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LONG PAPER

Exploring the potential of Easy Language for enhancing website sustainability

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Abstract
Sustainable design principles have become increasingly important in website development, mainly focusing on reducing carbon emissions and energy consumption. Easy language (EL) is a simplified language variety that makes websites more accessible to a wider range of users; but there has been no attention given to its usefulness in sustainability efforts. As such, this study is intended to become a starting point for future research in the area. By examining the intersection between EL and website sustainability guidelines and practices, the study highlights the potential for EL to contribute to sustainable website design. Along the paper, the following theory is defended: when adapted to Easy Language, text and interactions in websites are simplified, which makes them require less data transfer, become more efficient and, ultimately, more sustainable. The paper also presents a small comparative analysis of the sustainability of websites in EL and standard language that indicated that EL generally enhanced the sustainability of websites. The nine websites in EL analysed showed a mean reduction of CO2 production of 42% in comparison to their equivalents in standard language ($p = 0.049$, $F = 2.42$). The discussion and results presented open potential solutions for an urgent problem that deserve to be considered and researched further.

Keywords Accessibility · Sustainability · Easy language · Websites · Carbon footprint

1 Introduction

In 2020, Spanish citizens spent on average, six hours a day online [1, 2]. The spread of the Internet in the last two decades has brought some challenges with it that still need to be overcome. Accordingly, in the pursuit of an equitable information society, some milestones still need to be reached, and finding ways to make our digital environment more sustainable and inclusive is one of them.

Recently, many people have become more aware of the need to change the current course of society towards environmental degradation [3], but some of them are not fully aware of the consequences their everyday activities have and may overlook some daily actions that can be harmful for the environment. For instance, although online activities may seem benign, they play a major role in global warming [4–7]: every minute spent on the Internet, every loaded webpage, every click and interaction pollute and affect the environment adversely. But, while some people might need to reduce their online presence to become more environmentally friendly, others may not have access to most online content. The Internet is still not fully accessible to all its potential users, a problem that entails the need for websites to be readable and easy-to-understand [8].

This paper will explore website accessibility, mainly focusing on one problem (the lack of readability and comprehensibility), and on one solution: the adaption of website content to Easy Language (EL), a simplified language variety that allows a wider range of people to access information [9, 10], which will be explained in Sect. 2. This study will evaluate the previously mentioned challenges and explore how websites can enhance both their sustainability and comprehensibility by identifying congruences in EL and sustainability guidelines and practices. The study builds upon the hypothesis that websites in EL are more sustainable than websites in standard language (SL). To evaluate the truthfulness of this assumption, the author performed a comparative carbon footprint analysis between web pages with content in EL and SL. Although the study works with a

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small sample size of nine web pages, results open new lines of research. Additionally, the limited number of web pages that are currently adapted to EL is reflected in the difficulty to broaden the sample size.

The results of this comparative analysis allowed to not only assess the hypothesis, but to detect the aspects of EL that might affect the carbon footprint of websites.

The initial sections of this paper provide detailed explanations of website sustainability and accessibility, along with arguments supporting the hypothesis of this study. Following that, the comparative analysis will be outlined: its aims, methodology, results, and discussion will be presented, followed by subsequent conclusions.

2 Enhancing website accessibility through Easy Language

In our contemporary digital society, Information and Communication Technology (ICT) has become integrated into our daily lives. Ensuring the full accessibility of ICT stands as a crucial objective that holds the potential to benefit many users [11]. Media accessibility spans across various types of media and targets collectives that encounter barriers in accessing information and media content for diverse reasons. Internet usage should be easier for everyone, a goal that can be pursued through diverse practices and services such as audio descriptions, subtitles for the deaf and hard of hearing, and web accessibility initiatives [12].

In support of this cause, the United Nations Convention on the Rights of Persons with Disabilities [13] emphasizes the necessity for measures that guarantee equal access to information and communications, including technologies and systems, for individuals with disabilities. Hence, web pages and online content should diligently identify and address potential information barriers to maximize accessibility for all potential Internet users – essentially, nearly everyone.

