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The Accessibility of Learning Management Systems from Teachers' Perspective

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Abstract: The study presented in this paper focuses on the accessibility of Learning Management Systems (LMSs) from teachers' perspective. We seek to identify accessibility issues and propose possible improvements. Based on universal design principles and guidelines, this study adopts heuristic evaluation method and collects qualitative data on the accessibility of one popular open source LMS, Moodle. Data analysis shows that although Moodle has paid much attention to accessibility, the level of conformance to the ATAG guidelines is still low and many accessibility issues remain unsolved. These issues must be addressed in order for teachers with physical disabilities to be able to use the system efficiently.

Keywords: Accessibility, universal design, learning management systems, Moodle

1. Introduction

Information and communication technologies (ICT) have become a necessity in higher education in developed countries. Equal access to ICT systems and services requires Universal Design (UD) of ICT and use of assistive technology when UD is not enough. The UN Convention on the Rights of Persons with Disabilities imposes countries, which have ratified the convention, to promote accessibility to ICT systems and services, including Internet. Internationally, physical / ICT barriers created by society are more and more regarded as obstacles for equal opportunities and participation. With the development of e-education and e-society it is important for ICT systems and services to be equally accessible to all users, including those with physical impairments.

The use of Learning Management Systems (LMSs) is essential for participation in higher education. Accessibility issues are most likely experienced by users of assistive technology, such as screen readers. Existing studies mostly focus on the accessibility of LMSs from students' perspective or focus on one particular user group. Very few studies have focused on accessibility of LMSs for teachers who use LMSs to create content for students. We argue that there is a pressing need to take into consideration various users' needs and make LMSs accessible and usable to all users. Using Moodle as an example, this study explores the accessibility issues of LMSs from teachers' perspective and is based on existing guidelines (e.g. ATAG - Authoring Tool Accessibility Guidelines) and principles of universal design. The research questions that guide the study are:

1. To what extend do LMSs comply with the ATAG guidelines on content creation?
2. What accessibility issues exist in LMSs and how should they be addressed?

2. Literature Review

2.1 LMSs and accessibility

A large body of studies have been carried out on LMSs. Some found that LMSs could make teaching more efficient (e.g. (Lonn & Teasley, 2009; Swan, 2001)). While others suggested that LMSs requires that teachers must be able to operate in the technological domain and handle the managerial domain in addition to their tasks such as designing and planning and teaching courses (Alvarez, Guasch, &

Espasa, 2009). Usability of LMSs has also been studied in the past (Granic & Adams, 2011). The existing research focusing on usability of LMSs have very limited findings on the accessibility issues, although accessibility can be seen as an essential part of usability.

With the increasing complexity of LMSs, learners and teachers with disabilities are having more difficulties in using them and the accessibility issues are becoming more profound. Several studies have been conducted focusing on accessibility of individual LMSs in relation to learners with a specific disability (Habib et al., 2012; Ulbricht et al., 2012; Woodfine, Baptista Nunes, & Wright, 2008). Rangin and colleagues (2011) conducted a systematic comparison of the accessibility among four LMSs including Blackboard 9.1 Service Pack 3, Desire2Learn 9.2, Moodle 1.9, SAKAI 2.8.0. They found that many accessibility issues were in fact general usability issues, but had an overwhelmingly negative impact on the accessibility of the LMS. Their study can be considered a heuristic evaluation that was based on eight categories of interactions and a set of evaluation criteria. Among the eight categories, there are one specific for students (common modules/tools including announcement, discussion, email, chat, assignment/activities/course content, grade book, and quiz/testing component), one specific for teachers (authoring tools and content creation including file uploading, helper features, HTML authoring tool, grade book and multimedia content handling). The rest of the categories are common for both. It was not specified how the criteria were compiled, but one can see the influence of WCAG guidelines.

