Analysis of Accessibility of the Electronic Graphic Elements and Other Focal Areas in Tertiary Education

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Abstract

Within the context of information content growth in the tertiary education, the issue of the accessibility of electronic graphic elements and other focal areas belongs to the current practice issues. The main research goal is to introduce the key aspects of electronic graphic elements' accessibility and other focal areas for the individuals with impaired visual perception in tertiary education in the Czech and Slovak Republic. By qualitative analysis, we have evaluated the websites and other electronic documents at 106 electronic platforms of universities and colleges in the Czech and Slovak Republic. In the process of accessibility analysis of electronic graphic elements and other focal areas, we used the specifically adapted system of accessibility assessment. Since 2008, this assessment system has been an integral part of the official methodology of the electronic document accessibility in the Slovak Republic. We found that only 2.8% of universities and colleges in total provide their electronic graphic elements in an accessible form. For visually impaired individuals, the information provided via graphic elements without text equivalent represent a substantial digital barrier, since the assistive technology is not able to interpret such non-text elements correctly.

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Keywords: Electronic accessibility; tertiary education; visual impairment.

1. Introduction

The tertiary level educational process is generally one of the most complex processes in the teaching practice. High demands on the teaching quality are reflected reciprocally in the level of demands placed by the university teachers on the students' learning performances. Recently, the Czech and Slovak Republic claim to adhere to the European university education standard, the obligations of which include the provision and mediation of equal involvement of specific needs students into the university education.

Unlike the lower education levels, there are no "special" universities or colleges in the Czech and Slovak Republic, intended for and fully adjusted to educating students with special needs. Thus, the study usually takes place in the form of individual or group integration. As mentioned by Vitásková et al. (2003), the improvement of the university education for students with special needs is an integral part of the demanding long-term inclusion process, which if successful should result in professional and social inclusion.

In this case, the need for an inclusive electronic environment respecting the requirements for universal design accessible for all students without distinction is rising sharply. This paper describes the results of the analysis of accessibility of the graphic elements as the main determinant of the electronic inclusion in tertiary education.

2. Research Methodology

We have analysed the accessibility of graphic and other non-text elements for any available documents, published within the publicly accessible electronic platform of the universities and colleges. For any non-textual information in the internet environment, a suitable alternative should be provided, conceived in a way accessible to sightless students.

Within the research, the non-text and graphic elements have been evaluated in compliance with the requirements and rules defined within the following methodologies, standards and regulations:

- Web Content Accessibility Guidelines 1.0: Check point 1.1;
- Web Content Accessibility Guidelines 2.0: Success criterion 1.1.1;
- Blind Friendly Web 2.3: Rule 1.
- Methodological instruction to the Decree No. 64/2008 Coll.: Rule 1;
- Annex No. 1 to the Decree No. 55/2014: Point 1.1;

We analysed the accessibility of electronic graphic elements by using assistive technologies, on-line tools, internet web browsers and special web browser applications. Table 1 below provides the overview of individual technologies, tools and programs used to analyse the electronic environment of individual university platforms.

Tab. 1. Specification of individual applications used in the electronic accessibility analysis.

Category	Title	Version
Assisive technology	NVDA	2015.1+
Assisive technology	JAWS	11+
On-line tool of the W3 consortium	Markup Validation Service	-
On-line tool of the W3 consortium	CSS Validation Service	-
On-line tool of the WebAIM company	WAVE Web Accessibility Tool	-
Web browser	Internet Explorer	10+
Web browser	Mozilla Firefox	45+
Web browser	Google Chrome	49+
Web browser	Opera	26+
Web browser extension	Accessibility Evaluation Toolbar	1.5.7.1.1
Web browser extension	WAVE Firefox Toolbar Extension	1.0.0
Web browser extension	WAVE Chrome Toolbar Extension	1.0.1
Web browser extension	Web Accessibility Toolbar for IE	2.0
Web browser extension	Web Developer Extension	1.2.5.1

Within our research, we have included the basic set in the research sample, i.e. all the public, state and private universities and colleges in the Czech and Slovak Republic.

In total, 106 universities and colleges were included in the research, representing their publicly accessible electronic environment. These publicly accessible electronic parts included in particular:

- University websites;
- Academic information systems (e.g. IS Stag/Portál; Moggis, MAIS, AiS2, IS MU; UIS and other.);
- Digital catering and accommodation information systems (e.g. ISKaM; WebKredit);
- Access interfaces to electronic library systems, library indexing services and registers;
- Electronic educational and learning systems (Learning Management System, Course Management System), including the support dynamic interactive teaching-oriented interactive tools (e.g. Moodle, LMS Unifor);
- Other electronic services and publicly accessible tools for the management of digital data in the university environment.