If users encounter difficulties in comprehending, navigating, or interacting with a website, problems which, according to W3 [14], should not appear in any accessible website, one effective solution is to implement Easy Language (EL) in content and design. Easy Language is a very simplified language variety that aims to make communication easier to any person who finds SL hard to understand [15, 16] and that can experience comprehension barriers at some point. That includes people with low levels of literacy, dyslexia, aphasia, advanced age, or limited language skills [10, 15, 16]. Plain Language, on the other hand, is a less-simplified variety that aims to make expert content accessible to laypeople but may be less comprehensible for specific user groups [17]. EL deviates from the SL in different aspects related to content, vocabulary, and structure [15, 16], as well as in paratextual elements, like the use of illustrations as visual support, the design, or the layout of the documents [16]. EL content follows guidelines that range from general use to more case-specific publications, but a standard on EL online content creation is yet to be set. Guidelines on web accessibility that consider easy-to-understand languages will be presented in Sect. 2.1.

People with cognitive disabilities still constitute one of the primary target groups of EL. One of the goals of many EL professionals is improving the acceptance of this language variety and broadening its pool of users, both in number and diversity. Accessible communication through EL has shown to be less accepted by certain audiences and could even be stigmatising if it is not offered optimally [17]. While Easy Language serves as a valuable tool for overcoming communication barriers and enhancing content accessibility [17:209], identifying a group of people as a primary target group of Easy Language runs the risk of potentially stigmatizing them and portraying them as individuals who lack understanding or are seen as contributing to the deterioration of standard language norms [17:16]. Notably, research indicates that relying solely on awareness campaigns may have limitations, as they can provoke animosity, as shown in studies by Cloerkes [18] and C. Maaß [17:224]. While Karreman et al. [19] discovered no adverse effects of transforming text into Easy Language for a cohort lacking intellectual disabilities, they observed a lower satisfaction level among this group compared to the Standard Language (SL) version. Conversely, individuals with intellectual disabilities indicated a preference for the adapted site. The authors [19] suggest that explicitly clarifying the adaptation's purpose as catering to the specific needs of a particular segment of the public could prevent the alienation of the non-disabled community. Again, it is conveyed that EL is the most simplified and comprehensible easy-to-understand language variety, but also the less acceptable and the most potentially stigmatizing [17]. For that reason, it is not only important to offer adapted websites, but also to work towards making them as acceptable as possible.

Nevertheless, EL can be beneficial to any user in terms of website usability. According to ISO 9241 – 114 [10], accessible usability means being able to develop specific goals with (1) effectiveness (reaching the goal of the task), (2) efficiency (the time and resources required to fulfil the task), and (3) satisfaction (how users feel when using the product - in this case, the website) [10, 20]. Schmutz et al. (2019) studied the influence of using easy-to-read language on non-disabled users and proved that "considering accessibility in web site design may provide a wide range of benefits for [them]" [21:103]. The authors also state that using easy-to-read language in websites led to an improvement of user

performance, "but also to increased reading time, decreased text liking and reduced intention to revisit the web site" [21:1], which are drawbacks that can be linked to the lack of acceptance the public often feels for simplified texts. Karreman et al. [19] also found that adapting websites into Easy Language showed numerous benefits for the participants with ID (better understanding of the verbal content and less reading errors); and although observing less effects for the neurotypical participants, this group performed better with an adapted website for questions for which the answer could be found literally in the text.

In conclusion, and in consideration of what has been presented in this section, accessible web design is essential for enabling all users to browse the Internet independently [11, 12]. The delicate balance between improving accessibility and avoiding stigmatization underscores the need for careful implementation and consideration of diverse user preferences. Despite these challenges, EL can significantly enhance website usability, contributing to effectiveness, efficiency, and user satisfaction. As we delve into the subsequent section, our focus will shift towards practical recommendations for achieving accessible web content, with a specific emphasis on Easy Language.

2.1 Web Content Accessibility Guidelines (WCAG) and Easy Language recommendations

There are various entities that work for the spread and improvement of practices for online accessibility. One organization lays the foundations of web accessibility: The World Wide Web Consortium (W3C). Their Web Accessibility Initiative (WAI) is a project that develops guidelines, technical reports, educational materials, and other documents with the aim of helping web developers create accessible websites, as well as educating the public about the importance of web accessibility [14].

The Web Content Accessibility Guidelines (WCAG) are one of the main resources produced by the WAI. These guidelines provide a standard for creating accessible web content that can be used by developers, designers, and content creators. The guidelines cover a wide range of topics, including text alternatives for visual content, keyboard accessibility, and colour contrast [14]. These guidelines also emphasize that web content, including information, interactions, and interfaces, should be designed in a way that promotes understandability [14]. Additionally, it asserts that websites should strive to employ the simplest form of language possible [14, 22, 23].

