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Raising students' awareness of accessibility as a key element of web design training: project for Web Accessibility Rankings of university websites

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Abstract: This paper deals with a way to raise the awareness of IT students on accessibility as a key element in web design training. To this end, students are given project assignments to calculate Web Accessibility Rankings for a set of university websites according to their validation results. Thus, while making conclusions about the degree of accessibility of the websites of local and international universities, future developers understand the perspective of people with special educational needs (SEN) as their potential customers. In this way, students not only learn about and gain experience with the basic tools for accessibility, but also increase their social commitment - they realize that providing accessibility empowers people with SEN to pursue educational development and professional development.
Keywords: projects, web design, special educational needs (SEN), reflection, autonomy

Introduction. The term "web accessibility" has long been established and stands for the opportunity provided for people with disabilities to "perceive, understand, navigate, and interact with the Web" [1]. It is also in the interest of millions of people without disabilities who want to access the Internet and who have suffered in accidents or are experiencing changes in terms of their ability to perceive and respond to the environment as a result of age advancement, also people with older or limited devices where complex content is not displayed correctly. A cornerstone principle of Web accessibility is designing websites which adapt to different user needs and preferences.

The more ubiquitous information and communication technologies become, the higher the number of people employed in this sector, as well as those who wish to acquire the appropriate education and training in pursuit of an ICT career. Quite a number of the students on IT programs are likely to engage in a web design or web development career. Busy in their daily lives, like most other people, they take for granted the senses that serve them unobtrusively and seamlessly, whle not paying attention to the challenges that confront people with SEN.

Brief review of publications related to the subject. Problems of people with special educational needs are numerous and varied, determined by the nature of their disabilities. The main SEN types according to [2] and [3] are: mental retardation, hearing impairment, visual impairment, impaired learning ability, dyslexia, dysgraphia, dyscalculia and acalculia, movement disorders, communication disorders, multiple impairments. For each of these issues, there are various alternatives described in the literature for ensuring accessibility for people with different types of SEN. The topic of dynamic models and their role in the presentation and perception of certain content is discussed in [4] and [5], for example. The use of projects in teaching is referred to as "one of the standard methods of teaching" [6], while "learners, in addition to mastering a certain body of knowledge, have to master highly efficient methods of independent thinking, preparation and action." [7].

Goal. The overarching aim of this work is to discuss a way to raise the awareness of IT students on accessibility as a key element in the teaching and learning of web design by means of a project for producing Web Accessibility Rankings of university web sites after assessment and comparison.

Materials and methods. Project is used as "a means by which students can (a) develop independence and responsibility, and (b) practice social and democratic modes of behavior" [8]. This method has been applied in education, especially in vocational training, for centuries, and inspiration to do so can be found in the ancient sages such as Confucius (551-479 BC): "Tell me and I'll forget; show me and I may remember; involve me and I'll understand". This particular project assignment provides that students compare the accessibility of university websites. The core activities during implementation include the following work packages:
1) putting up a list of university websites;
2) choice of methods to assess the accessibility of the sites;
3) selection of suitable testing tools;
4) elaboration of the ranking methodlogy;
5) conducting the tests and illustrating the results;
6) calculating the rankings for each indicator;
7) producing the final rankings;
8) analysis of the results and drawing conclusions for implementing accessibility in web design.

Recommendations to students include guiding them to key documents such as the guidelines for creating accessible websites provided in WCAG 1.0 and WCAG 2.0 [1], as well as the methodology derived and summarized by Svetoslav Enkov for development of accessible websites [2].

For the implementation of their projects, students are advised to undertake, as a minimum, the following seven steps:

1. Selection of a pool of universities for the research. Within a class, the project teams cannot have overlapping lists, while at the same time each team must include the university they study at. The choice is usually among universities which offer similar undergraduate programs and/or are based in a certain geographical region, e.g. South and Eastern Europe, the Balkans, etc. Alternatively, selections can be made based on universities' academic rankings.

2. Testing for accessibility with WAVE. The online accessibility validator WAVE [9] provides detailed testing of webpage errors, the latter being marked on places where they occur; also testing the contrast and viewing the page without CSS styles.

3. Testing for review in a text browser with LYNX Viewer. The LYNX Viewer [10] software makes it possible to see the site in the same way as it would appear if viewed in a text browser. Thus there is no need to install such a browser on tester's own computer.

4. Testing the markup validity with W3C MarkUp Validator. W3C Markup Validator [1] is a free service provided by the World Wide Web Consortium (W3C) which helps to check the markup validity of Web documents.

5. Testing the CSS styles with W3C CSS Validator. The W3C CSS Validator [1] is a free service created by the W3C to help web designers and web developers find errors or improper use of CSS.

