

ACCESSIBLE LEARNING MANAGEMENT SYSTEMS: STUDENTS' EXPERIENCES AND INSIGHTS



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Abstract

Learning Management System (LMS) is a type of an e-learning system is one of the main infrastructural requirements that improves access to higher education for persons with disabilities. The primary aim of the research study¹ was to explore perceptions of students with disabilities regarding the use and accessibility of learning management systems and benefits and/or barriers in e-learning.

Students mainly have negative experiences while attempting to enter university web-sites/libraries/LMSs because of the inadequate adaptation to the specific needs of students with disabilities. In countries that do not have a developed LMS, the prevalent mean of communication with professors is via e-mail, in those where there is a LMS, there is not a fully accessibility of entire content and services for students with special needs.

This research defined the need for creation of an accessible LMS or adjusted already existing LMS with accessibility solutions such as: a text-to-speech engine for blind students, a mode with sign language support for deaf students and a mode which supports dyslexic.

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1. Introduction

We live in a modern world where all information is easily available and accessible through internet technology. Higher education globally is facing many challenges as it is being reshaped by the digital evolution. In line with the ever-changing modern times where students rely on the Internet for most of their daily activities, it is appropriate for an online system or student portal to be set up to cater to their academic needs (Adzharuddin & Ling, 2013).

According to Zhang (2007), in the educational context there is a tendency to select and integrate new technologies “that fit the existing pedagogical culture, designing them in familiar patterns, and adapting them in line with the features of the local educational system”. Historically teachers have faced challenges to effectively integrate the new technologies into educational settings (Baldwin, 1998; Dvorak & Araújo, 2018; Ertmer & Ottenbreit-Leftwich, 2010; Knezek & Christensen, 2002; Labbo et al., 2003; Sang, Valcke, Braak, & Tondeur, 2010; Such, Ritzhaupt & Thomposon, 2017). Ubiquitous learning, supported by smartphones and other emergent technologies, may bring new approaches to digital learning and LMSs; furthermore, with the exponential development of technologies and constant innovation, overcoming challenges will always be an ongoing work.

Learning Management System (LMS) is a type of an e-learning system that supports a range of uses such as: administration, documentation, reporting and delivery of online courses and training programs. Providing an accessible LMS for students with disabilities will encourage them to continue their education and will allow them to acquire more skills and competencies. This leads toward more employment opportunities, active social inclusion and improvement of quality of life. The Learning Management System should provide personalized learning and the most common element of a ‘personalized learning’ definition refers to an education system that focuses on learning which is tailored to the needs, attitudes, and interests of every learner (Edmunds, Hartnett, 2014).

At a time when the possibilities of e-learning and various LMSs are in the public spotlight it is a bothering notion to find that there is a limited and belated approach to access for people with disabilities. E-learning holds many possibilities for inclusion for people with disabilities. This research is in line with Kent’s views (2015) where he argues that LMSs must provide access for all students.

Disability is activated differently online. Impairments that might encounter significant disabling environments in the analogue

world, such as for a wheelchair user, may have less impact when using the internet. Other impairments such as print impairments related to vision, cognition, and manual dexterity and, increasingly, with the use of video and audio through the Internet, people with hearing impairments may find different online environments can be significantly disabling (Ellis & Kent, 2011; Goggin & Newell, 2003). In regard to study materials, people with sight disability need their materials to be provided in a suitable format or have the materials (in word or pdf) void of tables and images, diagrams and so on because the software dedicated to converting text to speech is not capable to read visual information (Ruolytė-Verschoore & Ruškus, 2012). Using an LMS allows students with disabilities to study from home, communicate online, express their opinion that they would otherwise feel uncomfortable doing due to physical or psychological issues (Spiriajeviene & Spiriajevas, 2015).