Using EL can help reach the accessibility principles that were just presented. The WCAG includes a set of recommendations for "making web content more accessible to users with disabilities" [14, 23] in which it is advised to write in Plain Language, a less-simplified variety of the easy-to-understand languages mentioned in Sect. 2. However, I argue that the characteristics of EL make this more simplified language variety the optimal choice, as certain principles of the WCAG advocate for similar adaptations as those found in texts written in EL. For instance, in guideline 2.4 (which "[provides] ways to help users navigate, find content, and determine where they are" [11]) the use of "a hierarchical structure, a table of content, a logical sequence and the usage of paragraphs for the information presented, and a division of documents, especially long ones, into hierarchical subsections with clear and informative titles" is encouraged [11:276, 14]. This guideline aims to help users find the content they need, orient themselves and move through the content [22] through a clear structure. In addition, principle 3 states that both content and controls need to be understandable. The use of vocabulary that is likely to be familiar to the intended readers is encouraged, while professional jargon or specialized terms are advised to be avoided [11:276, 14]. Concerning this, it is also advised to "review the document for plain language" [14] and to use the "simplest sentence forms consistent with the purpose of the content" [14]. This principle also states that the active voice should predominate in the text. It also highlights the importance of naming and labelling consistently, of explaining instructions and required actions in detail, as well as of providing summaries, examples, illustrations, and symbolic languages [11:276, 14]. These website accessibility principles and instructions align with the recommendations outlined in EL guidelines, in terms of textual and paratextual characteristics.

There are numerous EL guidelines published, some of the most popular being those by IFLA (International Federation of Library Associations and Institutions) [16] and Inclusion Europe [24], as they have been translated and adapted to different European languages. Additionally, an upcoming International Organization for Standardization (ISO) publication will mark the first international standard for writing in EL [9]. This ISO project, in turn, succeeds a previously published EL standard, the UNE 153101:2018 EX [25]. This standard was published in Spain and presents some specificities from the Spanish language [10, 25, 26]. None of the guidelines specify how EL can or should be applied in an online environment [24, 27]. This oversight is indicative of the general underdevelopment of EL implementation on the Internet in Europe [11]. Kerstin Matausch et al. (2012) believe that the delayed progress of this practice may be attributed to the lack of closeness of the main stakeholders' fields of knowledge [11]. This problem causes, on one hand, content developers to not be able to detect accessibility problems in their product and not knowing how to make their content more accessible. On the other hand, those in

the social sector voice the need for information in EL everywhere but lack the tools to provide accessible information as part of accessible web design [11]. Hence, one aim of this paper is to bring together two sectors that may not typically collaborate, to stimulate future discussion and efforts towards a more inclusive digital environment.

As mentioned, certain recommendations from EL guidelines align with the WCAG guideline 2.4 [14] and principle 3 [14] presented above, and the correlation between the two sources' recommendations is illustrated in the table below. Table 1 provides extracts from these publications that exemplify the aspects of WCAG guideline 2.4 and principle 3 that agree with EL recommendations.

The comparison between the WCAG (Web Content Accessibility Guidelines) and Easy Language guidelines reveals significant parallels in their approach to information structure and presentation, as well as their shared emphasis on simplifying content for enhanced understanding. The convergence between these guidelines lies in their common goal of fostering accessibility by breaking down barriers to comprehension and navigation. In summary, their shared goals are to make content:

- Clearly presented and distributed;
- Simple, understandable and consistent;
- Supported by examples or images if needed.

By joining forces with Easy Language practitioners, website accessibility experts could present improved guidelines, as their experiences could be mutually inspiring and many recommendations could be simplified through the possibility to present online content in Easy Language. According to Van der Geest and Velleman [8], to develop web content in EL effectively, the content, structure, and layout of the page should facilitate the user in locating, comprehending, and using the information [8]. Therefore, adaptations need to be applied to the content (text adaptation) and the contingent (technical adaptations) to create an inclusive online environment. Fortunately, as demonstrated in this section, the WCAG principles consider adaptations of both types that are also addressed in certain EL guidelines. Therefore, it is rational to think that by adapting web content following what EL guidelines recommend, we may also be agreeing to some of the WCAG principles. After all, optimal accessible web content should consider recommendations both in the WCAG and in EL guidelines [22].