6. Testing for valid links with W3C Link Checker. The W3C Link Checker [1] is a tool that can check whether a site contains broken links, anchors and referenced objects in a Web page, CSS style, or recursively to the desired depth, the entire website. Finding and correcting broken links is important because such faults impair the functionality, e.g. visitors cannot open the target; the search engines cannot find such a site.

7. Testing the validity of the HTML code without CSS styles or without images with Mozilla web developer toolbar. Mozilla web developer toolbar [11] is a useful addition to the Mozilla Firefox browser which contains the following menus required for verification of the design of a web site: Disable – deactivate certain web page functionality, e.g. caching, Java, JavaScript, page colors, etc. CSS – visualizes the deactivation of CSS in real time; Images – hides the images on the page; reveals image and file sizes, etc. Information - provides information about the page palette, structure, nested tables, etc.

Web Accessibility Rankings methodology. The positions in the rankings are based on the quantitative assessment of the performance of university websites confirmed by the six validation tools briefly described above.

The **WAVE** score is formed by summing up the number of notifications in each category: Errors, Alerts, Features, Structural elements, HTML5 & ARIA and Contrast Errors.

As for **LYNX**, one point is awarded for each of these requirements: The text is well formatted and is easy to read; all links can be traced; forms, if any, can be used; text descriptions of the images can be seen; free of extras which cannot be seen in a normal browser.

The **W3C MarkUp Validator** results yield one point for each notification in the two categories: Errors and Alerts, while in **W3C CSS Validator** and **W3C Link Checker** each error notification accounts for one point in the score for that category.

In **Mozilla web developer toolbar**, without CSS, one point is awarded when the menus can be seen, one when the structure of the page is retained, and 0 – when titles cannot be discerned or the text cannot be read because of inadequate color contrast.; without images, one point is awarded when the menus can be seen, one when the structure of the page is preserved, and a zero - in the absence of sufficient color contrast, resulting in illegibility of the main menu. An equal number of points for a given instrument should be translated into the same position in the standings, to avoid distortion of information about the significance of performance.

The total point score for each university website is calculated while taking into account the fact that the test results for the validation tools used differ in their scales and for some of them a higher point score indicates a higher quality (LYNX, Mozilla web developer toolbar), while for others (WAVE, W3C MarkUp Validator, W3C CSS Validation Service and W3C Link Checker) it is the opposite. Therefore, the following approach is applied. The aggregate point score for a university website is obtained as the sum of the ranking positions of that university website for each test tool in the battery, as shown in Table 1 illustrating part of the work of one of the students.

Table 1. Calculation of the total point scores for university websites

ID	Position in the rankings for each of the validation tools						Total point score
	WAVE	LYNX	MarkUp	CSS	Links	Mozilla	
Uni 04	11	4	2	16	3	1	**37**
Uni 11	1	2	8	14	2	1	**28**
Uni 12	7	1	6	15	4	2	**35**
Uni 14	9	4	1	10	7	1	**32**
Uni 15	1	1	11	7	4	1	**25**
Uni 17	2	3	1	1	3	2	**12**
Uni 18	18	5	1	5	1	1	**31**
Uni 20	8	5	5	13	3	1	**35**
Uni 21	9	2	4	12	1	2	**30**
Uni 24	3	3	1	9	1	3	**20**
Uni 30	2	3	7	6	2	2	**22**

The final ranking is done in ascending order of aggregate point scores, while the university websites with identical points scores are assigned the same ranking position as shown in Table 2 illustrating part of a student's work.

The fewer points correspond to better results, i.e. number one is the one who has taken the most prestigious positions in the standings for all validation tools, while the last one is the one who has taken the most unglamorous places in individual rankings.

Results and discussion. The Web Accessibility Rankings of university websites is a project that succeeds in attracting the attention of the students, who are led by their desire to see how their university's website measures up against those of international counterparts, thus boosting their motivation for involvement in the learning process.

Table 2. Web Accessibility Rankings of the university websites

Ranking	University – ID	Total point score
1	Uni 17	12
2	Uni 24	20
3	Uni 30	22
4	Uni 15	25
5	Uni 11	28
6	Uni 21	30
7	Uni 18	31
8	Uni 14	32
9	Uni 12	35
	Uni 20	35
10	Uni 4	37

For the sake of illustration we shall provide a diagram made by a student who compared the websites of higher education institutions based in Bulgaria, Sweden, UK, Germany, and Italy. The first bar stands for the tester's own university.