The elastic nature of LMS makes it suitable for almost any type of institutional academic structure, but the major challenge faced by Learning Disabled (LD) users is to match their accessibility needs and preference in the existing LMS. The accessibility issues acts as a barrier in the growth of LMS. Accessibility describes materials that may be accessed by individuals with disabilities, depending upon the type of disabilities and special needs, screen content, layout and navigation has to vary (Horton, 2000). The analysis of the data that Pirani & Sasikumar (2014) collect in their research, pointed nine evaluation criteria of the existing learning management systems: pedagogical support, accessibility compliance, content authoring, migration of existing courses, sections and groups, E-portfolio, testing and assessment tools, training, gradebook and student tracking, thus from the obtained results can be concluded that available open source LMS in the market are not at all matching the accessibility needs or requirements of the LD students.

In 2009 Cooper and Heath critiqued learning management systems for adopting a one-size-fits-all approach to accessible eLearning through adopting a compliance approach to the initial Web Content Accessibility Guidelines of 1999 (WCAG 1.0) from the World Wide Web consortium (W3C). While these have been updated in 2009 to WCAG 2.0 there is still a tendency to see accessibility as an afterthought or a potential legal liability to overcome (Kent, 2015).

When applied to the educational context, accessibility does not only include students with specific disabilities (e.g. blind, low-vision, deaf and with reduced mobility in various aspects), but should be framed in a more comprehensive perspective i.e. international students or students with learning disabilities (LDs, e.g. dyslexia, dysgraphia, dyscalculia, etc.) (Cortiella &

Horowitz, 2014, WAI, 2018). In the case of LDs, students have difficulties to cope with the existing LMSs (Pirani & Sasikumar, 2012).

In recent years there are many studies concerning internet technology accessibility for persons with disabilities, but there are still insufficient data about the self-perception and personal attitudes of the disabled persons. In that line, the primary aim of the research study was to explore perceptions of students with disabilities regarding the use of learning management systems, e-learning and the Internet in general as well as it's accessibility. One of the underlying objectives was to identify positive practices and policies that can be applied in an international context in countries that do not have an established learning management systems. Data was collected on a sample of 34 university students with disabilities coming from 4 countries included in the project, North Macedonia, Lithuania, Portugal and Denmark.

2. Research Design

The qualitative case study methodology provides tools for researchers to study complex phenomena within their contexts (Baxter & Jack, 2008). It stresses the socially constructed nature of reality, as well as the close relationship between the researcher and what is studied (Denzin & Lincoln, 2004; Renz, Carrington & Badger, 2018). The design and context in which the qualitative part of the research was placed was non-rigid and naturalistic because the research focused on studying situations in which disabled university students learn by using the Internet or LMSs. These situations unfolded naturally during the semi-structured interviews. The advantage of using qualitative methods is that they generate rich, detailed data that leave the participants' perspectives intact, and provide multiple contexts for understanding the phenomenon under study. This study also used structured approaches to applying a method or methods which helped to ensure that there is comparability of data across sources and researchers.

The following research questions were set:

What is the daily use of information and communication technologies in university students with disabilities?

Which is the most preferred manner of communication for students with disabilities?

Which information and communication systems are mostly used by the university?

During the research design we set three **dependent variables**: use of internet and smart technology, use of learning management system and studying experiences and communication with professors. As **independent variables** we set type of disability, the country they come from.

2.1. Research method and procedure

This study was conducted with the purpose to get a deeper understanding of the LMS use, particularly in disabled university students. A case study methodology was used as a specific descriptive-explanatory cross-sectional qualitative and study. A case study involves generation of a deep understanding through using multiple types of data sources. As a research strategy, the case study enabled an empirical inquiry that investigated the LMS and Internet use in disabled young people in their real-life context. As part of the participant observation method, the following technique was used:

Semi-structured interviews. With the purpose of gathering data from relevant university students with disabilities, 34 semi-structured interviews were conducted with university students that study in public and private universities in North Macedonia, Lithuania, Portugal and Denmark. All interviews were conducted face-to-face and were accommodated to the preferred manner of communication (this was disability-related). All the transcriptions were sent to the informants to ensure data credibility.