2.2 Content creation and standard for accessibility

Among other functions, LMSs provide platforms for teachers to create educational content. In the last decade, a considerable group of guidelines and standards related to accessibility has been published that can be applied in virtual education. They include Web Content Accessibility Guidelines (WCAG), Authoring Tool Accessibility Guidelines (ATAG) and Accessible Rich Internet Applications (ARIA) from W3C, ISO/IEC 24751-1, Individualized adaptability and accessibility in e-learning, education and training, and IMS Guidelines for Developing Accessible Learning Applications (IMS DALA). These guidelines and standards offer support to ensure the accessibility of virtual education to learners.

Despite of the standardisation and tools to measure accessibility, most LMSs do very little to ensure education for all and without barriers (Ulbricht, et al., 2012). Efforts have been made to implement accessibility guidelines, standards and tools have been created to facilitate content designers to create accessible content. For example, Ulbricht et al. (2012) developed a tool for the Moodle platform that aimed to facilitate content designers to create accessible content, thus allowing greater use of a course for the visually impaired. In addition, many researchers reported studies and process in developing accessible e-learning courses for students and pre-service teachers (Burgstahler, Corrigan, & McCarter, 2004; Mauch & Mauch, 2012). In the EU project ESVI-AL three levels of accessibility have been identified: LMS (Accessible Learning Management Systems), LMCS (Accessible Learning Content Management Systems, including search engines in learning object repositories), and Open Education Resources (OER, Learning objects with accessibility content).

3. Method

In this research we have combined standard review and heuristic evaluation. Three accessibility experts participated in the evaluation. All three are teachers in higher education and one of them is partially sighted and uses a screen reader on a daily basis. Two have computer science background and one has social science background.

Because the focus of the evaluation is the accessibility of the content generation in Moodle, we chose to use ATAG principles and success criteria. We have carefully examined the principles and criteria and decided on those that are relevant for the evaluation (Table 1). Based on an analysis of the main tasks of teachers, we identified the most frequent tasks in Moodle: Creating and organizing course content, grading, and giving feedback. In addition, we made a list describing different physical impairments in mobility, hearing and vision, and their main challenges.

In the evaluation, each participant carried out the tasks, inspected the elements in Moodle individually, and took notes about the conformance to the principles. This process was based on the

ATAG principles, success criteria and the different impairments. We evaluated Moodle 2.4.3 and the platforms were Firefox 21.0.1 and Internet Explorer 9 on Windows 7. The screen readers used were open source NVDA 2013.3.1, subscription-based ZoomText 10 and InfoVox Desktop Pro version 2.220. The evaluations from individual participants were gathered and an analysis session was organized for all participants and researchers to discuss and summarise the results.

Table 1. Principles and success criteria (adapted from ATAG2.0)

Principles	**Guidelines**	**Success Criteria**
A.2 Editing-views must be perceivable	A.2.1 Make alternative content available to authors	A.2.1.1 Text Alternatives for Rendered Non-Text Content (Level A)
		A.2.1.2 Alternatives for Rendered Time-Based Media (Level A)
	A.2.2 Editing-view presentation can be programmatically determined	A.2.2.1 Editing-View Status Indicators (Level A)
		A.2.2.2 Access to Rendered Text Properties ((Level AA)
A.3: Editing-views must be operable	A.3.1 Provide keyboard access to authoring features	A.3.1.1 Keyboard Access (Minimum) (Level A)
		A.3.1.2 No Keyboard Traps (Level A)
		A.3.1.3 Efficient Keyboard Access (Level AA)
		A.3.1.4 Keyboard Access (Enhanced) (Level AAA)
		A.3.1.5 Customize Keyboard Access (Level AAA)
		A.3.1.6 Present Keyboard Commands (Level AAA)
	A.3.2 Provide authors with enough time	A.3.2.1 Auto-Save (Minimum) (Level A)
		A.3.2.2 Timing Adjustable (Level A)
		A.3.2.4 Content Edits Saved (Extended) (Level AAA)
	A.3.3 Help authors avoid flashing that could cause seizures	A.3.3.1 Static View Option (Level A)
	A.3.4 Enhance navigation and editing via content structure	A.3.4.1 Navigate By Structure (Level AA)
		A.3.4.2 Navigate by Programmatic Relationships (Level AAA)
	A.3.5 Provide text search of the content	A.3.5.1 Text Search (Level AA)
	A.3.6 Manage preference settings	A.3.6.1 Independence of Display (Level A)
		A.3.6.2 Save Settings (Level AA)
		A.3.6.3 Apply Platform Settings (Level AA)
		A.3.6.4 Multiple Sets ((Level AAA)
	A.3.7 Ensure that previews are at least as accessible as in-market user agents	A.3.7.1 Preview (Minimum) (Level A)
		A.3.7.2 Preview (Enhanced) (Level AAA)
A.4: Editing-views must be understandable	A.4.1 Help authors avoid and correct mistakes	A.4.1.1 Content Changes Reversible (Minimum) (Level A)
		A.4.1.2 Settings Change Confirmation (Level A)
		A.4.1.3 Content Changes Reversible (Enhanced) (Level AAA)