Finally, the Techniques for the Cognitive and Learning Disabilities Accessibility Task Force (Coga TF) also presents recommendations directed towards web designers that address the needs of users with cognitive and learning disabilities. However, these recommendations do not specifically mention easy-to-understand languages [28].

3 Website sustainability

The impact of online access barriers varies among individuals, and some impediments may even go undetected by the users that are suffering its effects. Similarly, different people also experience the effects of the climate crisis differently and to varying degrees over the world [29]. However, it surely will have damaging consequences for everyone if not stopped. In response to the global challenge of climate change, international organizations have undertaken efforts or set goals for the near future to address its detrimental effects. One example is the Sustainable Development Goal 13 of the United Nations [30], which emphasizes the urgent need to combat climate change and its impacts through the regulation of emissions and the promotion of developments in renewable energy. The shared responsibility to take action and reduce carbon footprints becomes crucial for the collective well-being of our planet.

According to Gombiner [4:119], a carbon footprint refers to the "total greenhouse gas emissions caused directly and indirectly by a person, organization, event or product". All our activities have a carbon footprint, which can sometimes be estimated. In order to cut the carbon emissions that we are responsible for, we need to revise our everyday choices. Nevertheless, as we strive to adopt a greener lifestyle, "our hunger for data and web services is growing ever greater - as are our Internet emissions" [6:75]. In his book, Greenwood [6] compares the annual emissions from the Internet to that of Germany and highlights that the electricity usage of data centres worldwide surpasses that of the entire United Kingdom [6:2, 31]. However, how and why is the Internet polluting to this extent? Almost every step of the process of making it possible for users to browse the web is high in greenhouse gas emissions, starting from the stage of manufacture to the shipment of hardware [6:120]. Additionally, until the day these devices are permanently turned off, they will continue to operate using energy generated through different methods that are severely polluting [4:120]. Hence, it is important to recognize that the environmental impact of technology extends beyond its production, and that includes its usage. One approach to mitigating the effects of technology usage is by designing web pages that are environmentally sustainable and have a reduced ecological footprint in the end. Achieving this objective requires integrating sustainable practices throughout every stage of the web design process, in accordance with the principles articulated in the Sustainable Web Manifesto [7].

The concept of the three R's of the environment, "Reduce, Reuse, and Recycle", has become a very popular slogan for sustainability. It serves as a reminder of actions that can minimize waste generation and improve waste management practices. Similarly, sustainable web projects are defined

Table 1 Correlation of recommendations in WCAG and EL guidelines

Recommendations in WCAG	Recommendations in EL guidelines
Information should be presented in a clear, hierarchical structure. [Guideline 3.4, WCAG]	Text structure shall be designed in a way that supports the users' goals and expectations. Text structure will help the user identify important information easily and quickly. Starting the text and each paragraph with the most important information is normally a good strategy. [ISO, 2021]
Long documents should be divided into subsections. [Guideline 3.4, WCAG]	Think about the size of your document. A book of 100 pages is too long. People could feel they are not able to read such a long book. In this case, it would be better to write 3 smaller booklets. [Inclusion Europe, 2009] Ser concisos, expresando una idea por frase y evitando introducir varias ideas o acciones en una oración simple. Cada línea debe contener una o dos frases con una o dos ideas. Es importante concentrar la información relacionada, pero si no es posible porque es extensa, se optará por cortarla y ofrecerla por separado, utilizando guías, como encabezamientos y pies que faciliten la continuidad y el seguimiento de la información entre las páginas, si resulta necesario. [García-Muñoz, 2012] ("Be concise, expressing one idea per sentence and avoiding introducing multiple ideas or actions in a single sentence. Each line should contain one or two sentences with one or two ideas. It's important to condense related information, but if it is not possible because it is extensive, you should opt to divide it and offer it separately, using guides such as headings and footers that facilitate continuity and tracking of information between pages, if necessary.")
Content needs to be understandable: familiar vocabulary should be used, and professional jargon or terms with a specialized meaning should be avoided. [Principle 3, WCAG]	Se debe utilizar un lenguaje sencillo y de uso frecuente. [UNE, 2018] ("Simple language and frequently used words should be used") Se debería evitar el uso de términos abstractos, técnicos o complejos. [UNE, 2018] ("The use of abstract, technical or complex terms should be avoided.")
Use simple sentence forms. [Principle 3, WCAG]	Utilizar oraciones simples cortas, con la estructura «sujeto + verbo + complementos». [García-Muñoz, 2012] ("Use simple short sentences with the structure 'subject + verb + complements'.")
Use of the active voice. [Principle 3, WCAG]	Evitar la voz pasiva y utilizar la activa, que da viveza y facilita la comprensión de la acción. [García-Muñoz, 2012] ("Avoid the passive voice and use the active voice, which gives liveliness and facilitates the understanding of the action.")
Consistency in naming and labelling. [Principle 3, WCAG]	Use the same word to describe the same thing throughout your document. [Inclusion Europe, 2009]
Summaries. [Principle 3, WCAG]	A summary can be included at the beginning or at the end of each chapter, section or publication. [ISO, 2021]
Examples. [Principle 3, WCAG]	Use examples to explain things. Try to use examples that people will know from their everyday lives. [Inclusion Europe, 2009]
Illustrations, symbolic languages. [Principle 3, WCAG] ("Some users experience great difficulty in recognizing written words yet understand extremely complex and sophisticated documents when […] ideas are illustrated visually[…].").	To illustrate your text, you can use photographs, drawings, or symbols. Where possible, try to use the same style of images throughout your document. [Inclusion Europe, 2009]

