A.2.3.1	--	--
A.3	A.3.1.1; A.3.4.1; A.3.4.2 A.3.7.1; A.3.7.2	A.3.5.1; A.3.6.1; A.3.6.2	A.3.1.4; A.3.1.5; A.3.1.6 A.3.6.3; A.3.6.4
B.1	B.1.1.1	B.1.1.2	B.1.1.3; B.1.2.3
B.2	B.2.1.1; B.2.1.2 ; B.2.2.1 B.2.2.2; B.2.2.3; B.2.2.4 B.2.3.1; B.2.4.1; B.2.4.2 B.2.4.3; B.2.5.1; B.2.5.2	B.2.2.5; B.2.2.6; B.2.2.7 B.2.3.2; B.2.4.4; B.2.5.3 B.2.5.4	B.2.2.8; B.2.3.3; B.2.5.7 B.2.5.8; B.2.5.9
B.3	B.3.1.1; B.3.2.1; B.3.2.2 B.3.3.1; B.3.4.1	B.3.1.2; B.3.2.3; B.3.2.4 B.3.4.2	B.3.1.3; B.3.3.2; B.3.4.3

With reference to the ATAG 2.0, the first guideline that the tool does not accomplish is the guideline A.1.1 which specifies that the tool should achieve the WCAG 2.0 level A at least. As it will be explained later there are different

accessibility barriers for the users. Also, the most important accessibility difficulties found in Moodle are related to the absence of automatic accessibility checks and the absence of accessibility support for authors (ATAG: A.3.6.4/ B.2.1.1/ B.2.2(all its testable success criteria)/ B.2.3(all its testable success criteria)/ B.3.1(all its testable success criteria) /B.3.2(all its testable success criteria) /B.3.3(all its testable success criteria) and B.3.4(all its testable success criteria)). Besides, the user is not able to change website presentation because there is not any feature that allows the user to complete it (ATAG: A.2.2.1/ A.2.3.1/ A.3.1.1/ A.3.1.6/ A.3.6.3). Furthermore, shortcuts cannot be changed by the user, so sometimes these shortcuts are the same to different features (ATAG: A.3.1.5). Other accessibility difficulty is that there are different situations in which the user cannot change the structure of the Web contents (ATAG: A.3.4.1), there are themes which are not accessible and the tool does not inform the author about it (ATAG: B.2.5 (all its testable success criteria except B.2.5.5 and B.2.5.6)).

Regarding to WCAG 2.0 guidelines, table 4 summarizes which Success Criteria are failed by Moodle. There are WCAG 2.0 Success Criteria that are not implemented successfully so as a result the tool is not accessible because there are important accessibility fails such as: not all text and combo boxes have associated descriptive texts, the tool's "look and feel" is not the same along the website, images of text are used to convey information or there are not headings. Besides, these accessibility problems are worst for blind people. For example, if the tool uses tables for layout, the screen reader identify it as a table and it could be confused for the user because s/he thinks that tables are used to present tabular information. Moreover, if the table markup is used to present tabular information, it is very important to mark up data tables correctly. It should preserve relationships within the information. This information should have data in two dimensions (columns and rows), and the columns and rows must be recognizable in order to perceive the logical relationships. In other case, the user will be lost in the table because the screen reader is not able to read joined or cells without text.

Table 3. WCAG 2.0 Fails.

Principle	Success Criteria		
	Level A	Level AA	Level AAA
1. Perceivable	1.4.1	1.4.4; 1.4.5	1.4.8; 1.4.9
2. Operable	2.1.1; 2.2.2; 2.4.2	2.4.5; 2.4.6	2.1.3; 2.4.10
3. Understable	3.1.1; 3.2.1; 3.2.2; 3.3.2	3.1.2; 3.2.3	3.2.5
4. Robust	4.1.2	--	--

4 Recommendations

The evaluation has showed that Moodle is not accessible for people with visual impairments, so it should be necessary to create the tool in an accessible way to solve these found problems.

In this section, we provide a set of useful recommendations to solve the accessibility barriers of Moodle. It is important to notice that if Moodle is not accessible, it does not matter if the content generated could be accessible or not.

- **Separate content and structure from the presentation.** Moodle's developers should separate the content from the presentation. For instance, tables should not be used for layout and presentation elements (color, size, type of font, etc.) or control layout elements (Layout, positioning, layering, and alignment) should be included in a CSS file exclusively. As a result, the user will not have problems to change the appearance of the tool and the screen readers could read aloud the Web pages without accessibility problems.
- **Allow the user to control the navigation:** the user should always have the control of the Web page, so the system should not refresh the page. Major changes in the navigation of the Web page can disorient users, if they are made without awareness.
- **Provide mechanisms to cancel actions and go backwards.** Mechanisms must be available for the users to cancel or allow undoing actions.
- **Show error suggestions:** The user should be able to have mistakes when s/he is doing something in the platform. Thus, the user should be informed about his/her mistakes with the aim of avoid and correct them. Also, the tool should be created in usable way to avoid possible mistakes that users could have when they are using the tool. Besides, this issue is important for the user to feel comfortable when s/he is using the tool.
- **Offer full keyboard access.** Users with visual impairments are not able to use the mouse so all the features should be able to be executed using the shortcuts of the keyboard too.
- **Provide descriptive headings to structure the Web page.** Another important issue is the use of headings in a right way; the webpage should have a structure with headings in a right order. Also, all pages without exception should have headings. It is especially useful for users who use screen readers because headings allow them to navigate Web pages by structure. User can read or jump directly to top level elements (<h1>), next level elements (<h2>), third level elements (<h3>), and so on. Viewing or listening to it, the headings give them a good idea of the contents and structure of the page.
- **Produce accessible contents.** Not only the authoring tool user interface should be accessible, the content produced by the system should be accessible too. Because of this, Moodle should provide mechanisms to create accessible content such as: evaluate the content before publish it and allow and guide the user to create accessible content. Some features are easy to change, for instance, guide the user to insert an alternative text of the image; so, if the user has not added this alternative text, then the tool should inform him/her that it is

necessary. Also, it is important to make aware the users about the necessity of create accessible content and inform him/her about his/her mistakes.