2.2. Analysis

As in any other qualitative studies the data analysis occurred concurrently. Five techniques were used for qualitative content analysis (Yin 2003): pattern matching, linking data to propositions, explanation building, time-series analysis, logic models, and cross-case synthesis. A focused analysis in the LMS use was used so that analysis of data that are outside the scope of the research questions was avoided (although within qualitative researches the methodology of research as well as the research question can be changed during the research if the researcher believes that is beneficial). One danger associated with the analysis phase is that each data source would be treated independently, and the findings will be reported separately but this was not the purpose of this case study. The data in this research was converged in an attempt to understand the overall case, not the various parts of the case, or the contributing factors that influence the case. The analysis of the semi-structured interviews included (Huberman & Miles 2002): defining concepts; mapping the range, nature and dynamics of phenomena; creating typologies; finding associations; seeking explanations; and developing new ideas or strategies. The authors used codes aligned with the research questions to create themes. Within each theme, several subthemes emerged from the aggregated answers with similar or same meaning.

2.3. Results from semi-structured interviews analysis

In the scope of this study, interviews were conducted with students with the specific needs identified to better understand the changing needs of how smart technology and learning management systems work and how to make them more accessible.

In this direction, information was collected through interviews with students with specific needs in order to collect information about habits of use of smart technology (e.g. computers, mobile phones, tablets), Web activity (e.g. use of email, social networks, school platforms to support learning), as well as the main problems / barriers of accessibility found in these same activities.

Demographic data sample for semi-structured interviews

A total of 34 semi-structured interviews were conducted. The sample comprised 18 females (53%) and 16 males (47%), aged

between 19 to 29. Twelve students participated from Macedonia, 9 students participated from Portugal as well as from Lithuania and 4 students came from Denmark. The most prevalent group of students were students with impaired vision (35%), the dyslexic student consisted 26% of the sample, 24% of the students were students with physical disability, 9% had impaired hearing and 6% were students with Asperger syndrome.

Analyses of student's responses

The student responses were categorized and subcategorized. The categories and subcategories came from bulk of information from the interviews. Each theme that emerged from the interviews was thoroughly analysed which gave in-depth information regarding the investigated phenomenon. The data from the semi-structured interviews, are shown integrally within every category (and subcategory subsequently) (Table 1).

Table 1. Integrated review of the results

Questions	Visual impairments	Physical impairments	Dyslexia	Hearing impairments
Daily use of information and communication technologies	- computers and mobile phones	- computers and mobile phones	- computers and mobile phones	- computers and mobile phones
- Devices;	- additional assistive technology (text to speech, magnifier, screen reader)			
- Calendars;	lack of use of calendars			
- Library resources;	- problems with accessing library materials (written and online)	- library resources as well as online library tools	- library resources as well as online library tools	- library resources as well as online library tools
- Website	- Negative experiences - screen reader does not read graphic information on the web-site	- Negative experiences	- Negative experiences - Materials are never accessible for dyslexics	- Negative experiences
Communication				
- Social media;	Facebook and Instagram (N. Macedonia) Facebook, Instagram and Moodle (Portugal, Lithuania and Denmark)			
- E-mail	Most frequent for communication with professors			
Information and communication systems used by the university				

- Learning Management System (Moodle); - Other systems; - Online learning	- more balance and systematization of the shared content - great solution for students with disabilities			
Other - Physical environment; - Reaction of University teachers	- Physical accessibility barriers - Braille signs	- Physical accessibility barriers		
Improved work and efforts of professors, preparing accessible materials				

The respondent's responses were divided into categories. Several categories were defined during the analysis phase:

Daily use of information and communication technologies;

Communication;

Information and communication systems used by the university;

Other issues;

Within the **first category** (Daily use of information and communication technologies) several subcategories were discussed among the respondents:

Devices;

Calendars;

Library resources;

Website.