in the Sustainable Web Manifesto [7] as being characterized by being clean, efficient, open, honest, regenerative, and resilient. These six qualities should be striven for when planning and designing web pages:

- *Clean*, in terms of the energy that their services are powered by, which must come from a renewable source [7];
- *Efficient*, in terms of the amount of energy and material resources used by the products and services provided. The less, the better [7];
- *Open*, meaning that the products and services provided have to be accessible, to allow for the open exchange of information, and to let users control their data [7];
- *Honest*, meaning that the products and services provided need to avoid misleading or exploiting users in their design or content [7];
- *Regenerative*, meaning that the products and services provided need to be supportive of an economy that benefits people and the planet [7];
- *Resilient*, in terms of the times and places that the products and services provided work in. These should be operational when and where people need them most [7].

We will focus on and delve deeper into the topic of efficiency and its direct correlation to a website's sustainability level, as we will later explore how the use of EL in webpage content could potentially impact this relationship. We will now also explain the correlation between the efficiency of a webpage and the data transfer it requires.

When the amount of CO2 produced by a web product is estimated by online carbon emissions calculators like Website Carbon Calculator [32] or Greenpixie [33], one of the metrics that is taken into account is the data transfer over the wire. It is impossible to know the exact amount of greenhouse gas produced by a website or app [6], though from measuring and analysing factors like the energy intensity of web data, the energy source used by the data centre, the carbon intensity of electricity, the website traffic, or the data transfer [33], online calculators of the carbon emissions attributed to a website can estimate how sustainable such web products are.

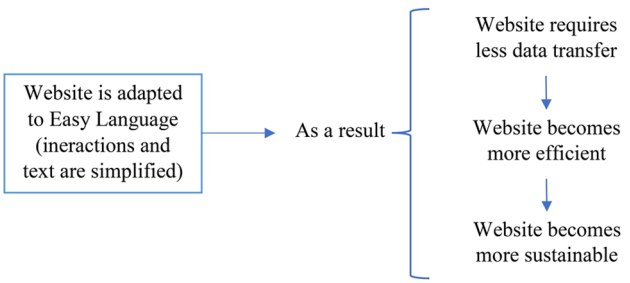


Fig. 1 Diagram of defended causal chain

Data transfer is estimated by measuring the weight of the page - that is, its transfer size the first time anyone visits it [6, 34]. This metric allows a better comparison of the efficiency of web pages [6]. Greenwood [6] states that websites used to be smaller and, therefore, more efficient, as they used to weigh less and have a lower data transfer size. It is estimated that from 2017 to 2020, the median size of a web page increased by around 30% [6, 35], and much of it "has done nothing to improve user experience, performance, or accessibility" [6:8]. We are more and more used to any content we consume being shiny, colourful and eye-catching. That includes websites, which become heavier and, therefore, less sustainable and inclusive.

