Learning Management Systems as Platforms for Increasing the Digital and Health Literacy

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ABSTRACT

Today, information and communication technology (ICT), that covers a wide plethora of various software applications and hardware devices, plays role as an integrated part and routine of the everyday lives, hence rapidly changing the manner of approaching to the useful information. In order to function effectively in the contemporary digital society, individuals need appropriate skills to be digitally literate and these skills need to be updated for information evaluation and knowledge gathering. Beside these digital literacy skills, another skills covering the ability to obtain, read, understand, and use healthcare information for addressing or solving various health problems are needed. In order to increase these both skills between population, especially between people with disabilities and elderly people, easiest way is to provide e-learning courses. Choosing the appropriate learning management system (LMS) in accordance with the Web Content Accessibility Guidelines (WCAG) standard in order to increase the digital and health literacy is a challenging task. In this paper we analyze and compare the key differences of the 8 most commonly used LMSs, according to the WCAG standard predefined criteria.

CCS Concepts

• Information system→Information systems application • Applied computing→Computing education • Human-centered computing→Accessibility technologies.

Keywords

E-learning; Learning Management Systems; WCAG; e-Health, Digital literacy; Health literacy.

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1. INTRODUCTION

Nowadays, information and communication technology (ICT) has become an integrated part and routine of our everyday lives, rapidly changing the way of accessing to the useful information. ICT comprises a wide variety of numerous software applications and hardware devices. In order to adopt ICT in appropriate way, the individuals need to gain the suitable confidence, abilities, skills and perception.

According to the DigEuLit project, digital literacy is defined as the awareness, attitude and ability of individuals to suitably use digital tools and services to identify, access, manage, integrate, access, analyze and synthesize digital resources, create new knowledge and expressions, and communicate with others, in the context of specific life situations, to allow beneficial social action and to analyze this process [1].

One aspect of using ICT is to obtain helpful information and services about healthcare. Health literacy has been defined by the Institute of Medicine (IOM) and National Library of Medicine (NLM) in the United States as the "degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" [2].

According this, the health literacy is a concept, that covers the ability to obtain, read, understand, and use healthcare information for addressing or solving various health problems, such as: make appropriate health decisions, follow instructions for treatment, and take action based on healthcare-related material. A conceptual model of the health learning is shown on Fig. 1.

Although the associations between health literacy, patient behaviors, and health outcomes are evident, the specific pathways

by which low health literacy may affect these outcomes are not entirely clear [3].

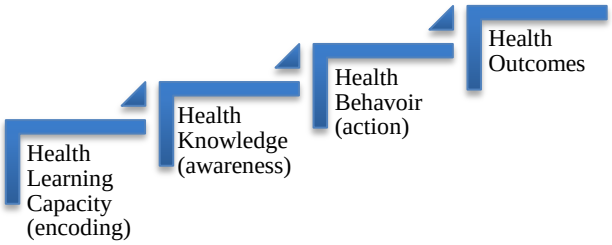

Figure 1. Conceptual model of health learning [6].

Many of the strategies who address the health literacy problem try to solve the problem by writing health materials at a simpler level or by following other design principles to enhance reading comprehension [4][5]. They intend to overcome the gap between the necessary medical knowledge and the necessary knowledge according to the concept of self-care management.

Digitization makes big impact in health care the last decades, and online information and (mobile) applications are playing a growing role in health care. Beside these changes, digital health literacy, or eHealth literacy are becoming increasingly important for healthcare consumers. For them, ability to search, select, assesses, and applies online health information and healthcare related digital applications became very important skills [7].

The relevance of this form of literacy is demonstrated in recent studies, showing that people's self-perceived skills to use online information actually affect their health and the quality of their healthcare, while the lack of such skills may lead to adverse outcomes [8][9].

Hsu et al. [8] found that digital health literacy skills are associated with various types of health behavior, including healthy eating, exercise as well as sleep behavior. Neter and Brainin [9] found relationships between digital health literacy and the presence of chronic illness, perceived self-management skills, and better self-perceived understanding of health status, symptoms, and optional treatments.

The healthcare consumers use the Internet as a source of medical and healthcare information. But, information found on the Internet may suffer from several drawbacks: incomplete information, not clear information, not highly ranked in search engine results. Although the information is scientifically reliable, problems with used software tools, assessment tools of health information have some restrictions. These drawbacks can be overcome by health literacy educational involvement of e-learning. E-learning enables course navigation at a pace that fits health care consumers learning style, learning on own schedule without the inconvenience of time away from the office, taking a topic with content developed by professionals. Another advantage of using the e-learning is its cost-effectiveness.