Regarding the **subcategory Devices**, the respondents from all countries reported that they mostly use computers and mobile phones for their everyday communication. Some of them use additional assistive technology (especially the students with impaired vision) which enables better communication with their peers of professors.

Lithuania

Student4 (visual disability): *"I usually make phonecalls. To the teachers, to the head of the study department. We frequently also write each other using Outlook, but it is even more comfortable for me to communicate by phone. If it is stil working hours, I call because it is faster, if the time is not suitable for calling, then I write [e-mails] using Outlook".*

Macedonia

Student1 (physical disability): *"I use smart technology...I use a laptop and a mobile phone and I have my own computer which I use for everyday e-mail communication."*

Within the **subcategory Calendars**, all the responses pointed to the lack of use of calendars. Students prefer to use more traditional methods of planning rather than calendars.

Macedonia

Student1 (physical disability): *"I don't use a calendar".*

Portugal

Student9 (Asperger): *"No."*

The use of **Library resources subcategory** showed a discrepancy in the responses. Students with impaired hearing and physical disability as well as students with dyslexia used library resources as well as online library tools. Unfortunately, students with impaired vision had problems with accessing library materials (written and online).

Lithuania

Student1(blindness): *"In the library itself, to use a library computer, no, I haven't [used it], because, like, really, I am not sure if they are accessible. Maybe, I think, there is one but I am not sure because I need a talking programme in the computer and I am not sure if it is there."*

Denmark

Student1 (physical disability): *"I can only read through e-books, which resulted in me still missing 3 out of 5 books."*

Regarding the last subcategory within this category – **Use of Faculty or University web-sites**, the respondents mainly had

negative experiences. The largest problem is for the students with impaired vision, especially if there is graphic information on the web-site and their screen reader does not read such information. The materials on the web-site are never accessible for dyslexics (example: specialized font for dyslexics, use of colourful background and so on). All the problems students with disabilities encounter while visiting the Faculty's official web-site lead to less frequent attempts for accessing the respective web-sites.

Lithuania

Student2 (blindness): *"I needed to look some time ago. To check something about the requirements for papers, how what paper has to look like. I think it was accessible, I forgot now. I think everything was ok there <...> You download it [timetable] and, say, it is spring semester of the fourth year. And it would be so that it is a table and it is, for example, archaeology, one column is the time and the other, the subject. For me personally, I don't know, maybe there is somebody else who navigates better, but for me personally and I heard that for others who are blind, it is not very comfortable to navigate that table. Maybe, for example, it is possible to upload separate documents, if, say, culture history. Well, so that there is a separate document for each subject."*

Macedonia

Student8 (dyslexia): *"The webpage of the Faculty is not regularly updated and also the materials are not accessible for dyslexics."*

The **second category Communication** is organized through the following two subcategories:

Social media; and
E-mail.

Students with disabilities most often use Facebook as a mean to get information regarding classes, lectures or tasks. Some of them even use Facebook to communicate with their respective professors. In the countries such as Portugal, Lithuania and Denmark, students use Moodle as a platform for communication with professors.

Macedonia

Student10 (impaired hearing): *"I use Facebook and Instagram daily. I also use Facebook messenger to communicate with other students."*

Portugal

Student4 (dyslexia): *"I use Instagram and Facebook, but also Moodle to communicate with professors."*

Nevertheless, the most prevalent medium for communication between students and professors is via e-mail correspondence.

The only issue that arises is the possibility professors not checking their e-mails regularly.