A key point in this approach is the reflexive component. In [12] the authors elaborate on a type of reflection where one should look at their own position and at themselves seemingly from aside in order to comprehend it and evaluate it objectively. Students assess the position of their university's website and how it performs in terms of accessibility of its website. They consider how to improve its performance in this area, and draw up their recommendations to send to the webmaster or to the management, such as those in [13]:
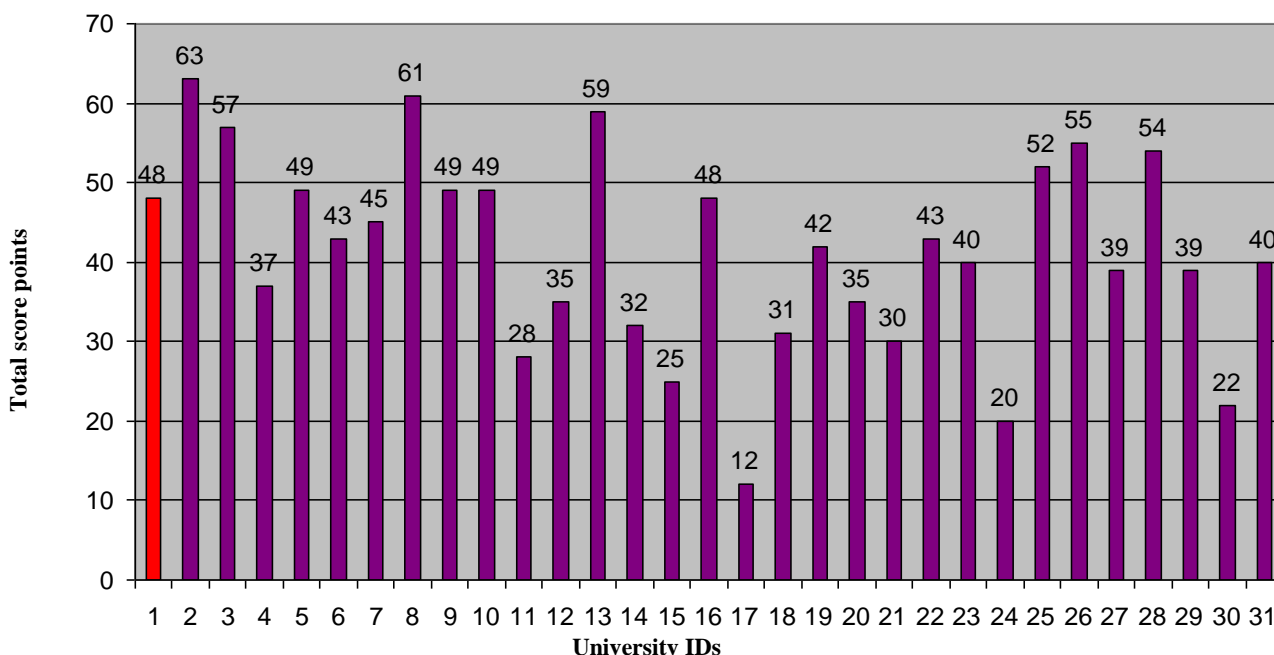
Figure 1. Web Accessibility Rankings of universities - sample made up of 31 universities

- Avoid empty links, i.e. ones that do not contain text, because the function of such a link will not be displayed to the user;
- Avoid alternative text that is identical to an adjacent or nearby text, because when viewed without images, it will be presented repeatedly to screen readers; • Pay more attention when creating links to PDF documents, as these documents are usually addressed through the use of separate programs which can lead to confusion or navigational difficulties;
- Remove the access codes (accesskeys) when there is risk of conflict with user's keyboard shortcuts or enabling technologies;
- Provide header cells to the relevant columns and/or rows in tables in order to specify their content;
- The first level headings in a page should provide the most important information on the contents thereof.

This project works best in the context of efforts to foster learner autonomy where it yields a synergistic effect.

Conclusion. The experiment conducted by the authors shows that the project assignment for calculation of Web Accessibility Rankings of university websites is an efficient way to raise the awareness of IT students about the importance of web accessibility in web design training. By way of reflection, prospective web designers rationalize the needs of people with SEN not only as their potential customers, but also as people entitled to educational and professional development. As an added value, students develop some of the skills needed to enhance their autonomy as learners.

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Шотлеков И.И., Энков С.Х., Малчева М.П. Повышение осведомленности студентов о доступности как важном элементе в обучении веб-дизайну: проект о Рейтинге веб-доступности университетских сайтов

Аннотация. В статье рассматриваются пути повышения информированности ИТ-студентов о доступности как ключевом элементе в обучении веб-дизайну. Для этого по различным проектам студенты получают задание выработать Рейтинг веб-доступности ряда университетских сайтов с помощью тестирования и сравнения. Таким образом, делая выводы о степени доступности веб-сайтов местных и международных университетов, будущие разработчики понимают точку зрения людей с особыми образовательными потребностями (ООП), являющихся их потенциальными клиентами. Так студенты не только учатся и приобретают опыт работы с основным инструментарием при оценке доступности, но также увеличивают свою социальную ангажированность - они понимают, что обеспечение доступности дает возможность людям с ООП повышать уровень своего образования и квалификацию.

Ключевые слова: проекты, веб-дизайн, особые образовательные потребности (ООП), рефлексия, автономия