Digital Barriers In Educating Students With Visual Impairment

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Abstract

Successful inclusion of the visually impaired students is significantly influenced by digital barriers in their educational environment. For students with visual impairment, the occurrence of digital barriers reflects negatively in the quality of their university studies. Provision of sighted person assistance or other support measures may help to overcome the impacts of digital barriers, however it does not comply with the inclusive approach requirements. The aim of the paper is to examine the development of digital barriers in the university environment in 2007 - 2015. Selected conclusions of the research carried out have been subsequently compared while monitoring individual specifics and differences between the occurrence of digital barriers in the Czech and Slovak Republic. We have found out that the trend in development of digital barriers is gradually deteriorating. At the same time, we ascertained that there are no statistically significant differences in the e-Accessibility level in the countries monitored.

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1. Problem Statement

In the educational environment, digital barriers have a significant impact on success of the visually impaired students' inclusion process (Jašková, 2008; Regec & Pastieriková, 2013). In this process, the task of the university system shall be to eliminate the electronic obstacles in the access to information for all students indiscriminately. Accessible electronic environment of the educational platform (Hersh & Johnson, 2008) means that a student with severe visual impairment is able to use the academic information system, e-learning, electronic library and the like independently and without a sighted person's assistance. At the same time, implementation and provision of access
to the electronic systems used by the visually impaired student for administrating the related agenda such as the accommodation system and digital catering system is no less important. The aim of the paper is to examine the development of digital barriers in the university environment in 2007 - 2015. Selected conclusions of the research carried out have been subsequently compared while monitoring individual specifics and differences between the occurrence of digital barriers in the Czech and Slovak Republic.

2. Research Methods

Qualitative and quantitative analysis was chosen as the key research method, applied to 114 websites of public, state and private universities and colleges. In total, 76 universities in the Czech Republic and 38 universities in the Slovak Republic have been evaluated considering the accessibility and digital barriers. In terms of e-Accessibility, we have evaluated 29 areas based on the international rules compiled under the title WCAG 2.0. These rules also represent a part of the legal standards for the area of website accessibility in the countries monitored.

The accessibility rating methodology used in our research represents a specific method of calculating the accessibility rating of a website quantifying the individual conclusions from the manual control form. The manual control is defined as specialized evaluation by an experienced website accessibility expert (Regec, 2015). In addition to theoretical mastering of the rules, the expert also needs to have practical knowledge of the principles of the assistance technologies for persons with visual impairment. In our research, we used the speech synthesizers (screen readers) NVDA (NonVisual Desktop Access) and JAWS (Job Access With Speech). On the basis of individual assessment, we have evaluated the conclusion for each individual area of accessibility, determining whether or not the status detected is in compliance with the rule. In case of an exact detection of contradiction between the actual status of the website and the methodological wording of the rule, we have considered the severity of the breach detected. In this respect, our methodology differentiates the following types of evaluation results (Regec, 2014):

- **Significant breach** shall mean the breach which fails to enable access to information for the visually impaired users in the same extent and quality as for the intact users. The practical and user accessibility is demonstrably disturbed and apparent.

- **Moderate breach** shall mean the type of breach not having a significant impact on the practical and user accessibility. These are usually technical deficiencies breaching the standard without significantly disrupting the access to important information values or functionality of the website.

- **Conclusion reading “No breach” or “Satisfactory” represents fulfilment of the monitored point and no contradiction with its diction found.**

Sensitive differentiation of the rules by their severity is the key one because the impact of digital barriers on the user accessibility may be variable. Therefore, it depends significantly on the quality and the particular type of digital barrier.

In case of detecting digital barriers, our methodology of website accessibility rating defines a system of penalty points awarding. The number of penalty points is awarded based on the severity of the breach. In total, there are the following 3 priorities detected for the 29 rules evaluated in total:

- basic (23 rules);
- higher (3 rules);
- highest (3 rules).

The value of penalty points is awarded based on the severity of the breach. For the penalty point calculation system based on priority of the rule see Table 1.
A table showing the awarding of penalty points based on the priority of the digital accessibility rule:

<table>
<thead>
<tr>
<th>Evaluation conclusion</th>
<th>Number of penalty points Basic priority</th>
<th>Number of penalty points Higher priority</th>
<th>Number of penalty points Highest priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Significant breach</td>
<td>2</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Moderate breach</td>
<td>1</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>No breach/satisfactory</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

According to the occurrence of the cases of breach, the formula for calculating the summary of penalty points has the form as follows:

\[ s_b = b_m + b_s + 3b_m + 3b_s + 6b_m + 6b_s \]

Where:
- \( b_m \) = moderate breach
- \( b_s \) = significant breach

Rating of accessibility represents conformity of the website expressed in percentage with wording of the rated rules. Highest rating of accessibility is marked with the value of 100% which represents fulfilment of all valued aspects of individual rules in full extent and complex provision of the website environment accessibility (Regec, 2008).

Basic formula for accessibility rating calculation in %:

\[ r = \left(1 - \frac{s}{100}\right) \times 100 \]

Where:
- \( r \) = rating of website accessibility
- \( s \) = summary of assessed penalty points

The numerical value of 100 listed in the denominator represents the summary of penalty points in case of severe breach of all rules.