Lithuania

Student1 (blindness): *"With teachers it's mostly e-mail. If there is a question, I have to write them <...> so then I have to write via Moodle, but mostly it's e-mail. <...> we don't have some unified system, but somehow we share [materials among students]. Most often it is a common e-mail sent to all the students by the group leader."*

Macedonia

Student10 (hearing impairment): *"I use e-mail communication with the professors exclusively, I do not use social media to contact them."*

The third category **Information and communication systems** used by the University was the most delicate part of the research having in mind that Macedonia is the only country where students do not have access to platforms such as Moodle. Hence the following subcategories were defined:

Learning Management System (Moodle);

Other systems;

Online learning.

Regarding the first subcategory the students in general asked for more balance and systematization of the shared content and agreed that the professors are essential for the success of such a platform and they have to adapt their teaching styles, methods and techniques and incorporate them in the Learning Management System. Students that use Moodle frequently believe that if it wasn't for Moodle they would have to take academic leaves.

Lithuania

Student3 (hearing disability): *"I ask others, my friends, for lecture notes and copy them <...> It would be easier for me. For example, when the teacher is showing something on Youtube, I ask to turn on the captions so that I can understand the words better. <...> Now there are no forums, not enough information, lecture notes are very brief. If there were more, I would understand better."*

Portugal

Student 5 (impaired vision): *"more balance and systematization of the shared contents to have more balance between shared material; some teachers share YouTube videos, but lessons recorded on video / audio. It would be nice if the text-to-speech in Portuguese is part of Moodle."*

Sometimes Skype consultations are preferred rather than e-mail correspondence.

Macedonia

Student3 (physical disability): *“For successful online teaching courses we need fast internet and everyday communication with the teachers.”*

Student10 (hearing disability): *“It would be best, if we can have sign language interpretations embedded in the system”.*

Denmark

Student2 (impaired vision): *“This means that I sometimes have been exposed and extended time on many tasks. In addition, I have a secretary system where another student can be employed to help with practical complications, such as figure descriptions, correction of task layout, etc.”*

Students from Macedonia believe that Online learning is a great solution for students with disabilities in humanistic and social sciences. In this manner students with disabilities could attend lectures from any geographical point. In the virtual school the explanation is succinct, given slowly, has images on the subject, and it can be seen multiple times.

Macedonia

Student4 (impaired vision): *“Availability of materials in electronic form would simplify online learning. I am a part of this society, and I have the same rights as all others.”*

Portugal

Student7 (Asperger): *“In the virtual school the explanation is succinct, given slowly, has images on the subject, and can be seen as many times as you want.”*

The last category **Other** incorporates responses that could not be categorized under any of the other categories or subcategories. This category is consisted by the following subcategories:

Physical environment;

Reaction of University teachers.

The students with disabilities discussed the physical accessibility barriers they face. The students with impaired vision could benefit if the classroom number was written in Braille. The physical accessibility of materials as well as their online editions are also barriers for learning for students with disabilities. For the students in Macedonia (in particular the students with impaired vision) the accessibility of public transportation as well as the physical accessibility of the University are a big barrier for their education process.

Lithuania

Student1 (blindness): *“What concerns rooms, you learn them little by little. Maybe it would be easier if the number of the room was written also in Braille”.*

Portugal

Student2 (dyslexia): *“No difficulties were found on the platform. Already in the app considers that this could have more specific functionalities.”*

The students believe that the role of the University professors is changing from mechanically repeating/quoting/paraphrasing their own or other research to mentorships and one-on-one communication and work. They also have a large role in making materials accessible before they upload them on the e-learning platform. This Universal Design of Learning (UDL) is crucial for the e-learning process and the effective Learning Management System operations.

Macedonia

Student6 (impaired vision): *“The university professors should foremost be mentors and not lecturers. In the 21st century there shouldn't be professors that mechanically repeat/quote/paraphrase their own or other scientific papers which are available to all of us.”*

Portugal

Student2 (dyslexia): *“eLearning is basically a teacher-student communication and sharing tool.”*

5. Conclusions

There is a general increase in the popularity of LMS in Lithuania. LMSs (most commonly Moodle) are widely used in higher education (Dagienė, et al., 2018) Based on research conducted in Lithuania, the biggest issue that people with disabilities have overall is access to necessary study materials – some books are still unavailable in audio format or Braille, scientific databases are not accessible to people with certain disabilities, therefore, students encounter a lot of issues when they need to find alternative study materials to those that are provided by the teacher or the University library (MOSTA, 2014).