Choosing the appropriate learning management system (LMS) for development of e-learning healthcare courses might seem like a daunting task. The challenge is to find a platform that is easy to use and manage, not just for the educational providers or trainers, but also for the health care consumers (learners).

In this article, we compare key attributes of the 8 Learning Management Systems: Moodle, Eliademy, Docebo, Sakai, Blackboard Learn, ILIAS, D2L (Desire2Learn) and ATutor. There are many things worth to consider when a decision about the most suitable LMS should be made.

The rest of this paper is organized as follows. The second section depicts the digital and health literacy as skills of individuals needed to obtain, process, and understand basic health information and services needed to make appropriate decisions. In Section 3, we describe the learning management systems and their roles in improvement of the digital and health literacy between users. The differences of the characteristics of the most commonly used LMSs are tabled in the consequent section. The last section provides concluding remarks about using of LMSs for increasing of digital and health literacy among healthcare users.

2. DIGITAL AND HEALTH LITERACY

Nowadays, digital literacy is not only a set of skills that include ability to send e-mails, preparing and print documents and searching for information on the Web [17]. Today, being digitally literate covers not only skills to use software applications or use digital devices, but it includes various complex cognitive, emotional and sociological skills. These skills are needed individuals to function effectively in the contemporary digital society. Digitally literate individuals need to update their skills for information evaluation and knowledge gathering.

While ICT is part of a techno-social system, therefore digital literacy has to cover much more than obtaining a set of technical skills. Learning how to use and manipulate ICT is very important, but without a comprehension of the role that individuals play in interrogate, challenging and thus modeling this techno-social system, the scope of digital literacy is limited [16].

Low level of digital literacy in the health context should be addressed to promote sufficient skills in using ICTs, offering online services tailored to the users' digital and health literacy levels. Effective educational strategies can help individuals with limited digital literacy learn how to use ICTs and healthcare services [15].

Nowadays, rate of changes in health care is high. Also, technological advances, research and innovation lead to increasing complexity of the health care system. A health literacy is answer for these trends. Health literacy is the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions [12]. Health literacy includes skills for solving problems in real life. In addition to basic literacy skills, health literacy requires knowledge of health topics. People without knowledge about the body and nature and causes of disease may not understand the relationship between lifestyle factors (diet, exercise) and various health outcomes.

Important tool for improving health literacy is plain language - information that users can understand the first time they read or hear it. In plain language document people can find what they need, understand what they find, and act appropriately on that understanding with reasonable time and effort [13].

Cultural and linguistic competency of health professionals can also contribute to health literacy. Healthcare professionals have their own culture and language developed as a result of their training and work environment. In order to improve health literacy, they need to adapt language to the public, communicate in their primary language, using words and examples that make the information understandable.

Education, language, culture, access to resources, and age are all factors that affect a person's health literacy skills. The primary responsibility for improving health literacy has health professionals and the healthcare and public health systems. Low literacy has been linked to poor health outcomes such as higher rates of hospitalization and less frequent use of preventive services [14]. Low health literacy often is associated with delayed diagnoses, poor obedience to treatment programs, as well as increased rates of morbidity and mortality [15]. Very promising and effective manner to improve the digital and health literacy among individuals is using e-learning and e-services provided by learning management systems.

3. LEARNING MANAGEMENT SYSTEMS

The health professionals and the health systems realized that Learning Management Systems (LMS) can be used as a tool for continuous improvement of digital and health literacy. LMS are used to house information and create opportunities for individuals to learn. Learning platforms are used to document and deliver online, asynchronous and live streaming (synchronous) computer-based teaching via the web. In addition, they offer the ability to generate analytical reports for learning progress and enable communication. There is a plethora of available LMS, and each one has different features which is tailored to different needs of the target groups. To find and choose the right LMS is very important task and it has a big impact on health literacy improvement.

For health literacy improvement, e-learning content is also important. The content need to be well designed: relevant, learner centric, logically organized, easy to use, with logical navigation, flexibility/variety in use of methods, interactive, providing for feedback, support materials, identification and dissemination of examples of good practice.

Today, a respectable progress is achieved of public awareness for accessibility on all levels. Over the past few years, commercial LMS vendors, and open-source communities have invested significant resources into making their products more accessible. At the same time, accessibility still remains a challenge for users with disabilities as well as elderly people. There are many examples where some usability issues can be manageable for typical users, but it can be extremely difficult for users with disabilities as well as elderly people.

4. A COMPARISON OF THE DIFFERENCES IN THE KEY ATTRIBUTES OF THE MOST COMMONLY USED LMSs

In order to maximize e-learning potential, LMS implementations should endeavor to satisfy the needs and concerns of all stakeholder groups as much as possible [18].