3. Key Findings

Based on the results obtained, we may state that one of the very frequent breaches in the environment of the electronic platform of universities are the images, without the correctly defined text equivalent in the source code. For visually impaired students, the information provided via graphic elements represents a substantial digital barrier, since the assistive technology (screen reader) is not able to correctly interpret such non-text elements. In this respect, our research has discovered particularly negative findings, because in total, only 2.8% of universities present non-text information in an accessible form (Fig. 1). In Slovakia, none of the public, state or private universities or colleges comply with the requirements for the Area I Graphic and Other Non-text elements.
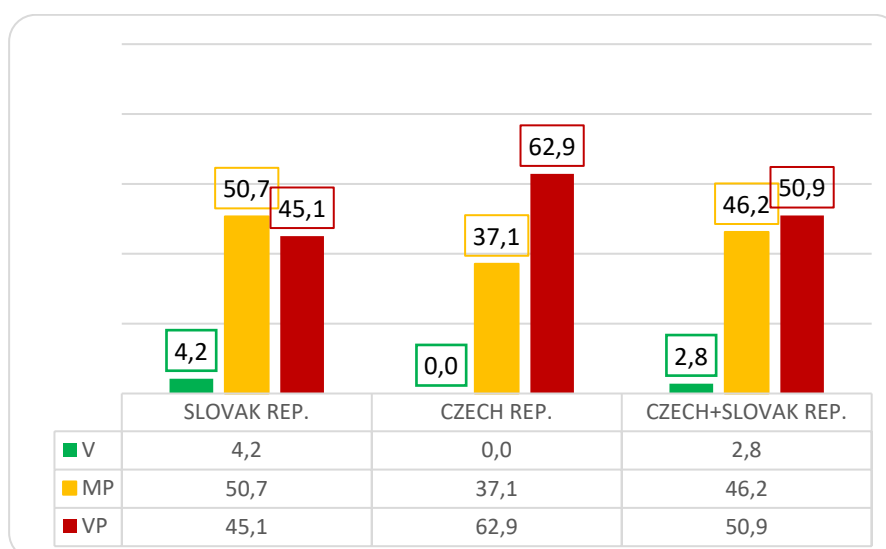

	SLOVAK REP.	CZECH REP.	CZECH+SLOVAK REP.
■ V	4,2	0,0	2,8
■ MP	50,7	37,1	46,2
■ VP	45,1	62,9	50,9

Fig. 1. Overall results of relative figures (in %) for the Area I Graphic and other non-text elements (n = 106)

Key: V = significant breach; MP = moderate breach; V = satisfactory/no breach

Of the total number of 106 public, state and private, only 3 private universities in the Czech Republic adhered to the accessibility requirements for the Area I Graphic and other non-text elements. All the state universities in the Czech and Slovak Republic significantly fall short of the requirements for digital accessibility of non-text elements.

The most frequent failures within the evaluation of accessibility of graphic elements were detected within the university web environment. Universities did not provide an appropriately defined ALT attribute for non-text elements. An example of complete absence of the ALT attribute in defining the graphic element is provided in the following Figure 2.
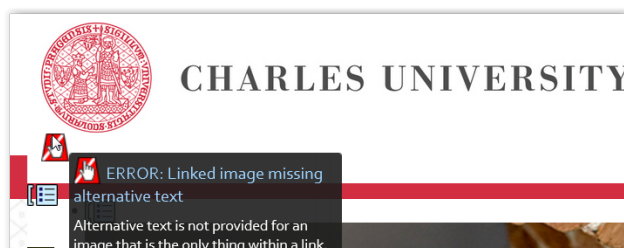

Fig. 2. Display of the graphic element without the text description through the WAVE Firefox Toolbar Extension on the Charles University home page

In order to specify the breach of the assessed area, we can show this particular part of the source code for figure 21:

- <imgsrc="UKEN-1-version1-afoto.jpg" height="102">

The aforementioned source code does not contain the ALT key attribute which should contain the text equivalent for users with assistive technologies (screen reader). Considering the fact that the graphic element is a link at the same time (pair tag A;), in terms of linear arrangement, the user is not informed about the direction of the very first link on the University home page. Thus, the digital barrier is not apparent to students with visual impairment immediately at the beginning of the Charles University website electronic content. In this regard, we have identified almost an identical shortfall on the home page of Comenius University in Bratislava (Fig. 3).
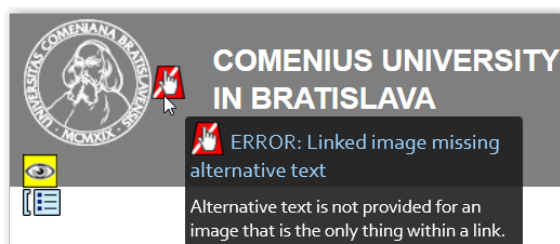

Fig. 3. Display of the graphic element without the text description through the WAVE Firefox Toolbar Extension on the Bratislava Comenius University home page

When analysing the source code, we found that even if the Home Page text description is defined within the TITLE attribute, the text description through the ALT attribute has not been define for the graphic element:

- <imgsrc="/fileadmin/templates/img/logos/logoUK.png" width="95" height="94" alt="">

Figure 4 displays another example of the breach of e-Accessibility principles in the library opening hours, presented in form of a figure without text alternative.

Otevírací doba		
Pondělí	9 - 12	-
Úterý	9 - 12	13 - 16
Středa	-	-
Čtvrtek	9 - 12	13 - 16
Pátek	9 - 12	-

Fig. 4. The library opening hours presented in form of graphic element without text alternative in the electronic environment of Medical College (Vysoká škola zdravotnická, o.p.s.)

College of Business and Hotel Management (Vysoká škola obchodní a hotelová, s.r.o) does not provide text descriptions for the graphic elements containing text information (Bachelor degrees, admission process) etc. These graphic elements serve as hypertext links at the same time, having the function of active elements (controls). For the sightless students using assistive technology, the information on the direction of individual links are not accessible at all. For the graphic element identified as dendvere.jpg, an alternative description us provided with incomprehensible and incorrectly defined content ("*ghvfgzh*").

Source code:

- <img alt="*ghvfgzh*"
  src="http://www.hotskolabrno.cz/upload/userfiles/images/dendvere.jpg" style="width:
  225px; height: 35px" />

Non-compliance with the accessibility principles is the publication of text information in form of scanned image is a specific issue (Fig. 5).
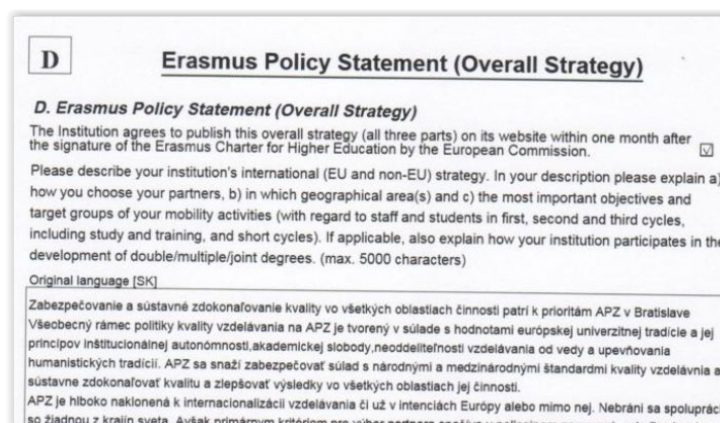

Fig. 5. Inaccessibly published document in form of scanned image on the website of Academy of the Police Force in Bratislava (Akadémia Policajného zboru v Bratislave)

For the Area I Graphic and other non-text elements, in 2015 we analysed whether the information in the electronic documents in PDF, DOC, DOCX, and RTF formats are created and presented in an accessible form. Here, Figure 6 provides an example of a completely unsatisfactory solution (electronic application form in PDF format, uploaded in form of scanned image).

Fig. 6. Inaccessible electronic application form in PDF format for sightless students at the private *School of Management* (Vysoká škola manažmentu)

3.1. Electronic accessibility and CAPTCHA

Considering the fact that one of the most complicated elements in the internet network is CAPTCHA (*Completely Automated Public Turing Test to tell Computers and Humans Apart*) in graphic form, which is unreadable for sightless individuals by using the assistive technology, we have examined the accessibility of forms using the CAPTCHA method in particular. Hence, it is necessary to specify that the CAPTCHA graphic method excludes the use of standard alternative image description, as it loses its protective meaning for the electronic form.