- **Allow the user to choose and save his/her preferences.** The user should be able to save his/her preferences related to the layout and presentation elements. As a result, the user will be more familiar with the tool and the user will spent less time executing tasks.

Following these recommendations, the accessibility level of Moodle would be easily increased, avoiding most of accessibility barriers that are currently present in this Moodle version.

5 Conclusions and Further Research

After the results obtained of the user and expert evaluation, some conclusions have been reached.

The user evaluation shows that the difficulties found with both screen readers: JAWS and NVDA are similar. Nevertheless, there is a difference of usability between NVDA and JAWS when they read tables, NVDA reads tables in an easier way. As a result, the user is able to have a better image of the table in his/her mind.

Regarding to the expert evaluation, it demonstrates that Moodle has not a full neither partial Conformance of ATAG 2.0 nor WCAG 2.0. There are many accessibility difficulties which show that the authoring tool and the produced Web pages are not accessible. Many ATAG 2.0 and WCAG 2.0 Success Criteria are not according to accessibility level A at least, mainly because the tool does not provide automatic accessibility checkers and it does not support the user when using the authoring tool. So, it is difficult for the author to create accessible Web contents. Moreover, these accessibility problems become more critical when a person with vision problems try to access to a website.

Besides, as it has been specified the Moodle's Editor is not accessible (See Appendix); however, Moodle have changed its default editor. For the next version the Moodle Editor is TinyMCE¹¹. However, we have not evaluated this Editor yet and we cannot assure if it is accessible or not.

To conclude, Moodle, as many LCMSs, is not accessible. Although Moodle's community is trying to solve this problem, there are many changes that should be easily done to be accessible for everybody regardless of their circumstances. Most of teachers and developers are focused on providing accessible resources in order to provide equal opportunities for all the students, but it is important to underline the fact that if the LCMS, is not accessible, the user could not access to it and it will not matter if the educational resources are accessible or not.

Currently, we are working to complete the evaluation presented in this paper. A visual-impaired person will evaluate Moodle. Moreover, it could be interesting to consider other impairments to evaluate the tool, such as: deaf, hearing loss or movement disabilities. Furthermore, we are aware that the used technologies are not

¹¹ TinyMCE. HTML Editor. Available in:
<http://www.webcourseworks.com/sites/default/files/moodle-tinymce.zip> [July 2011]

enough to evaluate the tool. Thus, it should be taken into account other environments and technologies such as: other operating systems, different user agents and versions of them (web browsers and other assistive technologies), etc.

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APPENDIX

The default editor of Moodle is a Windows editor (see Figure 3). It allows changing the text format, to include tables, to include bullets, etc. The user evaluation presented in this paper evaluates this editor, because s/he needs it to create content. However, the expert evaluation has not included the study of the editor because Moodle allows the user to change this editor by another one more accessible if s/he wants. The most similar editor is TinyMCE which is the default editor for the next Moodle’s version. Also, if the user is not comfortable with this type of html editors, s/he can turn off the editor in Moodle too. Besides, the editor can be adapted for the user necessities because it is possible to change the colour, the font size and other features.

However, even if the user wants to use the editor, it is not accessible mainly because the user cannot access to all tasks using keyboard. In general, this editor has a help feature to inform the user about the shortcuts to access to all features. However, some of these shortcuts are not right because they are the same shortcut to access to different Windows features. For example, Moodle provides the shortcut *ctrl+P* to change width print, it is right because it is an alternative to access to this feature, but there is problem, Windows SO uses this shortcut to show print settings. Thus the user cannot complete the task successfully because s/he cannot use all features.

Also, this editor has combo boxes which have not associated descriptive texts and as a result the screen reader cannot read it right. Another important accessibility problem is that the component uses images to convey information instead of using descriptive text.

Description:

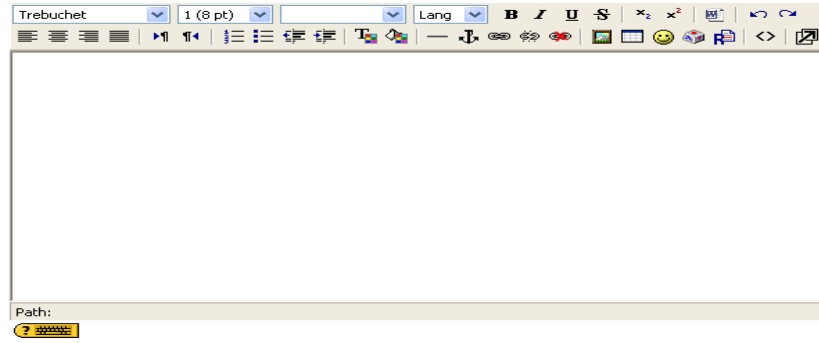


Figure 3: Default HTML editor of Moodle 1.9 Version.