Nowadays in Portugal LMSs are understood as web-technology/software based tools that allow proximal or distance teaching/learning through sharing of content and activities, asynchronously and/ or synchronously, offering spaces of communication and collaboration for greater ease of teacher-student interaction, as well as other administrative functions (Carvalho, 2018; Cruz, 2014; Such, Ritzhaupt & Thompson, 2017). The Moodle open source software (under the GNU license) is largely adopted by many HEIs, Portugal being no

exception (Barge & Londhe, 2014; Linawati et al., 2012; Rodrigues et al., 2018). LMSs offer learning support without geographical or time limitations, allowing for more comprehensiveness, availability and accessibility when compared to the traditional classroom model. However, overcoming the merely instrumental use of LMSs, as well as the emerging need to prepare students for the challenges of the Digital Age, seem to be the current top challenges (Aparicio et al., 2014; Dvorak & Araújo, 2018; Moreira, 2018; Such et al., 2017).

In Denmark, universities have generally been more reluctant to develop virtual teaching methods than universities in most other European countries. However, LMS use in Denmark is widespread at all educational levels, has been such for many years, and is still developing. All higher education institutions have included LMS as part of their online information and education, with Moodle as the most common. Students with disabilities are expected to use such courses exactly like all other students. The question of accessibility is dealt with by other services.

Only fifteen institutions, in total, in North Macedonia use Moodle, primarily state and private universities. Research regarding LMSs use in North Macedonia is scarce. The data from Moodle logs is usually used for Prediction of Student Success Through Analysis of Moodle Logs like in the case study conducted by Ademi, Loskovska and Kalajdziski (2019) and in Students Behavior Analysis to Improve the Learning Process Using like in the paper written by Zdravev, Velinov and Nikolovska (2019). The Moodle Learning Management System has also been used for promotion of on-line methodology (Kirova & Ulanska, 2009). However, no research has been conducted in North Macedonia regarding the LMS use by persons with disabilities.

Similar to our interests examining the quality of distance learning for students with disabilities, Catalano (2014) conducted a survey in which seven students with diverse disabilities participated in a one-credit online library research course, adapted to be accessible using the best practices literature on distance education for students with special needs. Students provided feedback on the design of the course and participated in in-depth interviews. Results of this study suggest any given class may have students with different types of disabilities, with different paths toward learning. Using the principles of universal design for learning can improve distance education not only for students with special needs, but for all types of learners.

Fuglerid (2011) includes 28 visually impaired PC users in Norway in order to identify benefits of, and barriers to, use of ICT

for the visually impaired, and to propose measures to remove barriers. Visually impaired users' encounters with technology (Internet services, mobile phones, kiosks, ticket machines, ATMs, and queuing management systems) were investigated through a focus group interview, observation of task-solving activities, and semi-structured interviews. The analysis revealed that several commonly used ICT services, such as online banking, electronic forms, and learning material have major accessibility problems. The first barrier is often mechanisms for registration and authentication. The proliferation of inaccessible everyday technologies, unstable systems, and lack of training constitutes other major challenges. Based on the findings some suggestions for further development and research priorities are suggested.

An exploratory study was conducted in Canada with the main goal to investigate the use and accessibility of social media by postsecondary students with disabilities in order to raise basic awareness by the higher education community. The results indicate that YouTube was the most popular form of social media used by these students. MSN / Windows Live Messenger was rated the most accessible social medium, and InternSHARE.com was the least accessible. The most popular suggestion for developers and producers of social media was to have a simpler or better layout (Assuncion et al., 2012). Comparing these results with our findings, we can conclude that our examinees most frequently use Facebook and Instagram for unformal communication. We consider that the difference of the findings is a result of the popularity of the different social media in representative countries.