4. Result

4.1 Compliance with ATAG Guidelines

Moodle is one of the LMSs that have paid much attention to accessibility. In its developer documentation, there is an accessibility page providing coding guidelines for developers. This page contains also a list of web standards, guidelines and legislation as well as accessibility validation tools

and other resources. When running Moodle though an accessibility validation tool or an accessibility checker, it does not give any error messages.

In our evaluation, however, we found that Moodle does not fully comply with any of the criteria based on ATAG 2.0 except for A.3.3. In Moodle, the default setting for audios and videos is to not play automatically. They can be played only when the Play button is activated and authors have the possibility to pause, stop, and start again. Table 2 shows the main accessibility issues categorised by the criteria.

Table 2: Compliance with the criteria

Criteria	**Accessibility issues**
A.2.1	When uploading videos/audio files, no possibility for adding alternative text.
A.2.2	The status for spelling errors is not accessible for screen readers.
A3.1	Sequential keyboard access, inefficient. Many functions in the text editor are not accessible with keyboard. Keyboard traps in YouTube video. No keyboard access in audio player. Shortcuts can be defined in Moodle themes, but need programming. No list up of all shortcuts defined, and users must discover them by reading the documentation Once in the text editor, it is not possible to use Shift-Tab to move to previous field. Note: only 5 out of the 39 icons on the text editor menu are accessible via shortcuts (more shortcuts can be found in the documentation). But all 39 are accessible via ZoomText, although requiring very many clicks for simple editing and formatting.
A.3.2	Auto save plugin must be installed and enabled, requires administrative privileges. No warning for automatic logging off (session time limit is 2 hours by default and this can be customized by authors).
A.3.4	Tab, Shift-Tab, Enter, Escape, and arrow keys are the main keyboard navigation methods. Although elements are grouped together with a group title, there is no effective way to navigate between them using keyboard. For example, in the Assignment Editor/Update interface, the contents are organized into 6 groups (General, Assignment settings, Submission settings, Feedback settings, Grade, and Common Moodle settings), but it is not possible to navigate between these groups using keyboard. In the text editor, it is possible to navigate by levels of headings, images (if a description is provided) and tables.
A.3.5	From the main page, search does not return the results from sub-pages, e.g. the assignment text. There is a search function in the Forum. When searching a word in the Forum, there is no possibility to jump directly to next result. The word is highlighted in green colour which in invisible in high-contrast setting. In the text editor, when using keyboard to navigate in the search popup window, the focus goes back to the editor without warning. Because of this an Enter key intended to Find Next actually deletes the appearance of the word in the editor.
A.3.6	Customizing the text editor view requires programming. There is a conflict with platform settings. For example, in the high-contrast mode set up in the platform, the search result (which is highlighted with green colour) is no longer visible. The buttons in the text editor are also missing in this mode, only Font family, Font size, Paragraph, and Insert Moodle media remain). In the popup window for inserting Moodle media, all icons disappear in the high-contrast mode.
A.3.7	No preview for text, but there is a preview for video, image and audio. It is not possible to choose which agent to perform the preview in Moodle, but this can be done in the browser.
A.4.1	It is possible to Undo or Cancel in all pages. It is also possible to “Reset” course settings. However, there is no author confirmation. It is not possible to reverse in the same session. For example, once in the text editor, one cannot reverse to the previous field. This is also a navigation problem.