Due to the aforementioned, if the image is used to differentiate between a human or a computer using the computer, the visually impaired individual should have such methods available, so as to make such differentiation possible in spite of the individual's impaired capacity to obtain the required graphic information from the image (e.g. audio output, common text typing, etc.).

In the environment of electronic platform at the universities and colleges in the Czech and Slovak Republic, we have repeatedly identified the CAPTCHA method application in an inaccessible form (Fig. 7).

Fig. 7. Use of the CAPTCHA method in an inaccessible form in the environment of electronic platform of Masaryk University in Brno

Another specific example of the CAPTCHA method application in an inaccessible form from the environment of the University of New York in Prague is provided in the following Figure 8.
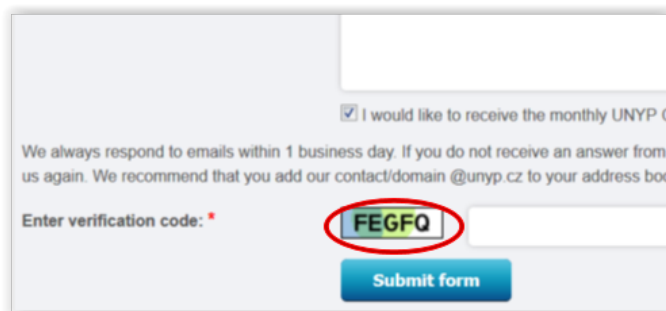
Fig. 8. The requirement for entering the verification code from the image without text description on the website of University of New York in Prague

3.2. Application of math task using the CAPTCHA method

When evaluating 106 electronic platforms of universities and colleges, we found the CAPTCHA method application in 7.5% of cases based on math task. This solution eliminates digital barriers in relation to visually impaired individuals. At the same time, however, it may represent a certain risk for the efficient use of electronic form for the individuals with dyscalculia (specific developmental learning disorder).
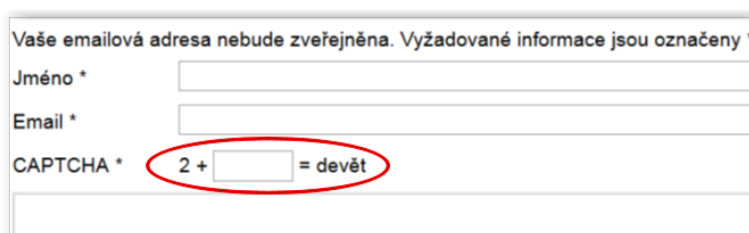

Fig. 9. Application of the CAPTCHA method in form of simple math task at AKCENT College, s.r.o.

The following figure illustrates another example of the CAPTCHA method application based on a math task at the Slovak University of Agriculture in Nitra.
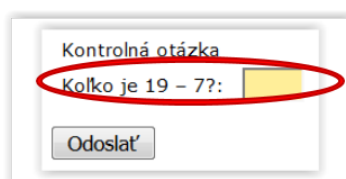

Fig. 10. Application of the CAPTCHA method in form of a math task at the Slovak University of Agriculture in Nitra

In one case, we recorded an explanation of the CAPTCHA method application based on a math task. Note in the brackets under the math task explains the purpose: "*the task serves for security, not as a math exam*" (Figure 11).
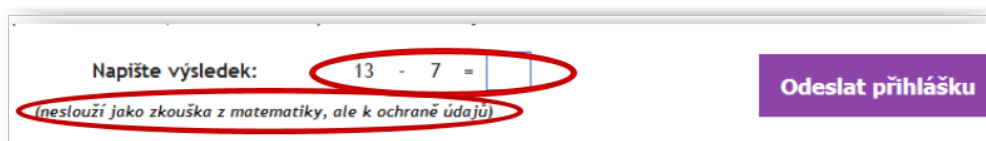

Fig. 11. The math based CAPTCHA method and justification of the application thereof on the websites of ART & DESIGN INSTITUT, s.r.o.