Based on the percentage of accessibility rating, an innovative range has been prepared, determining the individual accessibility levels (accessibility rating values are provided in brackets):

- Highest accessibility level (100% - 96%)
- High accessibility level (95.5% - 91%)
- Medium accessibility level (90.5% - 84%)
- Lower accessibility level (83.5% - 75%)
- Low accessibility level (74.5% - 70%)
- Very low accessibility level (69.5% and less)

3. Findings

In the context of the WCAG 2.0 rule requirements, we have evaluated the accessibility status of the websites in 2015 as unsatisfactory. The rating value of an average website of a university or college in the Czech and Slovak Republic was 77.9% which means a lower e-accessibility level. In mutual comparison of results from the monitored countries we have found out that in the Slovak Republic, the average value of e-accessibility rating of universities is higher than in the Czech Republic by 0.4% (Fig. 1).
We have found out that in the Slovak Republic, the development of digital barriers has had a stagnant trend since 2007. Compared to 2007, the average value of e-accessibility rating in 2015, was lower by 1.2%. Within the monitored period, the e-accessibility rating only had a downward trend until 2014. For more details, see Fig. 2.

Compared to 2014, the e-accessibility rating in the Czech Republic in 2005 was higher by 0.6%. At the same time, we ascertained that there are no statistically significant differences in the e-Accessibility level between the Czech and Slovak Republic.

When comparing the selected digital barriers, higher variations were recorded in the field of graphic elements accessibility. Higher breach of the rule with highest priority referring to the accessibility of non-text (graphic) elements was reported in the Czech Republic more frequently by 10.6%. On the contrary, the occurrence of barriers
in the field of electronic forms was higher in the Slovak Republic. We have also found extremely high differences between the countries in the area of accessibility of headings and lists (higher priority rule). The No breach assessment result was as much as twice more frequent in the Czech Republic than in Slovakia.

Table 2 Comparison of findings of selected digital barriers in the Czech and Slovak Republic

<table>
<thead>
<tr>
<th>DIGITAL BARRIER AREA</th>
<th>CZECH REPUBLIC</th>
<th>SLOVAK REPUBLIC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No breach</td>
<td>Moderate breach</td>
</tr>
<tr>
<td>GRAPHIC ELEMENTS</td>
<td>5.3%</td>
<td>23.7%</td>
</tr>
<tr>
<td></td>
<td>(4)</td>
<td>(18)</td>
</tr>
<tr>
<td>ELECTRONIC FORMS</td>
<td>19.7%</td>
<td>52.6%</td>
</tr>
<tr>
<td></td>
<td>(15)</td>
<td>(40)</td>
</tr>
<tr>
<td>KEYBOARD ACCESSIBILITY</td>
<td>36.8%</td>
<td>38.2%</td>
</tr>
<tr>
<td></td>
<td>(28)</td>
<td>(29)</td>
</tr>
<tr>
<td>CONTENT STRUCTURE (HEADINGS AND LISTS)</td>
<td>27.6%</td>
<td>56.6%</td>
</tr>
<tr>
<td></td>
<td>(21)</td>
<td>(43)</td>
</tr>
<tr>
<td>NAMING THE WEBSITE TITLES</td>
<td>40.8%</td>
<td>38.2%</td>
</tr>
<tr>
<td></td>
<td>(31)</td>
<td>(29)</td>
</tr>
<tr>
<td>FORMATTING AND ARRANGEMENT OF TABLES</td>
<td>32.9%</td>
<td>35.5%</td>
</tr>
<tr>
<td></td>
<td>(25)</td>
<td>(27)</td>
</tr>
<tr>
<td>MULTIMEDIA (AUDIO, VIDEO)</td>
<td>42.1%</td>
<td>48.7%</td>
</tr>
<tr>
<td></td>
<td>(32)</td>
<td>(37)</td>
</tr>
<tr>
<td>HYPERTEXT LINKS</td>
<td>13.2%</td>
<td>61.8%</td>
</tr>
<tr>
<td></td>
<td>(19)</td>
<td>(47)</td>
</tr>
<tr>
<td>CONTRASTS FOR TEXT INFORMATION</td>
<td>23.7%</td>
<td>55.3%</td>
</tr>
<tr>
<td></td>
<td>(18)</td>
<td>(42)</td>
</tr>
<tr>
<td>FONT SETTINGS</td>
<td>19.7%</td>
<td>57.9%</td>
</tr>
<tr>
<td></td>
<td>(15)</td>
<td>(44)</td>
</tr>
</tbody>
</table>

In both countries alike, the highest number of cases of compliance with rules was recorded in the field of multimedia element accessibility, website titles and keyboard accessibility.

4. Conclusions

The area of digital barriers and e-Accessibility belongs among the urgent issues in today’s practice. Based on our findings we may state that accessibility at universities in the monitored countries considering the specific needs of students with visual impairment is not satisfactory. For students with visual impairment, the occurrence of digital barriers reflects negatively in the quality of their university studies (Mendelová & Lecký, 2008). Provision of sighted person assistance or other support measures may help to overcome the impacts of digital barriers, however it does not comply with the inclusive approach requirements. A good practice would be to build the electronic environment in compliance with the universal design requirements, adjusted to the specific needs of all students, indiscriminately. In this respect, university electronic systems should be mandatory and regularly tested for accessibility (Regec, 2014). Gradual and systemic elimination of electronic obstacles should include implementation of tools aimed at evaluating the compliance with individual e-Accessibility rules. In the event of deficiencies it is essential that these findings were not only evaluated statistically but at the same time served as a platform for elimination thereof in practice.

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References