In addition to those presented in Table 2, there are other issues that also need attention. For example, there are quite a few popup windows in Moodle and none of them allow the cursor inside when navigating by keyboard. The information inside the popup windows is therefore not available for screen readers in synthetic speech or Braille.

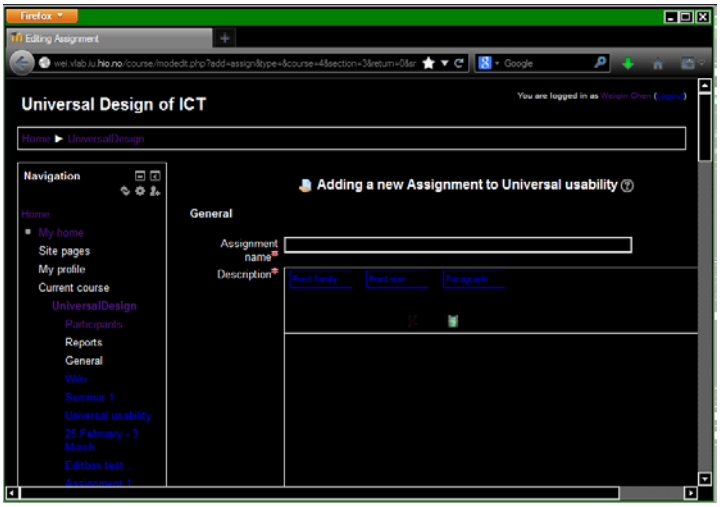

Figure 1. Text editor in the high-contrast mode.

All the 39 icons in the text editor's menu are tagged with alternative text, which become visible when moving the cursor over them. However, the three dropdown menus (Font family, Font size, and Paragraph) are not tagged with alternative text. When in high-contrast mode, most of the icons disappear together with their alternative text except for these three and the Insert Moodle media icon (Figure 1). When marking a text area, the icon Prevent automatic linking becomes visible.

4.2 Recommendations

Based on the evaluation, we provide the following main recommendations for improving the accessibility of Moodle.

Providing keyboard access to icons in the text editor menu. The text editor is one of the most frequently used functions in Moodle. It is involved in almost all aspects of the authoring process. An accessible text editor will improve the usability of the system.

Providing efficient keyboard navigation support. Currently using Tab and Shift-Tab is the only way to navigate in most of the pages in Moodle. Although screen readers allow users to skip some groups, the navigation with keyboard is still inefficient and tedious (Figure 2). Grouping items and allowing users to jump from group to group using keyboard will make the navigation more efficient.

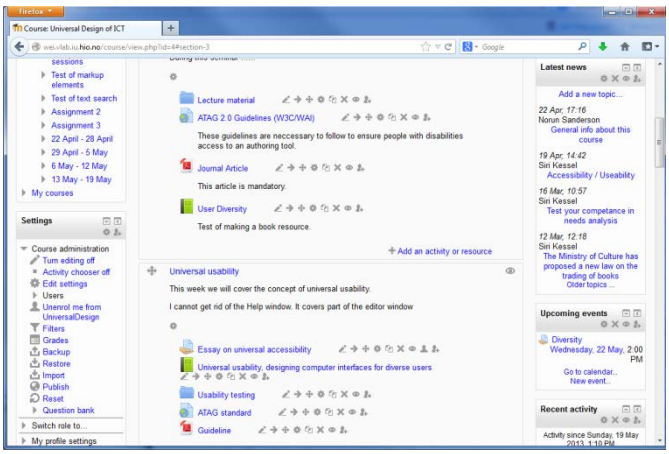

Figure 2. Using keyboard to navigate must sequentially go through all the icons and links.