How can designers, developers, and digital professionals make their projects greener and more accessible? Earlier, in Sect. 2.1, the importance of all the relevant professionals of different fields working together towards an accessible digital environment has been stressed. Similarly, professionals in web design need to bring their knowledge and expertise together "and develop a culture where sustainability is fundamental to everything [they] do" [6:3]. Resource wasting in web design should be minimised while trying not to sacrifice what makes up for a positive and inclusive user experience [6:8].

4 Aims

The focus of this paper is on the intersection of sustainable practices and website accessibility, exploring how these two pursuits align to create websites that are both environmentally conscious and inclusive. Firstly, the author aspired to establish a theoretical foundation for sustainable and accessible website design practices, which has been attempted in previous sections. The secondary objective of the article was to conduct a comparative study to provide evidence of the shared principles between sustainable and accessible websites that would support the theories presented earlier and the resulting hypothesis that "websites in EL are more sustainable than websites in SL" (See the causal chain depicted in Fig. 1):

1. The adaptation of a website to EL makes the page simpler and less cluttered, since simplification is one of the bases of this language variety;
2. A simpler, less cluttered website will require less data transfer to be processed, since the weight of the page will also be lower;
3. A website that requires a low data transfer size will be quite efficient, since less data transferred means less energy used or wasted;

4. A website that wastes little energy and is efficient will ultimately be a little bit more sustainable.

The comparative study will be detailed in the following sections.

5 Methodology

We performed a comparative analysis of the quantitative results of putting different websites through a website carbon calculator. The websites analysed had one version in EL and one version in SL, and the analysis was performed (1) between the different websites and (2) between each website's versions. To be considered as two versions of the same web page, these had to facilitate easy switching between the two versions within the website itself, without requiring users to exit the page or search for the other version separately.

I gathered a total of nine different websites, created by very different entities and in 3 standard languages (English, Spanish, Galician) and their EL versions: (1) FEDAGACE, (2) WWDA, (3) FEVIDA, (4) Extremadura Trabaja, (5) Fundación AMÁS, (6) GenU, (7) University of Bayreuth, (8) Make it in Germany, (9) Swiss Public Health. The two versions of all nine websites went through a carbon calculator, providing 18 different results. The calculator used was Wholegrain Digital's Website Carbon Calculator [32]. This website offers a comprehensive analysis of each website's environmental impact, including the amount of CO2 generated per page visit and presented in grams. The comparison was based on the informative sustainability score.

Although the sample size of 9 websites (or 18, if considering both versions as distinct pages) may seem limited, it was considered adequate for the goals of this study, as explained previously.

Table 2 CO2 produced every time someone visits each web page, in grams

	Standard language	Easy Language
FEDAGACE	1.26	1.3
WWDA	0.98	0.3
FEVIDA	0.43	0.21
Extremadura Trabaja	0.32	0.26
Fundación AMÁS	1.61	0.15
GenU	0.5	0.47
Uni Bayreuth	0.44	0.31
Make it in Germany	0.38	0.3
Swiss Public Health	0.45	0.37

6 Results and discussion

The website carbon calculator gave the results presented in the tables and graph below (Table 2; Fig. 2). The numbers in darker cells in Table 2 indicate values that surpass the mean