The access to internet and online communication for UK people with disabilities was investigated in 2002. 186 persons with disabilities had been included in survey, and 86% of them had used internet for e-mail, 71% had found information on goods and services, 40% had found information related to schoolwork or an educational course. In the same survey the examinees had some proposals for improvement if the web sites according the special needs: the most common themes were for sites to have guides on the home page as to what is on them, for pages to be less cluttered, for fewer graphics and advertising, for links to be clearer and fewer, for print size and colors to be easily changeable to suit the user, for greater standardization, for search to be more clearly marked and more precise, and for better accessibility for voice recognition system users (Pilling, Barrett, Floyd, 2004). Based on these findings and comparing them with ours, we can conclude that throughout all these years from 2002 until now the access and learning of the Internet for people with disabilities is based on their personal efforts and experiences. Barriers from the social environment that they cannot overcome forced to find the exit through online opportunities.

The need of learning management system arises from many obstacles that students with disabilities face during their studying at the Universities. In our research we found the physical barriers are most frequent, as well as the appropriate adapted materials and lecturers. Gillson, and Dymond (2012) have also found a lot of barriers for students with disabilities in Hong Kong Universities. In their study barriers are clustered in the areas of architecture, environment, systems, instructor- and classroom-related, student-generated, and the lack of evaluation.

Dobrinsky and Hargittai (2006) examined how people with disabilities have incorporated digital media into their lives and concluded that persons with disabilities are considerably less likely to be online than those who are not disabled. Persons with disabilities take distinct interest in certain online activities, such as sharing their own content and reviewing products and services, pointing to ways they may go online to adapt and respond to the wider inaccessible society. This is also in line with the semi-structured interviews analysis where it was stated students mostly communicate via e-mails with their professors rather than post on blogs or social media.

Fichten et al. (2009) explored e-learning problems and solutions. Included examinees pointed out that they have main problems with: accessibility of websites and course/learning management systems (CMS); accessibility of digital audio and video; course materials in PDF, and lack of needed adaptive technologies, poor use of e-learning by professors and their own lack of knowledge working with e-learning. Students in this research also mentioned the lack of professors' knowledge while operating LMSs and the need to change the teaching approach from formal paraphrasing to a more mentoring oriented approach.

Burdette, Greer and Woods (2013) analysed US special education policies and practices in online learning for students with disabilities, and their findings demonstrated an increase in the number of US states providing online instruction; indicated that students with many different types of disabilities participate in online learning. Corresponding to these findings are the expectations of our respondents, where majority consider that online learning system will have a positive impact on the professor-student interaction and will improve the education process in whole.

Kelly (2009) found that almost one-third of students who used assistive technology to access online educational material found that this material was unreliable or inconsistent if it could be accessed at all, which correlate to findings in our research. We found that most frequent problems are accessibility to any

relevant or updated information on the web pages of the certain education institutions as well as the design of the web pages.

In correlation to his findings "the relationship that disabled university students have with both their technologies and institutions is poorly understood", Seale (2013) considers that the e-learning platforms need to be as accessible as possible for students with a range of different impairments, in order all potentials to be realized.

In a representative survey of students of Lithuanian Higher Education Institutions (HEIs) about the 72% of respondents claimed to have used LMS in their previous or current studies. On the other hand, while there is no data separately for LMS, only 48 % claimed to have been satisfied with the way e-study tools had been used in their study process (Kinderis, Gaižiūnas, Lisauskas, & Zinkevičiūtė, 2018).