Providing immediate feedback in different modalities. When users use screen reader to interact with the system, they need to listen to the information repeatedly and to receive confirmations continuously that they are on the right track. Currently in Moodle, if an obligatory field is not filled in, there is no immediate audio feedback. So the user does not know that she or he has made a mistake. When the session reaches its time limit, the user is automatically logged off and unsaved work is lost.

Immediate confirmation and warning in different modalities will be able to increase the accessibility of the system.

Providing easily accessible customisation. Currently in Moodle, most of the customisations are done on the code level. Users must be able to read code to configure the system. An accessible interface for easy configuration will provide users with freedom and personalised interactions.

5. Discussion and Conclusion

In this paper we present the preliminary results from a heuristic evaluation of Moodle with focus on its accessibility for teachers. We have identified accessibility issues and provided recommendations for improvements. Comparing with the study of Moodle by Rangin and colleagues (2011), our study provides more concrete and detailed accessibility issues for teachers and recommendations based on ATAG guidelines.

Although universal design requires that all users, regardless of their physical abilities, ethnicities, and digital competence, should have access to ICT systems, in this research we focused mainly on users with physical disabilities. We plan to extend the user group in future evaluations. In this research only three accessibility experts participated in the evaluation and one of them is visually impaired. According to Rømen and Svanæs (2012), only 27% of the identified accessibility problems faced by disabled users could have been identified through the use of WCAG 1.0 guideline alone. The limited number of participants and the lack of user testing could have limited the results of the evaluation. In future evaluations, we plan to involve more accessibility experts as well as conduct user testing.

References

Alvarez, I., Guasch, T., & Espasa, A. (2009). University teacher roles and competencies in online learning environments: a theoretical analysis of teaching and learning practices. *European Journal of Teacher Education, 32*(3), 321-336.

Burgstahler, S., Corrigan, B., & McCarter, J. (2004). Making distance learning courses accessible to students and instructors with disabilities: A case study. *Internet and Higher Education, 7*, 233–246.

Granic, A., & Adams, R. (2011). User sensitive research in e-learning: exploring the role of individual user characteristics. *Universal Access in the Information Society, 10*, 307–318.

Habib, L. M. A., Berget, G., Sandnes, F. E., Sanderson, N. C., Kahn, P., Fagernes, S., & Olcay, A. (2012). Dyslexic students in Higher Education and Virtual Learning Environments: An exploratory study. . *Journal of Computer Assisted Learning, 28*(6), 574-584.

Lonn, S., & Teasley, S. D. (2009). Saving time or innovating practice: investigating perceptions and uses of Learning Management Systems. *Computers & Education, 53*(3), 686–694.

Mauch, L. H., & Mauch, C. (2012). An Online Accessible Learning Environment for a Selection and Training Process of Teachers in the Public Basic Education System in Brazil. *Procedia Computer Science, 14*, 351-358.

Rangin, H. (2011). A Comparison of Learning Management System Accessibility, from http://presentations.cita.illinois.edu/2011-03-csun-lms/

Rømen, D., & Svanæs, D. (2012). Validating WCAG versions 1.0 and 2.0 through usability testing with disabled users. *Universal Access in the Information Society, 11*, 375-385.

Swan, K. (2001). Virtual interaction: Design factors affecting student satisfaction and perceived learning in asynchronous online courses. *Distance Education, 22*(2), 306–332.

Ulbricht, V. R., Vanzin, T., Amaral, M., Vilarouco, V., de Quevedo, S. R. P., Moretto, L. A. M., & Flores, A. R. B. (2012). A tool to facilitate including accessible content in Moodle to the person with visual impairment. . *Procedia Computer Science, 14*, 138 – 147.

Woodfine, B. P., Baptista Nunes, M., & Wright, D. J. (2008). Text-based synchronous e-learning and dyslexia: Not necessarily the perfect match! *Computers & Education, 50*, 703–717.