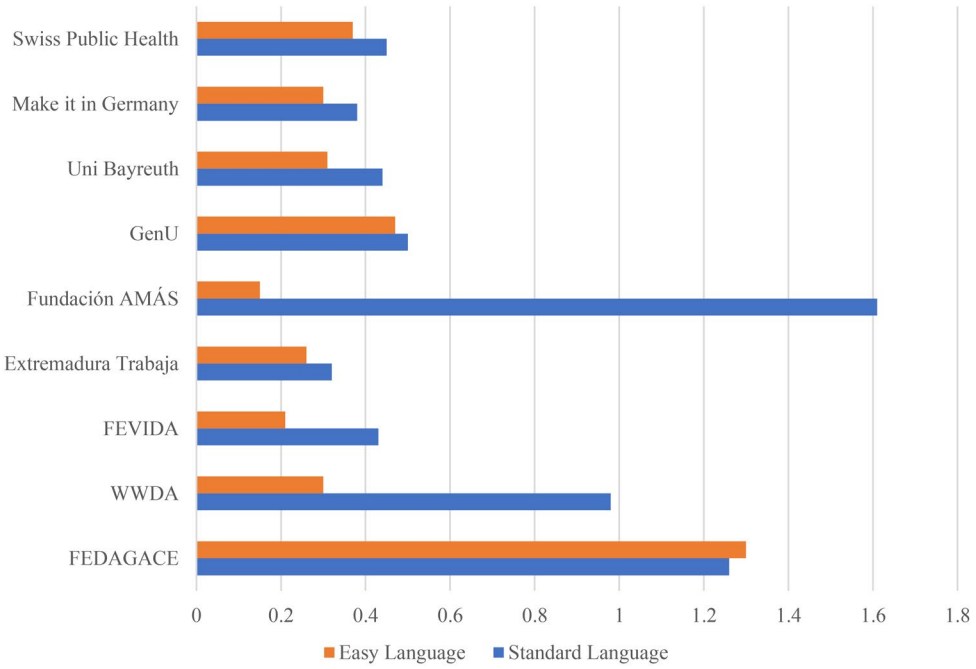


Fig. 2 CO2 produced every time someone visits each web page, in grams

of CO2 generated by the websites analysed by the calculator. These high values imply that there is a big room for improvement as the website is among the 50% of websites that are more polluting.

As illustrated, the general tendency is for websites in EL to be less polluting than their versions in SL. If we visited each of the URLs analysed once, the websites in SL (the 50% of URLs analysed) would make up for a 63.4% of the pollution caused, showing a relevant between-group difference ($p = 0.049$, $F = 2.42$).

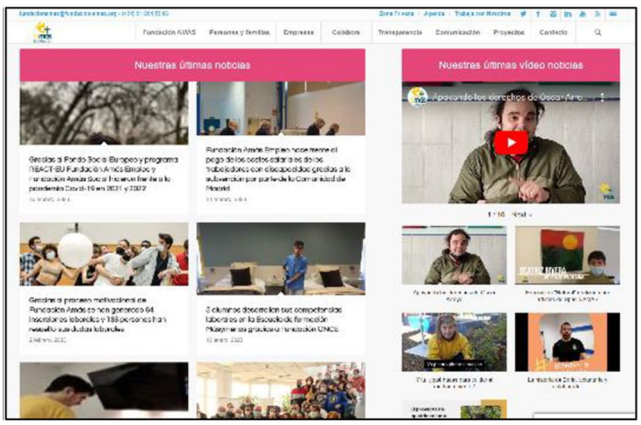
Out of the websites analysed, the EL version of three websites (WWA, FEVIDA, Fundación AMÁS) produced less than 50% of the CO2 per visit compared to their SL equivalent. For five other websites (Extremadura Trabaja, GenU, University of Bayreuth, Make it in Germany, Swiss Public Health), the reduction in CO2 production was smaller at 19%, 6%, 29.5%, 21% and 17.7% respectively. Only one website (FEDAGACE) had a slightly worse sustainability score for its EL version compared to its SL equivalent (+3% in CO2 production). Overall, the analysis revealed an average reduction of 42% in CO2 production for EL websites when compared to their SL versions ($p = 0.049$, $F = 2.42$).

While the results obtained are informative and offer insights, they also reveal some inconsistencies. This variability is likely due to the lack of standardized practices for designing or adapting websites in EL, resulting in uneven website adaptations. Our hypothesis posited that EL would result in more sustainable websites due to its accessibility adaptations, such as content and interaction simplification. However, if these adaptations are not properly implemented, the logic of our hypothesis may be inapplicable. This will be exemplified and discussed further with two examples: first, a website where the EL version showed the greatest improvement in sustainability; second, the only website where the SL version exhibited better sustainability results (despite both versions having comparable CO2 production).

1) *Fundación AMÁS*: The CO2 emissions from the EL site of this entity decreased by 90.7% compared to its SL equivalent. In fact, out of the 18 URLs analyzed, the SL version of this website was found to be the most polluting, while the EL version was the least polluting.