3.3. Development of accessibility of graphic and other non-text elements in the Slovak Republic

Based on our findings, we assess the development of graphic and other non-text elements in the Slovak Republic as unbalanced and with unclear further development prospect. We have not found statistically significant differences between the individual evaluation results for the period 2007 - 2015. 2015 is compared with the partial results of Regec (2010), assessing the accessibility of universities and colleges in Slovakia in 2007 – 2009.
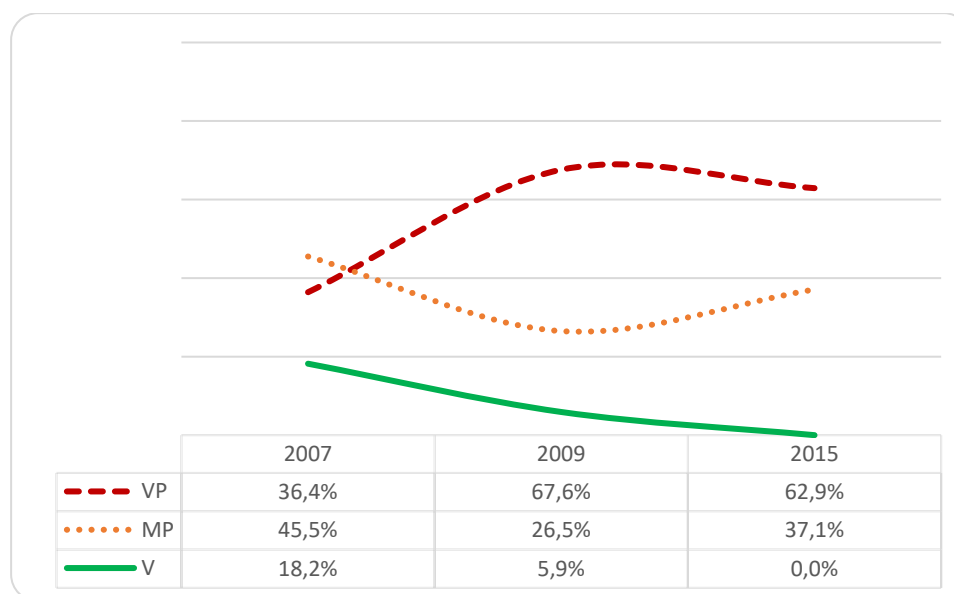

		2007	2009	2015
- - - -	VP	36,4%	67,6%	62,9%
••••••	MP	45,5%	26,5%	37,1%
——	V	18,2%	5,9%	0,0%

Fig. 12. Development of accessibility of graphic and other non-text elements at individual universities and colleges in 2007-2015
Key: V = significant breach; MP = moderate breach; V = satisfactory/no breach

Based on the above, we may state that representation of universities providing graphic elements in accessible form has dropped by 18.2% since 2007. This may be explained by the fact that the electronic platform of universities and colleges has significantly increased the robustness of electronic information in relation to students. Gradually, digital information has become an integral part of the university communication platform, with the use of images and other graphic elements being its natural part.

4. Conclusions

The results have confirmed explicitly that the level of e-Accessibility at universities does contradict not only the international documents (e.g. *UN Convention on the rights of persons with disabilities, Web Content Accessibility Guidelines 2.0*) but also the wording of valid legal regulations and rules adopted under the conditions of the Czech and Slovak Republic.

In terms of support of the inclusive environment at the universities in Slovakia, these include for example the *Decree No. 458/2012 Coll., determining the minimum requirements of a sightless and partially sighted student*.

In the Czech Republic, the rules include, for example the requirement resulting from the rules for granting contributions and subsidies to public universities (*MSMT-2067/2015-1*), imposing on the

schools the obligation to guarantee the minimum technical and technological background for individuals with special needs.

Based on the above, we consider it important to revise the concept and current policy in the field of digital barriers elimination at universities and colleges. However, the very existence of legal standards, rules, convention and other documents is not an automatic guarantee that the university electronic environment would comply with the electronic accessibility principles.

The support of increasing basic competences of the academic and non-academic staff at universities and colleges regarding the creation of accessible electronic environment also appears to be of importance. Several electronic documents (e.g. invitations, applications, study texts or other materials for students), presented in the electronic environment, are created by the university staff directly, without having sufficient knowledge about how to adjust them to the needs of visually impaired students.

In this relation, a positive signal from practice is the origin of the *Association of the Providers of Services to Special Needs Students* at the universities in the Czech Republic in 2013, which subsequently constituted the *Work Group for the Accessibility of University Information Systems*. One of the key issues being solved by this Work Group is the process of expert review of the problematic aspects in the field of electronic accessibility and support of initiatives aimed at eliminating the digital barriers at universities and colleges.

We firmly believe that this contribution will serve as an impulse in creating electronic environment accessible for all students indiscriminately.

Acknowledgements

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