First ambiguity about choosing the appropriate LMS is the choice between cloud-based deployment and open source ones. Furthermore, pricing models, specification support, customer type and additional features should be taken into account. It is necessary to pay more attention to all of these factors in order to choose the most suitable LMS for educators and the users.

In the survey Table 1, we have taken into consideration accessibility as key factor that appears to be emerging in the healthcare market for e-learning systems. That will influence the LMS choice aimed for the using in healthcare.

To accomplish an effective user experience, including users with disabilities and elderly people, it is important to consider basic factors that improve the user experience, productivity and accessibility/usability. According to these considerations and Illinois Information Technology Accessibility Act (IITAA), as well as according to the Web Content Accessibility Guidelines (WCAG) 2.0 standard, we have defined criteria that affect the learning. Although the list of comparison criteria is incomplete, we decide to focus on the following high priority aspects according accessibility of the various LMS:

User Interface (UI). The UI is crucial for any LMS to be easy to use so that all learners can effectively and efficiently use system. The design of the interface from all differing perspectives is very important, determining how the LMS looks like and how the user interacts with the LMS. Two basic parts of UX (user experience) and UI are Navigation and Forms. Regarding navigation and forms, the user needs to concentrate on the content and not be challenged or distracted by the complexity of the interface and navigation. It is important for any LMS to be easy to use so that all learners can effectively and efficiently use e-learning. It is critical the user can enter data with certainty, the user be notified about any warning, error, or successful form submission.

Personalization and Customization. The LMS must be customizable beyond just look and feel. Learning should be available on demand and gives the possibility to learners to learn at their own pace, without mobilizing all resources at once.

Common Modules/Tools. The common modules and tools of the LMS provide the necessary means by which learners create and interact with course content. The most essential modules/tools are: announcements, discussion, e-mail, chat, course content, grade book as well as quiz/testing component.

Authoring Tools/Content Creation. This is important attribute for instructors. The best time to address the accessibility of the content is when it is created. For example, authoring tools can warn or test for accessibility on the files being uploaded, prevent users from saving graphics without first specifying the type of image.

Help and Documentation. Guide help, documentation of supported accessibility features and quick accessibility is essential for helping users to learn, to warn about troubleshoots, and to work effectively in the LMS environment.

The comparative analysis about different levels of compliance according to the Guidelines for WCAG 2.0 standards are made in [10], while in [11] the authors had put focus on improvement of the digital health literacy.

The analysis is made for some points of the standard demands for which we suppose that are the most important. User Interface takes into consideration navigation and forms and it is obvious that Blackboard Learn and ATutor, have better features compared with the others LMSs. Personalization and customization analyzes required field technique and Submission verification or error reporting. Differently from others, Docebo and Blackboard Learn, have frame based layout.

Accessibility feature is the most important attribute for the people with disability and elderly people. ATutor as an e-learning platform outperforms other platforms that are considered in the analysis. Differently from others, ATutor has a glossary, users online and search bar, latest discussion topics on forum and site-map with an ARIA tree.

Authoring Tools/Content Creation tool considers HTML Authoring tool that are split in seven criteria which will be the topic of interest in the further analysis. The first criterion is the HTML authoring tool and according to this criterion, the selected platforms have different HTML editors. ATutor has the user friendly JavaScript WYSIWIG editor, which is appropriate for a wide community of users.

Because the feature Help and documentation is important for users to deal with troubleshoots and to learn how to use the platform, the WCAG standard pays a great attention to this criterion. For the people with disabilities, children and elderly people, the Multimedia help/documentation Handling is the most important, so these criteria are shown in Table 1. According to multimedia help, ATutor is the among best choices consisting of multimedia help of Handbook (HTML based guide for screen reader users), Community Support Forum (Support questions should be of a technical nature). However, Blackboard Learn have a great Video tutorial that can be run from mobile devices.

As the Table 1 shows, the breakdown results for the WCAG, according to the criteria in Table 1 as well as to WCAG standard ones, the most suitable e-learning platform is selected according to the predefined criteria intended to use by a wide population in order to increase their e-health digital literacy.

We have to mention that these analyses are made in real environment considering the WCAG standards on public accessible e-learning systems. In this process, we evaluated e-learning platforms for the criteria needed for the WCAG standard as well as necessary features. For the purpose of this paper, we select just those criteria that we estimate that are the most important. Perceptions from the practical use of the LMSs analyzed in this paper were used to support decision-making processes of Cross4all project of IPA2. Choosing an appropriate LMS in order to increase the digital literacy for e-health of the population of the cross border area in this project is the main goal of this analysis.

Table 1: Main differences between characteristics of different Learning Management Systems in several categories.