Homepage

Easy Language website

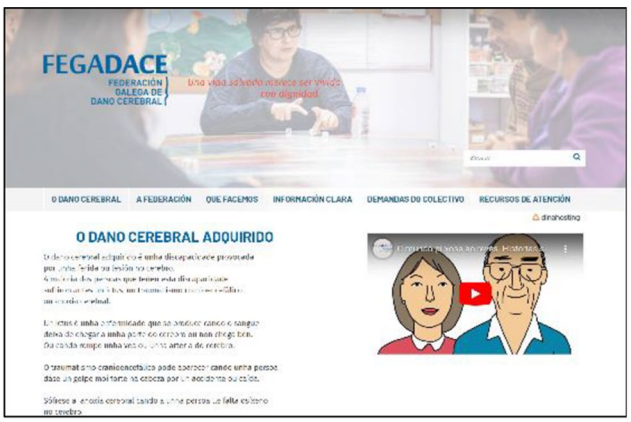


Standard language website

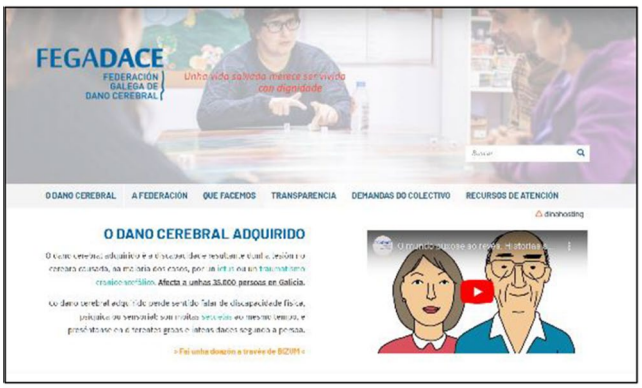
Upon reviewing the websites and the results from the CO2 calculator, it is evident that the EL version has achieved significant reductions in pollution compared to the SL version. One of the reasons for this is the complex layout, multimedia files, large file sizes, and numerous text and interactive elements present on the SL version, which contribute to a highly polluting website that can be easily improved in terms of sustainability and accessibility. On the other hand, the EL website serves as a good example of effective simplification and adaptation in terms of content and interface. The navigation bar is clearly visible in the header, unnecessary multimedia elements are absent, and each page features plain text and images that can be

easily read while scrolling down. Although there is room for improvement in terms of accessibility, such as providing Alt Text for images, it is evident that EL suggestions have been taken into consideration during the design process. These results emphasize the strong correlation between simplifying websites for accessibility and sustainability.

2) *FEDAGACE*: Despite having two versions of their website, one in SL and one in EL, the layout and content of both remain largely unchanged. In fact, these share the same interactive and multimedia elements, with the only differences found in the text, which tends to be longer in EL. This, in turn, leads to more elements to load and potentially to a higher CO2 production, which explains the 3% increase in CO2 production resulting from the adaptation to EL.



Easy Language website



Standard language website

7 Conclusion

This study achieved two main goals. First, it showed how sustainability and accessibility in web design can work together, explaining the benefits of using Easy Language (EL). By conducting a comprehensive theoretical review encompassing guidelines and standards for inclusive website design, sustainability practices, and Easy Language, we identified significant commonalities and shared principles. These findings provided a solid foundation for the study's hypothesis, asserting that the integration of Easy Language not only enhances website accessibility but also contributes to reduced environmental impact by making websites less polluting.

Second, a small study confirmed the idea that EL websites are usually more sustainable than those in Standard Language (SL). The comparative study revealed an average reduction of 42% in CO2 production for EL websites when compared to their SL versions ($p = 0.049$, $F = 2.42$). The results suggest that EL websites often have simpler designs, need less data, and use less energy, which supports our initial idea. EL websites typically have simpler layouts and fewer interactive elements, which lowers the energy needed to load and display the website. On the other hand, SL websites usually have layouts that are more complex and bigger file sizes, leading to more energy use.

Despite these findings, there are some limitations to consider for future research. The author did not find many websites that met the inclusion criteria (sites with versions in both EL and SL) and the study might not cover all websites in different languages, limiting the generalizability of the findings.

Nevertheless, the results have important implications for website designers and developers aiming to create sustainable and accessible websites. Some of the ways to reach these goals, like transitioning to an Internet powered by renewable energy, are remote [4], and for this reason this paper aims to unveil a simple practice that can help create greener and more inclusive websites in the future. In summary, this paper emphasized the importance of language choice in both web accessibility and sustainability, offering insights into potential solutions for urgent issues that need more consideration and research.

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Data availability Data generated or analysed during this study are included in this published article and its supplementary information files.

Declarations

Conflict of interest The authors declare that there are no conflicts of financial or non-financial interest.

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