This research has shown that adaptations in the forms of plug-ins should be incorporated in the LMSs from its original conceptions. Text-to-speech and related read-aloud tools are being widely implemented in an attempt to assist students' reading comprehension skills. Read-aloud software, including text-to-speech, is used to translate written text into spoken text, enabling one to listen to written text while reading along (Wood et al, 2017). The number of free and easily accessible text-to-speech software programs is increasing (Berkeley & Lindstrom, 2011). A text-to-speech engine which is available in more than 30+ languages should be integrated initially in the LMS.

Written information is often of limited accessibility to deaf people who use sign language (Kennaway, Glauert & Zwitterlood, 2007). A plug-in for deaf students which translates all content into sign-language could be extremely beneficial for deaf students particularly in countries in which sign languages are not yet developed, standardized and not yet rich in vocabulary. Before thinking of photorealistic avatars that would produce sign language sentences, we can initially focus on creating a system for automatic synthesis and visualization of sign languages sentences. The synthesis can be made by assembling previous filmed video clips of sign demonstrations of the most frequent signs (Krapez & Solina, 1999).

A dyslexia mod can also be integrated within the LMS platform from its initial conception stage. Open Cyrillic and Latin fonts for easy reading of persons with dyslexia have been developed throughout the years and research has shown that their use aids reading in dyslexic readers (Bernard et al., 2002). Pelli et al. (2007) generalized their results and suggested that under ordinary conditions (adequate light, correct vision) the only limit to

reading rate is crowding. Dyslexic fonts enable less overcrowding in the text.

E-learning due to its flexibility and wide adoptions performs an important social function making education accessible for different groups of people. They represent real opportunities for a better quality of education for many people. However, people with disabilities are still encountering many obstacles to benefit from these systems. The main problem, in fact, is that most available LMSs are inaccessible to people with disabilities and do not take in consideration their special needs. The availability of accessibility guidelines, the diversity of the e-learning platforms, and the evolution of assistive technologies represent just a partial solution. Actually, some accessibility features may exist in some e-learning systems and applications but implemented in an ad hoc way and exclusively dependent on some specific technologies or targeting only one kind of disability (Jemni et al, 2014).

Based on the analysis of the obtained data, discussion and comparison with relevant research and scientific studies, we can conclude that the digital information is not inherently accessible or inaccessible, but the choices made by those developing and implementing technology determine whether a technology ultimately will be accessible or inaccessible. The increasing spread of the Internet holds much potential for enhancing opportunities for people with disabilities. Although there is an evidence that people with disabilities are, in fact, participating in these new developments, we can conclude that their involvement is very small and insignificant, and whenever we work to improve their quality of life in any aspect, we should always start from the slogan "Nothing for us without us". In general, our research determinate the need for creation of different types of accessibility plugins which will provide greater accessibility of the LMSs, such as: a text-to-speech engine for blind students, a mode with sign language support for deaf students, mode which supports dyslexic, speech-to-text for motor impaired.

5.1. Limitations

While the study includes four distinct countries across Europe, they all have very different experiences with e-learning in general and its accessibility to students with special needs in higher education contexts, particularly. This is due to both varying attitudes towards students with special needs, distance learning and the different stages of technological development in the higher education area in all participating countries. This affects the comparative aspect of the research in that the scope of comparison is limited by the varying contextual factors that have to be accounted for. While we have not observed differences among the reported technological behavior of students in different countries, more data is needed to draw definitive

conclusions. Several distinct issues were observed in the qualitative study of special needs university students' experience with various virtual technologies and the study process in general; however, since e-learning is firmly interlinked with the regular study process, we cannot necessarily conclude that the experience is solely or mainly caused by an accessibility issue regarding a particular disability or if it is a more general flaw of the study and/or administration process. Further research would be extremely beneficial in order to clarify and support the results of this study.

5.2. Compliance with Ethical Standards

This research was guided by ethical principles and propositions for involving people with disabilities in scientific research, while respecting their right to choose to participate / or not in the research. Also, the privacy issues related to obtaining and overseeing the materials as well as the material destruction once the materials were transcribed, were explained and the researchers abided by these regulations.

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