Category/ Criteria	Moodle	Eliademy	Docebo	Sakai	Blackboard Learn	ILIAS	D2L (Desire2Learn)	ATutor
User Interface								
Navigation:Navigation bars and menus	breadcrumbs using unordered lists	Lists of links, menus with collapsible/expandable navigation lists, navigation buttons, breadcrumbs	Breadcrumbs and Navigation menu (collapsible/expandable and consist of lists of links)	Breadcrumbs and Navigation menu (collapsible/expandable and consist of lists of links)	Breadcrumbs, chevrons, arrow signs and navigation menu (collapsible/expandable and consist of lists of links, headings	Breadcrumbs, tree, top and main navigation	Headings and unordered lists	Navigation menu consists of list of links, Breadcrumbs, ARIA tree, Unordered lists of links, Navigation buttons
Forms: Required field technique/ error reporting	Exclamation mark icon/ In line text	None/ Java script alert	Asterisk/ In line text	Asterisk/ In line text	Asterisk / Java script alert	Asterisk /Java Script	Asterisk/ Tooltips	Asterisk/ List of errors on tap
Personalization and Customization								
Layout customization/ Default page	Non-frame based/ No	Non-frame based/ No	Frame-based/ No	Non-frame based (but has iframe) /No	Frame-based layout/ Yes	Frame-based layout/ Yes	towards non-frame based layout/ Yes	Non-frame based/ No
Common Modules/ Tools								
Accessibility Features	Announcements Forum is set up as a list of Discussion topics	Announcements Forum is set up as a list of Discussion topics	Announcements Forum is set up as a list of Discussion topics	Announcements and Forum are set up as a list of Discussion topics and Announcements.	Announcement within individual courses and in the Activity Stream	WCAG1 Level A conformant	WCAG 2.0 Level AA requirements for color contrast	Glossary, Users Online and Search bar; Forum is set up as a list of latest Discussion topics; Site-map represents the site content as ARIA tree; Users can choose alternatives for some kind of content
Authoring Tools/ Content Creation								
HTML Authoring tool	Atto HTML editor No, Yes, Yes, No, Yes	CKEditor No, Yes, Yes, No, Yes	TinyMCE (HTML editor) No, Yes, Yes, No, Yes	CKEditor No, Yes, Yes, No, Yes	Visual Text Box Editor	TinyMCE (HTML editor), CKEditor, inserting table, multimedia files, drag&drop	TinyMCE HTML editor, table wizard, math editor	JavaScript WYSIWIG editor No, Yes, Yes, No, Yes
Help and Documentation								
Multimedia help/documentation Handling	HTML based guide for screen reader users, Helpdesk to report issues	HTML based guide for screen reader users	Tour, Helpdesk to report issues and HTML based guide for screen reader users	Tutorial (tour) and Gateway (HTML based guide for screen reader users).	Video tutorials, mobile applications	Helpdesk, HTML based guide for screen reader users, video tutorial	HTML and PDF based guide as short tutorials	Handbook (HTML based guide for screen reader users), Community Support Forum (Support questions should be of a technical nature),

5. CONCLUSION

With the increasing number of LMSs, it is becoming very challenging task to decide which one to choose. Additionally, choosing the appropriate LMS for development of e-learning healthcare courses make the task more difficult.

Making the right choice while selecting an LMS is necessary because there are some open source LMSs that have unclear user terms and unnoticeable costs attached and are not as efficient as they claim to be [19]. This makes it necessary to know the kinds of available LMSs, select the most important criteria to compare [20]. Although, there are many easy to use user friendly developed LMS algorithms to help make choosing the best LMS easy, choosing the appropriate LMS in accordance with the WCAG standard, that aimed to increase the digital and health literacy of the population of the cross-border area in of CROSS4ALL project of IPA2, was a challenging task.

In order to choose an appropriate e-learning platform taking into account WCAG 2.0 standard and IITAA act, in this paper we focused on five important LMS criteria: User Interface, Personalization and Customization, Common Modules/Tools, Authoring Tools/Content Creation and system offering Help and Documentation.

The comparison of the eight LMSs: Moodle, Eliademy, Docebo, Sakai, Blackboard Learn, ILIAS, D2L (Desire2Learn) and ATutor, according defined criteria, shows that ATutor as an e-learning platform outperforms other LMSs considered in this analysis. Besides the Accessibility feature which are the most important attribute for the people with disability and elderly people, it has the best communication tools with user friendly interface and encapsulate multimedia help of Handbook. Moreover, ATutor has the user friendly JavaScript WYSIWIG editor, which is appropriate for a wide community of users and many useful features differently from others, such as: glossary, users online and search bar, latest discussion topics on forum and site-map with an ARIA tree.

ATutor as e-learning platform can help the population of the cross-border area in of Cross4all project of IPA2 to improve their digital and health literacy on easy way which is most convenient for them.

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